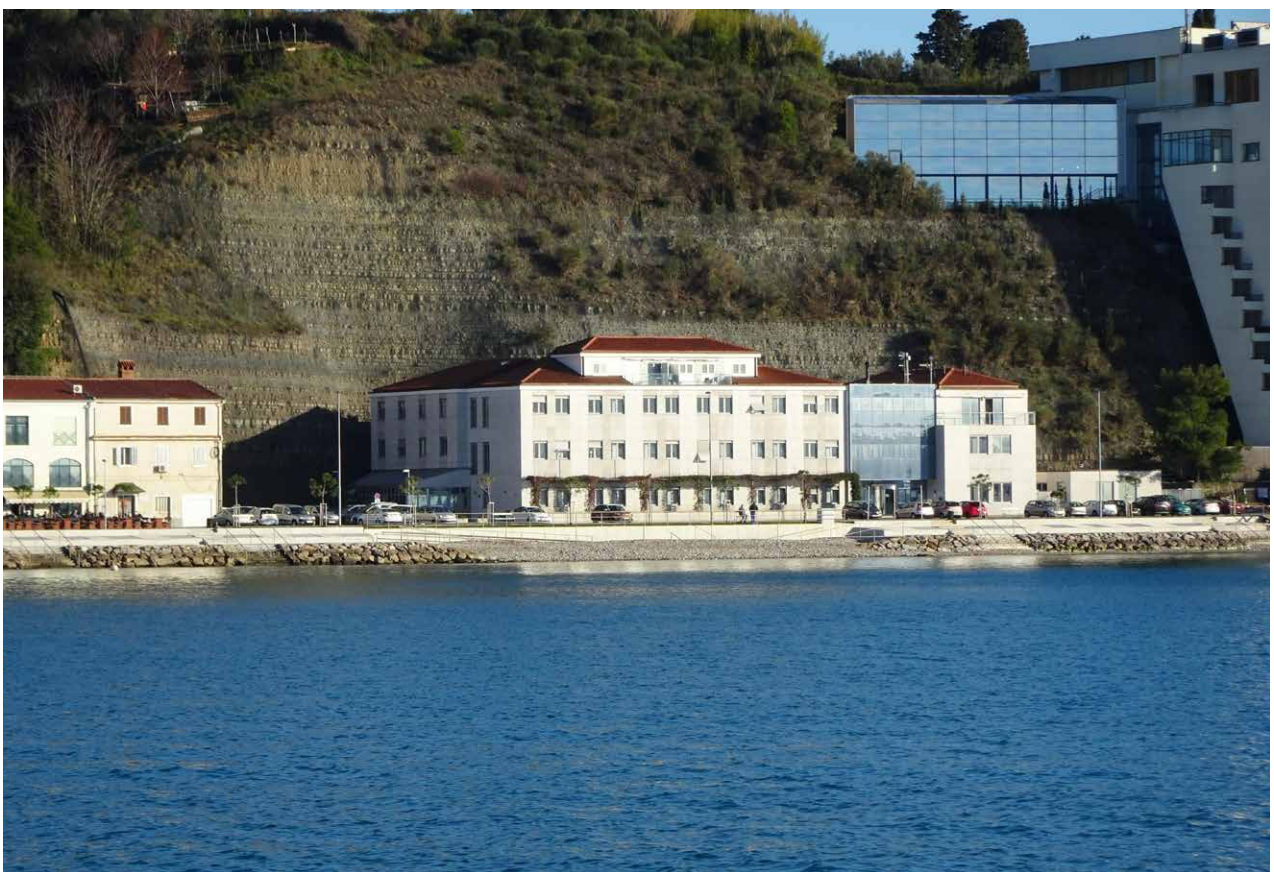
Poročilo o delu
Annual report
2023

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



Podpis: Morska biološka postaja Piran.
Foto: T. Makovec

Marine Biology Station Piran.
Photo: T. Makovec

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

Leto 2023 je bilo za Nacionalni inštitut za biologijo zagotovo prelomno. Z zaključkom gradnje Biotehnološkega stičišča (BTS-NIB) je ta v svojih prostorih združil vse organizacijske enote v Ljubljani. NIB je tako po večletnih prizadevanjih enotno zaživel v prostorih visokotehnološke zgradbe, opremljenih z najsodobnejšo raziskovalno opremo. Selitev smo obeležili s slavnostno otvoritvijo BTS-NIB, ki je poleg vrhunske raziskovalne infrastrukture obelodanila začetek novega razmaha raziskav na področju ved o življenju v Sloveniji in mednarodnem okviru.

BTS-NIB nas je sprejel z vzdušjem dobrodošlice in vanj smo se vselili, kakor se to ob dobrodošlicah spodobi: z nekoliko zadrege, a vseeno velikim pogumom in hvaležnostjo ob spoznavanju in sprejemanju vsega novega. Posebej ponosni smo, da sta raziskovalna in strokovna dejavnost Inštituta kljub napornemu zaključevanju gradnje nemoteno potekali. Iskrena hvala in globoko spoštovanje vsem predanim, vztrajnim ter visoko strokovnim sodelavkam in sodelavcem. Vem, da ste se potrudili daleč preko meja pričakovanega! Zahvala gre tudi mnogim zunanjim sodelavcem, ki ste nam v zadnjih treh letih pomagali na tej težki, a izredno pomembni poti – skupaj nam je uspelo!

The year 2023 was certainly a landmark one for the National Institute of Biology. The completion of the construction of the Biotechnological Hub of the NIB (BTS-NIB) brought together all organisational units in its premises in Ljubljana. After several years of effort, the NIB has now been brought together into a single high-tech building equipped with state-of-the-art research equipment. The move was celebrated with the inauguration of the BTS-NIB, which, in addition to its state-of-the-art research infrastructure, represents the beginning of a new blossoming of life sciences research in Slovenia and internationally.

The BTS-NIB greeted us with a welcoming atmosphere, and we moved in as befits the welcome: Slightly embarrassed, but with great courage and gratitude in learning and accepting everything new. We are particularly proud that the Institute's research and professional activities have continued uninterrupted despite the upheaval of the construction. My sincere thanks and deepest appreciation to all our dedicated, persistent and highly professional colleagues. I know your efforts have gone far beyond what is expected! Thanks also to the many external colleagues who have helped us on this difficult but

V zgodovini Inštituta bo leto 2023 zapisano kot eno najuspešnejših let. Poleg izgradnje BTS-NIB v vrednosti več kot 30 milijonov evrov smo zaključili tudi investicijsko operacijo »Nakup raziskovalne opreme« v vrednosti preko šest milijonov evrov. Oba projekta sta sofinancirala Evropski sklad za regionalni razvoj in Republika Slovenija – Ministrstvo za visoko šolstvo, znanost in inovacije v okviru Operativnega programa za izvajanje evropske kohezijske politike v obdobju 2014–2020. V veliko čast nam je, da je Evropska komisija operacijo BTS-NIB uradno prepoznala kot vzorčni projekt tega operativnega programa, kar je botrovalo tudi visokim obiskom s strani Evropske komisije in ministrstev Republike Slovenije. Pričeli smo tudi z intenzivnejšimi vzdrževalnimi deli na Morski biološki postaji.

Leto 2023 so zaznamovali tudi nadaljnje prilagajanje na novi Zakon o raziskovalni in inovacijski dejavnosti ter prvi razpisi razvojnega stebra na NIB.

NIB je s svojim znanstvenoraziskovalnim delom sodeloval pri vrhunskih dosežkih in oblikovanju smernic ter doseganju novih odkritij. V letu 2023 smo poleg aktivnosti, financiranih v okviru stabilnega financiranja (en infrastrukturni program, šest raziskovalnih programov kot nosilec in dva kot partner ter 26 mladih raziskovalcev), izvajali 44 temeljnih, 10 aplikativnih, osem podoktorskih, osem CRP projektov, tri mednarodne projekte (ERC in VA), tri projekte NOO in 12 bilateralnih projektov, financiranih oziroma sofinanciranih iz proračuna pristojnega ministrstva neposredno ali posredno prek ARIS ter iz proračunov drugih ministrstev. V Evropskem in mednarodnem okviru smo izvajali 11 projektov okvirnih programov EU – Obzorja 2020 in Obzorja Evropa (dva kot koordinatorji in devet kot partnerji), devet drugih evropskih centraliziranih projektov (LIFE, EMPIR, EMFAF, ERASMUS+, EU4H, EDF itd.), šest mednarodnih oziroma evropskih decentraliziranih projektov (npr. INTERREG, ICGEB) ter 18 drugih mednarodnih projektov (npr. akcije COST, Norveški in EGP mehanizem, EFSA itd.). Poleg znanstvenoraziskovalnega dela smo izvajali tudi strokovne naloge za javnopravne naročnike (25 projektov), slovenska podjetja (23 projektov) in tuje naročnike (osem projektov).

Svoja znanstvena in strokovna dognanja so v letu 2023 raziskovalci NIB objavili v 111 znanstvenih člankih, objavljenih v odličnih znanstvenih revijah, 68 strokovnih in poljudnih

very important journey over the last three years–together we have done it!

2023 will be recorded as one of the most successful years in the Institute's history. In addition to the construction of the BTS-NIB, amounting to over EUR 30 million, we have also completed the investment operation "Purchase of Research Equipment" amounting to over EUR 6 million. Both projects are co-financed by the European Regional Development Fund and the Republic of Slovenia – Ministry of Higher Education, Science and Innovation under the Operational Programme for the Implementation of the European Cohesion Policy 2014–2020. It is a great honour for us that the European Commission has officially recognised the BTS-NIB operation as a model project of this Operational Programme, and it also brought us important visits from the European Commission and Slovenian Ministries. We have also started intensified maintenance work on the Marine Biology Station.

2023 was also marked by further adjustments to the new Scientific Research and Innovation Activities Act and the first tenders for the development pillar at the NIB.

With its scientific research work, the NIB participated in cutting-edge achievements and the development of guidelines and new discoveries. In 2023, in addition to the activities funded under stable funding (one infrastructure programme, six research programmes as promoter and two as partner, and 26 young researchers), we had 44 basic, 10 applicative, eight postdoctoral, eight CRP, three international (ERC and VA), three NOO and 12 bilateral projects funded or co-funded from the budget of the competent ministry, directly or indirectly through ARIS, as well as from the budgets of other ministries. In the European and international context, we implemented 11 EU Framework Programme projects – Horizon 2020 and Horizon Europe (two as co-ordinator and nine as partner), nine other European centralised projects (LIFE, EMPIR, EMFAF, ERASMUS+, EU4H, EDF, etc.), six international or European decentralised projects (e.g. INTERREG, ICGEB), and 18 other international projects (e.g. COST Actions, Norwegian and EEA Mechanism, EFSA, etc.) In addition to our scientific research work, we also carried out professional assignments for public law clients (25 projects), Slovenian companies (23 projects) and foreign clients (eight projects).

člankih, devetih knjižnih poglavjih in petih knjigah. Izpostavljam nekaj posameznih dosežkov, ki jih je bilo izmed vseh pomembnih v letu 2023 res težko izbrati.

Sodelavca MBP, doc. dr. Tinkara Tinta in Tihomir Makovec, sta sodelovala pri mednarodni raziskovalni odpravi na vzhodni Tihi ocean v sklopu misije kalifornijskega inštituta Schmidt Ocean Institute, na kateri so raziskovali raznolikost biosfere pod dnom globokomorskih hidrotermalnih vrelcev, od virusov do živali. Med odpravo so prišli do izjemnega odkritja novega habitata v vulkanskih votlinah pod hidrotermalnimi izviri sicer dobro raziskanega podvodnega vulkana na vzpetini vzhodnega Tihega oceana ob Srednji Ameriki.

V okviru Twinning projekta CutCancer (Obzorja Evropa), ki ga koordinirajo sodelavci GEN, razvijajo nove alternativne *in vitro* sisteme, ki bi v prihodnosti lahko nadomestili ali zmanjšali število poskusov na laboratorijskih živalih. V letu 2023 so uspešno razvili in vpeljali tridimenzionalni *in vitro* celični sistem na jetrnih celicah in sistem ALI (air-liquid interface) na pljučnih celicah. Razvijajo tudi nove *in vitro* 3D celične modele iz jetrnih rib cebric (*Danio rerio*), medtem ko na modelu embrijev rib cebric v sklopu ARIS programa P1-0245 in projekta PARC (Obzorja Evropa) proučujejo škodljivo delovanje bisfenola A in njegovih analogov. Vodja navedenih projektov, izr. prof. dr. Bojana Žegura, je za izjemne znanstvene dosežke prejela Preglovo nagrado Kemijskega inštituta.

Sodelavci EKOS so ob svetovnem dnevu čebel pripravili javno predstavitev rezultatov pilotnega monitoringa divjih čebel v Sloveniji. V triletni raziskavi so našli 239 od 575 vrst divjih čebel (čmrljev in čebel samotark), ki so bile kadarkoli najdene v Sloveniji. Hkrati so pridobili nov projekt »Vzpostavitev monitoringa divjih čebel v Sloveniji (čmrljev in čebel samotark) po skupni metodologiji EU v letu 2023«, financiran iz Sklada za podnebne spremembe. Za zaščito opraševalcev je ključno razumeti, kaj povzroča spremembe v njihovih združbah na različnih geografskih območjih. EKOS je sodeloval v raziskavi, v kateri so preučili dejavnike, ki vplivajo na raznolikost 644 čebeljih vrst v 177 komercialnih sadovnjakih jabolk v 33 državah in štirih globalnih biomih.

Človeški, živalski in rastlinski virusi v vodi predstavljajo veliko zdravstveno, okoljsko in finančno breme. Sodelavci

In 2023, NIB researchers published their scientific and professional findings in 111 scientific articles in excellent scientific journals, 68 expert and popular articles, nine book chapters and five books. I would like to highlight a few individual achievements that were really hard to choose among all the important ones in 2023.

Our colleagues from the MBS, Assist. Prof. Dr Tinkara Tinta and Dr Tihomir Makovec, participated in an international research expedition to the eastern Pacific Ocean as part of a mission by the Schmidt Ocean Institute from California, which investigated the diversity of the biosphere beneath the bottom of deep-sea hydrothermal vents, from viruses to animals. During this expedition, they made a remarkable discovery of a new habitat in volcanic caverns beneath hydrothermal vents of an otherwise well-studied underwater volcano on a high plateau in the eastern Pacific Ocean off Central America.

The CutCancer Twinning Project (Horizon Europe), co-ordinated by colleagues from GEN, is developing new alternative *in vitro* systems that could replace or reduce the number of experiments on laboratory animals in the future. In 2023, they successfully developed and deployed a three-dimensional *in vitro* cell system on liver cells and an air-liquid interface (ALI) system on lung cells. They 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 on zebrafish embryos in the context of the ARIS programme P1-0245 and project PARC (Horizon Evropa). The leader of these projects, Assoc. Prof. Dr Bojana Žegura, was awarded the Pregl Prize by the Institute of Chemistry for her outstanding scientific achievements.

On World Bee Day, the colleagues from EKOS held a public presentation of the results from the pilot monitoring of wild bees in Slovenia. In this three-year study, they identified 239 out of 575 wild bee species (bumblebees and solitary bees) that have ever been found in Slovenia. At the same time, they have been awarded a new project "Establishment of monitoring of wild bees in Slovenia (bumblebees and solitary bees) according to the common EU methodology in 2023", funded by the Climate Change Fund. To protect pollinator species, it is crucial to understand what drives changes in their communities across different regions.

FITO so skupaj s Fakulteto za strojništvo Univerze v Ljubljani in Instituta »Jožef Stefan« sodelovali pri izdelavi posebne naprave, ki združuje hladno plazmo s superkavitacijo, ter preizkusili njeno učinkovitost pri inaktivaciji različnih vrst virusov v okuženi vodi v kratkem času. V letu 2023 so skupaj s partnerjema svoje znanje o dezinfekciji vode tudi patentirali pri ameriškem patentnem uradu.

Dr. Arijana Filipić je postala ena izmed prejemnic Zlatega znaka Jožefa Stefana za doktorsko delo z naslovom »Inaktivacija virusov v vodi s hladno atmosfersko plazmo«, ki ga je opravila pod mentorstvom prof. dr. Jane Žel in doc. dr. Davida Dobnika. Zlati znak se podeljuje najodmevnejšim doktoratom na področju naravoslovno-matematičnih in tehniških ved ter ved o življenju.

Javna agencija za znanstvenoraziskovalno in inovacijsko dejavnost Republike Slovenije (ARIS) je v letu 2023 kot odlične dosežke izbrala kar tri dosežke NIB. Rezultate odličnih raziskav so na prvem dnevu dogodka Dan ARIS 2023 »Odlični v znanosti« predstavili izr. prof. dr. Meta Virant Doberlet (»Spregledan svet vibracijskega sporazumevanja žuželk«, področje biologije), dr. Denis Kutnjak (»Viromske raziskave za odkrivanje nepoznane raznolikosti rastlinskih virusov v kmetijskih ekosistemih«, področje biotehnike) in dr. Jan Zrimec (»Učenje principov regulacije genskega izražanja v rastlinah s pristopi umetne inteligence«, področje biotehnike).

V okviru drugega dneva dogodka Dan ARIS 2023 so raziskovalci NIB predstavili dobre prakse inovacijskih raziskav. Raziskovalke FITO (dr. Arijana Filipić, Katja Fric, Tamara Košir in Karmen Pogačar) so predstavile postopek testiranja učinkovitosti mask, unikatno napravo za čiščenje onesnažene vode s plazmo in kavitacijo ter razvoj proteinskih kompleksov iz glivnega rodu Pleurotus kot novega biopesticida za zatiranje koloradskega in koruznega hrošča. Dr. Mateja Grego z MBP pa je v svoji predstavitvi CRP projekta občanske znanosti »Pirati plastike« razkrila, kako uspešno vključiti šolarje v raziskave onesnaženja rek s plastiko in mikroplastiko ter kako doseči mednarodno razsežnost projekta občanske znanosti.

NIB je v letu 2023 organiziral ali soorganiziral preko 60 dogodkov, namenjenih komuniciranju raziskovalnih tem in dosežkov z znanstveno, strokovno in splošno javnostjo, promociji dejavnosti in infrastrukture NIB, povezovanju znanosti z

EKOS participated in a study in which they examined the factors influencing the diversity of 644 bee species in 177 commercial apple orchards across 33 countries and four global biomes.

Human, animal and plant viruses in water represent a major health, environmental and financial burden. Our colleagues from FITO collaborated with the Faculty of Mechanical Engineering at the University of Ljubljana and the Jožef Stefan Institute to build a special device that combines cold plasma with supercavitation and tested its effectiveness in inactivating different types of viruses in contaminated water in a short time. In 2023, they also patented with the U.S. Patent Office their knowledge on water disinfection together with their partners.

Dr Arijana Filipić was one of the recipients of the Jožef Stefan Golden Emblem for her doctoral thesis "Inactivation of viruses in water by cold atmospheric plasma", carried out under the supervision of Prof. Dr Jana Žel and Assist. Prof. Dr David Dobnik. This Golden Emblem is awarded to the most outstanding doctoral theses in natural, mathematical, engineering and life sciences.

In 2023, the Slovenian Research and Innovation Agency (ARIS) selected three achievements of the NIB as outstanding. The outstanding research results were presented on the first day of the event titled ARIS Day 2023 "Excellent in Science" by Assoc. Prof. Dr Meta Virant Doberlet ("The overlooked world of vibrational communication in insects", field of biology), Dr Denis Kutnjak ("Virome research for discovering the unknown diversity of plant viruses in agricultural ecosystems", field of biotechnology) and Dr Jan Zrimec ("Learning the principles of gene expression regulation in plants using artificial intelligence approaches", field of biotechnology).

On the second day of the ARIS Day event 2023, NIB researchers presented good practices in innovation research. FITO researchers (Dr Arijana Filipić, Katja Fric, Tamara Košir and Karmen Pogačar) presented the process of testing the effectiveness of masks, a unique device for purifying contaminated water by plasma and cavitation, and the development of protein complexes from the fungal genus Pleurotus as a new biopesticide for the control of Colorado potato beetle and western corn rootworm. In her presentation of

gospodarstvom in umetnostjo ter vključevanju širše javnosti oziroma neprofesionalnih raziskovalcev v raziskave na različne načine – t. i. občanski ali ljubiteljski znanosti.

Posebej odmevni sta bili predstavitev knjige prof. dr. Lovrenca Lipeja »Podobe iz modrine«, ki jo je avtor ob pogovoru v soorganizaciji s Primorskimi novicami in Društvom za opazovanje in proučevanje ptic Slovenije (DOPPS) predstavil v Naravnem rezervatu Škocjanski zatok v Kopru, ter predstavitev avtobiografije prof. dr. Marine Dermastia in prof. dr. Toma Turka »Znansopotnika«, ki sta jo avtorja v družbi novinarja in pisatelja Marjana Žiberne ter dramskih umetnikov Ajde Smrekar in Borisa Ostana javnosti predstavila v prostorih Biološkega središča.

V maju je NIB pod vodstvom prof. dr. Maruše Pompe Novak sodeloval pri organizaciji in izvedbi že desetega Dneva očarljivih rastlin, ki poteka po vsej Evropi pod okriljem Evropskega združenja za raziskave rastlin (EFSA) in na katerem se je 1340 osnovnošolcev na 34 interaktivnih delavnicah (mikroskopiranje, pipetiranje, izdelava izdelkov, risanje, slikanje, tiskanje, določevalni ključ, čutne zaznave, kviz, igra itd.) seznanilo z različnimi vidiki pomena rastlin in znanosti o rastlinah. Širši javnosti je NIB odprl vrata tudi na septembrskem Dnevu odprtih vrat NIB, ki smo ga izvedli kot pridružen dogodek projekta Noč ima svojo moč – Evropska noč raziskovalcev. Raziskovalci so pripravili vodene predstavitve oddelkov, razkazali nove, vrhunsko opremljene laboratorije in mlade navduševali za poklic znanstvenika. Odvila se je tudi »znanstvena dogodivščina«, ki je okoli 500 obiskovalcev popeljala v svet znanosti na meji med domišljijo in resničnostjo, pri čemer so se srečali s čisto pravimi znanstveniki in poskusi. Izvrstno je bil obiskan tudi Dan odprtih vrat MBP, s katerim vsako leto obeležujemo 8. junij – svetovni dan oceanov. Ob svetovnem dnevu raziskav raka, 26. septembra, je GEN organiziral dogodek z naslovom »Z novimi tehnologijami do boljšega razumevanja in novih možnosti zdravljenja raka«, na katerem so spregovorili o novih tehnologijah pri iskanju bioloških označevalcev in tarč za zdravljenje raka, o pomenu povezovanja znanosti in klinike, nujnosti interdisciplinarnosti in sinergije znanj ter o prihodnosti poskusov na živalih v luči novih *in vitro* modelov raka.

Na NIB si prizadevamo, da znanost ne bi ostajala ujeta med stenami laboratorijev ali zapisana le v akademskih člankih.

the CRP citizen science project "Plastic Pirates", Dr Mateja Grego from the MBS explained how to successfully involve schoolchildren in research on plastic and microplastic pollution in rivers and how to achieve an international dimension of the citizen science project.

In 2023, the NIB organised or participated in the organisation of over 60 events aimed at communicating research topics and achievements to the scientific, expert and general public, promoting the activity and infrastructure of the NIB, connecting science with business and art and involving the general public or non-professional researchers into research in various ways – so-called citizen or amateur science.

Particularly well-noticed were the presentation of the book by Prof. Dr Lovrenc Lipej "Images from the Blue", presented by its author in a talk in the Škocjanski zatok Nature Reserve in Koper in co-organisation with Primorske novice and DOPPS – BirdLife Slovenia (Društvo za opazovanje in proučevanje ptic Slovenije – Association for Birdwatching and Bird Studies of Slovenia), as well as the presentation of "Znansopotnika", the autobiography of Prof. Dr Marina Dermastia and Prof. Dr Tom Turk, presented by the authors, together with the journalist and writer Marjan Žiberna and actors Ajda Smrekar and Boris Ostan, at the premises of the Biological Centre.

In May, the NIB, under the leadership of Prof. Dr Maruša Pompe Novak helped organise and carry out the 10th Fascination of Plants Day, a Europe-wide event organised by the European Plant Science Organisation (EPSO), where 1340 primary school children learned about different aspects of the importance of plants and plant science in 34 interactive workshops (microscopy, pipetting, product making, drawing, painting, printing, identification key, sensory perception, quiz, game, etc.) The NIB also opened its doors to the general public at the NIB Open Day in September, organised as an associated event of the project Night Has its Power – European Researchers' Night. Researchers prepared guided presentations of the departments, presented the new, state-of-the-art laboratories and encouraged young people to become scientists. Another highlight was a "science adventure", which took around 500 visitors into the world of science on the border between fantasy and reality, where they met real scientists and experiments. The MBS Open Day, which takes place every year on 8 June, World Oceans Day, was also

V času, ko se informacije in dezinformacije širijo hitreje kot kdajkoli prej, znanje ne sme biti zgolj privilegij izbranih, temveč mora biti dostopno vsem, razumljivo in uporabno. BTS-NIB ni le fizični prostor, temveč simbol našega poslanstva – sodelovanja, odprtosti in ustvarjanja mostov med znanjem in družbo. Naj bo naš skupni cilj preoblikovati kompleksne koncepte v zaupanja vredna sporočila in znanstvene dosežke usmeriti v vrednote, ki bodo namesto v uničenje vodile v razcvet. Veselimo se prihodnosti in pozdravljamo vsa dosedanja in prihodnja sodelovanja na tej poti – dobrodošli med nami na Večni poti 121.

Prof. dr. Maja Ravnikar
direktorica NIB

very well attended. On World Cancer Research Day on 26 September, GEN organised the event "New technologies for better understanding and new treatment options for cancer", which focused on new technologies in the search for biomarkers and targets to treat cancer, the importance of connecting science and the clinic, the need for interdisciplinarity and synergy of knowledge, and the future of animal experiments in the light of new *in vitro* models of cancer.

The NIB is committed to ensuring that science does not remain caught between lab walls or written only in academic articles. In this time when information and disinformation spreads faster than ever, knowledge should not be the privilege of a select few, but must be accessible, understandable and useful to all. The BTS-NIB is not solely a physical place, it is a symbol of our mission—collaboration, openness and building bridges between knowledge and society. Let our common goal be to transform complex concepts into trustworthy messages and to direct scientific achievements into values that lead to flourishing instead of destruction. We look forward to the future and welcome all past and future collaborations on this journey – welcome to Večna pot 121!

Prof. Dr Maja Ravnikar
Director of the NIB

Poslanstvo in vizija
Mission and Vision

POSLANSTVO

Poslanstvo NIB je ustvarjanje novega znanja na področju bioloških znanosti za razumevanje življenjskih procesov, ohranjanje biološke raznovrstnosti in zdravega okolja, za doseganje večje kakovosti življenja ter podporo trajnostnemu razvoju. Med biološke znanosti šteje biologijo in njej sorodne naravoslovne vede. Interdisciplinarno se povezuje na področjih varstva narave in okolja, biotehnologije, farmacije in medicine, kmetijstva, gozdarstva, ribištva in prehrane, turizma in pomorskega prometa ter prostorskega načrtovanja.

Poslanstvo se uresničuje:

- 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 v izobraževanju na dodiplomskem, podiplomskem in podoktorskem nivoju;
- s predstavljanjem znanosti različnim ciljnim skupinam in javnosti.

VIZIJA

NIB želi kot mednarodno uveljavljena avtonomna institucija ustvarjati vrhunsko znanje in razvijati tehnologije na področjih bioloških in sorodnih naravoslovnih znanosti. Z dobro organiziranostjo in vrhunsko opremo bo skrbel za zadovoljstvo zaposlenih in vzgojo vrhunskih kadrov. Svoj dolgoročni razvoj bo zagotavljal v tesni povezavi z družbo in poslovnim sektorjem.

MISSION

The NIB's mission is to generate new knowledge in biological sciences to understand life processes, as well as to maintain biological diversity and a healthy environment in order to achieve a better quality of life and support sustainable development; biological sciences include biology and related natural sciences. It works in interdisciplinary ways in the fields of nature and environment conservation, biotechnology, pharmacy and medicine, agriculture, forestry, fisheries and nutrition, tourism, maritime transport, and spatial planning.

Its mission is pursued through:

- ground-breaking basic research in 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 achieving a sustainable development of society.
- participation in education at the undergraduate, postgraduate and postdoctoral levels.
- presenting science to different audiences and the public.

VISION

As an internationally recognised autonomous institution, the NIB aims to generate cutting-edge knowledge and develop technologies in the biological and related natural sciences. It aims to ensure the satisfaction of its employees and the development of top-class staff with good organisation and state-of-the-art equipment. It will ensure its long-term development in close co-operation with society and the business sector.

Strategija
Strategy

NIB je strateške in dolgoročne cilje ter ključne pristope oziroma ukrepe za njihovo doseganje opredelil 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 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.

The NIB set out its strategic and long-term objectives and the key approaches or actions to achieve them 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 considering 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. With its diversity, interdisciplinarity and flexibility, it responds quickly and effectively to crises and other important situations, working together 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 expert 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

Vodstvo inštituta
The Institute's Management

Direktorica Managing Director

Prof. dr. Maja Ravnikar
Mandat Term of office: 1. 1. 2021 – 31. 12. 2025

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

Mag. Franc Potočnik (od since 1999)
Mandat Term of office: 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 Term of office: 10. 3. 2021 – 31. 12. 2025

Upravni odbor Governing Board

Prof. dr. Franci Demšar, Nacionalna agencija Republike Slovenije za kakovost v visokem šolstvu Slovenian National Quality Assurance Agency for higher education – predsednik President

Dr. Tomaž Boh, Ministrstvo za izobraževanje, znanost in inovacije Ministry of Higher Education, Science and Innovation

Mag. Gašper Polajnar, MSc

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

Prof. dr. Uroš Urleb, Biofarmacevtika Mengeš, Novartis

Mandat Term of office: 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 17/06/2020 to 16/06/2024, 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 (direktorica director),
doc. dr. Al Vrezec,
doc. dr. Anže Županič.

Častni člani Honorary Members

Prof. dr. Kazimir Tarman, od since 25. 10. 2010

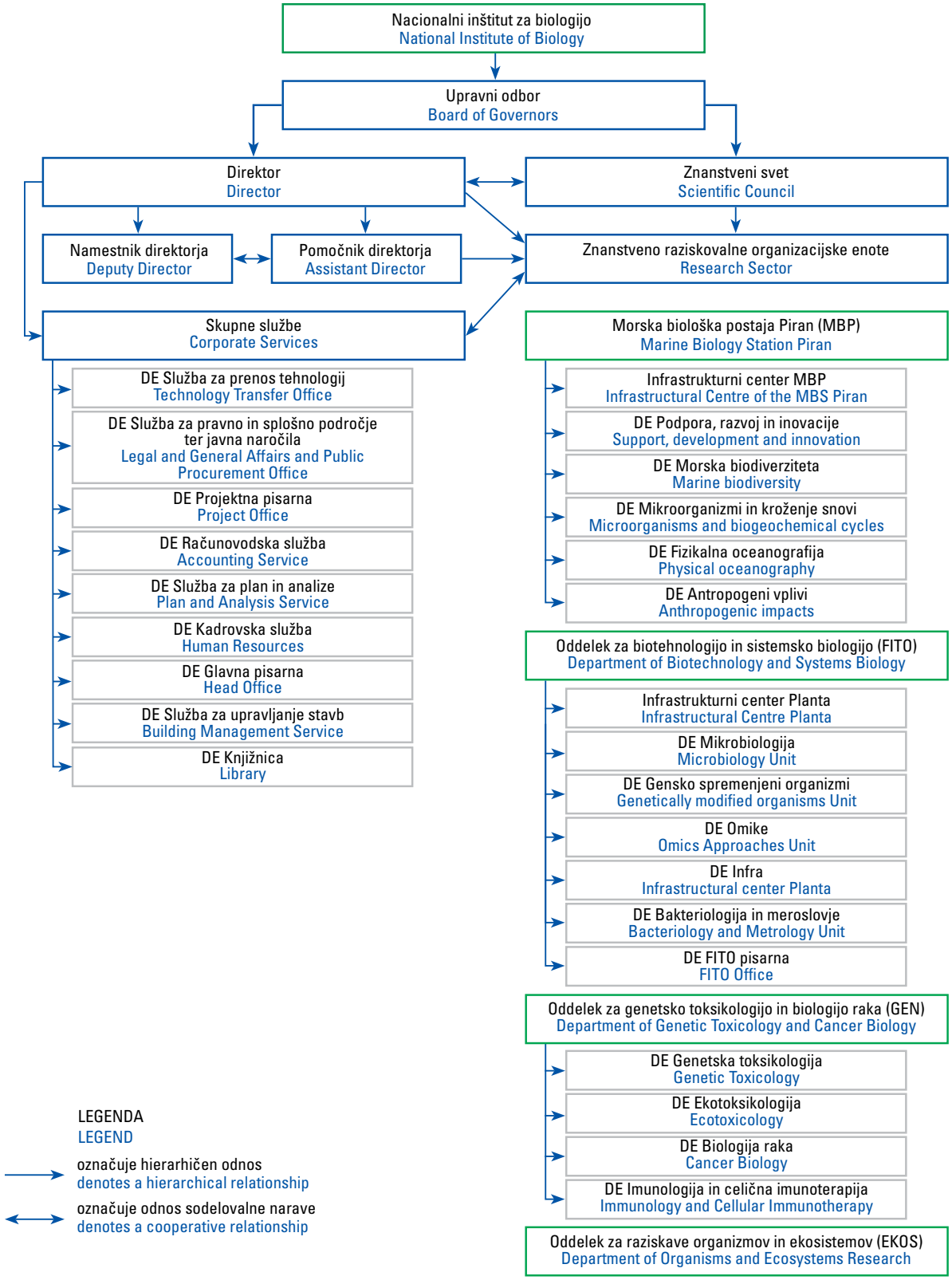
Dr. Guy Van Den Eede, od since 25. 10. 2010

Prof. dr. Cornelis Johannes Forrendinis van Noorden, od since 14. 11. 2014

Prof. dr. Tom Turk, od since 8. 11. 2017

Akad. prof. dr. Matija Gogala, od since 21. 12. 2020

Organizacijska shema
Organizational Chart

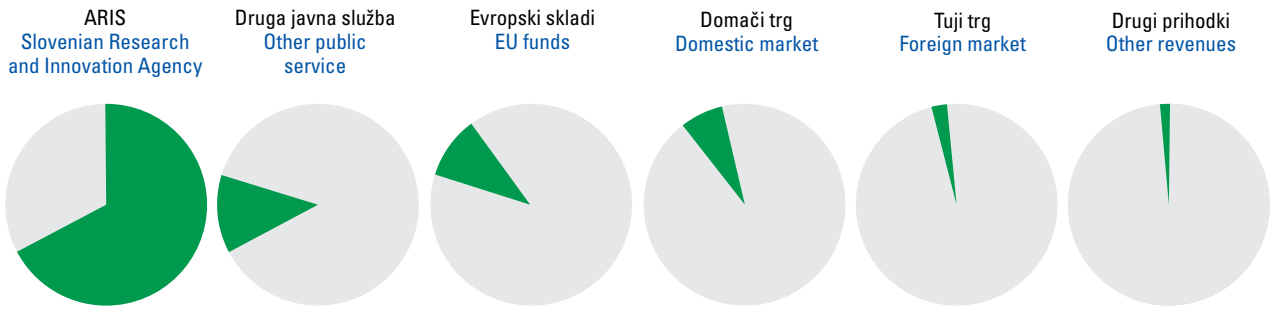


Pregled poslovanja NIB v letu 2023
Overview of the NIB's Operations in 2023

Leto 2023 bo v zgodovini NIB zapisano kot eno njegovih najuspešnejših. V tem letu je NIB namreč uspel zaključiti dve izjemno pomembni investicijski operaciji – »Biotehnološko stičišče Nacionalnega inštituta za biologijo« in »Nakup raziskovalne opreme«. Z dokončanjem navedenih investicijskih operacij je NIB pridobil najsodobnejšo raziskovalno infrastrukturno in opremo, kar mu zagotavlja vrhunske delovne pogoje in omogoča nadaljnji razvoj. Vsa dela v zvezi z gradnjo 2. etape BTS-NIB so bila zaključena do 30. 11. 2023, vključno s preselitvijo zaposlenih v nove poslovne prostore. Postopki nabave nove raziskovalne opreme so se zaključili v juniju 2023. Tudi na drugih področjih poslovanja je NIB v letu 2023 dosegel veliko uspehov, ki so navedeni v nadaljevanju tega poročila.

The year 2023 will be marked in the history of the NIB as one of its most successful. In this year, the NIB was able to complete two very important investment operations – the "Biotechnology Hub of the National Institute of Biology" and the "Purchase of Research Equipment". The completion of these investment operations gave the NIB a state-of-the-art research infrastructure and equipment, which provides it with excellent working conditions and enables further development. All works related to the second phase of construction of the BTS-NIB were completed by 30 November 2023, including the relocation of staff to the new premises. Procurement procedures for new research equipment were completed in June 2023. In other areas of its operations, the NIB also achieved many successes in 2023, which are outlined later in this report.

Struktura prihodkov NIB v letu 2023
NIB Revenue Structure in 2023



PRIHODKI V EUR / REVENUES IN EUR	2023	STRUKTURA / STRUCTURE 2023 (%)	2022	INDEKS / INDEX 2023/2022
ARIS / Slovenian Research Agency	9.854.446	67,39	8.492.725	116,03
Druga javna služba / Other public service	1.821.392	12,46	1.495.330	121,81
Evropski skladi / EU funds	1.456.196	9,96	1.799.856	80,91
Domači trg / Domestic market	956.597	6,54	1.024.166	93,40
Tuji trg / Foreign market	321.165	2,20	196.721	163,26
Drugi prihodki / Other revenues	212.608	1,45	198.755	106,97
Skupaj prihodki / Total revenues	14.622.404	100,00	13.207.553	110,71

ODHODKI V EUR / EXPENSES IN EUR	2023	STRUKTURA / STRUCTURE 2023 (%)	2022	INDEKS / INDEX 2023/2022
Stroški dela / Labour	8.208.183	59,26	7.287.248	112,64
Stroški amortizacije / Amortization	572.248	4,13	602.309	95,01
Stroški materiala / Material	1.717.047	12,40	1.440.103	119,23
Stroški storitev / Services	3.203.960	23,13	3.191.217	100,40
Drugi stroški in odhodki / Other	148.612	1,07	352.475	42,16
Skupaj odhodki / Total expenditure	13.850.051	100,00	12.873.352	107,59

REZULTAT POSLOVANJA / BUSINESS RESULT	772.353		334.201	231,10

Finančno je NIB v letu 2023 posloval zelo uspešno, kljub temu da so bili številni zaposleni še vedno intenzivno vpeti v izvajanje investicije BTS-NIB, kar je zanje pomenilo veliko dodatno obremenitev in posledično manj časa za izvajanje osnovne dejavnosti. Realizirani prihodki v višini 14.622.404 EUR so bili sicer nekoliko nižji od načrtovanih v finančnem načrtu za leto 2023 (za 356.344 EUR oz. 2,38 %), vendar so bili tudi realizirani odhodki v višini 13.850.051 EUR nižji od načrtovanih (za 905.552 EUR oz. 6,14 %), zato je posledično ustvarjeni poslovni izid – presežek prihodkov nad odhodki (pred obračunom davka od dohodkov pravnih oseb) v višini 772.353 EUR bistveno presegel načrtovanega (za 549.208 EUR oz. 246,12 %). V primerjavi z letom 2022 so bili prihodki v letu 2023 višji za 1.414.851 EUR (10,71 %), odhodki pa za 976.700 EUR (7,58 %). Poslovni izid v letu 2023 je bil zato bistveno višji kot v letu 2022 (v letu 2022 je presežek prihodkov nad odhodki pred obračunom davka od dohodka znašal 233.786 EUR). Nominalno največja rast prihodkov v letu 2023 v primerjavi z letom 2022 je bila dosežena pri prihodkih s strani Javne agencije za raziskovalno in inovacijsko dejavnost. Ti prihodki so v letu 2023 znašali 9.859.186 EUR in so bili od primerljivih v letu 2022 višji za

Financially, the NIB performed very well in 2023, despite the fact that a number of employees were still heavily involved in the implementation of the BTS-NIB investment, which placed a significant additional burden on them and consequently reduced their time available to perform their basic activity. While realised revenue of EUR 14,622,404 was slightly lower than planned in the 2023 financial plan (by EUR 356,344 or 2.38%), the realised expenditure of EUR 13,850,051 was also lower than planned (by EUR 905,552 or 6.14%), which resulted in an operating result – surplus of revenue over expenditure (before corporation tax) of EUR 772,353, which was significantly higher than planned (by EUR 549 208 or 246.12%). Compared to 2022, the realised revenue in 2023 was EUR 1,414,851 (10.71%) higher and realised expenditure EUR 976,700 (7.58%) higher. The operating result in 2023 was therefore significantly higher than in 2022 (in 2022, the surplus of revenue over expenditure before corporation tax amounted to EUR 233,786). The highest nominal growth in revenue in 2023 compared to 2022 was in the revenue received from the Slovenian Research and Innovation Agency. This revenue amounted to EUR 9,859,186 in 2023 and was EUR 1,366,461 (16.09%)

1.366.461 EUR (16,09 %). Prihodki s strani Ministrstva za visoko šolstvo, znanost in inovacije v letu 2023 v vrednosti 422.887 EUR so bili višji od primerljivih prihodkov v letu 2022 za 177.778 EUR oz. 72,53 %. Tudi prihodki iz tržne dejavnosti v letu 2023 v vrednosti 1.277.786 EUR so bili višji od primerljivih v letu 2022, in sicer za 56.898 EUR oz. 4,66 %. Prihodki iz druge javne službe v letu 2023 v vrednosti 2.849.938 EUR pa so bili nižji od primerljivih v letu 2022 za 200.140 EUR oz. 6,56 %.

higher than the comparable revenue in 2022. The revenue from the Ministry of Higher Education, Science and Innovation in 2023 amounted to EUR 422,887 and was EUR 177,778 or 72.53% higher than the comparable revenue in 2022. The revenue from commercial activities in 2023 of EUR 1,277,786 was also EUR 56,898 or 4.66% higher than the comparable revenue in 2022. However, the revenue from other public service in 2023 amounted to EUR 2,849,938 and was EUR 200,140 or 6.56% lower than the comparable revenue in 2022.

Polavtomatski sistem za fenotipizacijo (PSI), ki omogoča fenotipizacijo rastlin po principu rastlina k senzorju s 5 različnimi moduli.
Foto: M. Kambič

Semi-automated plant phenotyping system (PSI) that allows plant phenotyping on a plant-to-sensor basis with 5 different modules.
Photo: M. Kambič

Izvajanje raziskovalnih programov in projektov
Implementing Research Programmes and Projects

NIB s svojim znanstvenoraziskovalnim delom sodeluje pri vrhunskih dosežkih in oblikovanju smernic ter doseganju novih odkritij. V letu 2023 je NIB v okviru stabilnega financiranja izvajal osem raziskovalnih programov: šest kot nosilna in dva kot sodelujoča organizacija. Večina programov se glede na ERC panel uvršča v LS8 (Life sciences; Okoljska biologija, ekologija in evolucija) in LS9 (Life sciences; Biotehnologija in biosistemsko inženirstvo), en program je uvrščen v PE4 (Physical Sciences & Engineering: Fizikalna in analizna kemija):

Raziskovalni program P1-0237, »Raziskave obalnega morja« izvaja organizacijska enota MBP. V programski skupini, ki jo vodi dr. Patricija Mozetič, sodeluje 21 raziskovalcev, dva upokojena raziskovalca, štiri tehnični sodelavci in pet mladih raziskovalcev (MR). Program je uvrščen v LS8;

Raziskovalni program P4-0165, »Biotehnologija in sistemska biologija rastlin« izvaja organizacijska enota FITO. V programski skupini, ki jo vodi dr. Kristina Gruden, sodeluje 24 raziskovalcev, en tehnični sodelavec in šest MR. Program je uvrščen v LS9;

Raziskovalni program P1-0255, »Struktura in funkcija ekosistemov« izvaja organizacijska enota EKOS. V programski skupini, ki jo vodi dr. Meta Virant-Doberlet, sodeluje 20 raziskovalcev, dva tehnična sodelavca in pet MR. Program se izvaja tudi v soizvajalski organizaciji Prirodoslovni muzej Slovenije. Program je uvrščen v LS8;

Raziskovalni program P1-0245, »Ekotoksikologija, toksikološka genomika in karcinogeneza« izvaja organizacijska enota GEN. V programski skupini, ki jo vodi dr. Bojana Žegura, sodeluje 11 raziskovalcev, dva upokojena raziskovalca, štiri tehnični sodelavci in štiri MR. Program je uvrščen v LS9;

With its scientific research work, the NIB participates in cutting-edge achievements and the development of guidelines and new discoveries. In 2023, the NIB was carrying out eight research programmes under stable funding: six as lead and two as a collaborating organisation. The majority of programmes are classified as LS8 according to the ERC panel (Life sciences; Environmental biology, ecology and evolution) and LS9 (Life sciences; Biotechnology and Biosystems Engineering), and one programme is classified as PE4 (Physical Sciences & Engineering: Physical and analytical chemistry):

Research programme P1-0237, "Coastal Marine Research", is carried out by the MBS. The programme team, led by Dr Patricija Mozetič, comprises 21 researchers, 2 retired researchers, 4 technical assistants and 5 young researchers (YR). The programme is classified as LS8.

The research programme P4-0165, "Biotechnology and Systems Biology of Plants", is carried out by the FITO organisational unit. The programme team, led by Dr Kristina Gruden, comprises 24 researchers, 1 technical assistant and 6 YR. The programme is classified as LS9.

The research programme P1-0255, "Ecosystem structure and function" is carried out by the EKOS organisational unit. The programme team, led by Dr Meta Virant-Doberlet, comprises 20 researchers, 2 technical assistants and 5 YR. The programme is also carried out at the Natural History Museum of Slovenia as collaborative organisation. The programme is classified as LS8.

The research programme P1-0245, "Ecotoxicology, toxicological genomics and carcinogenesis" is carried out by the GEN organisational unit. The programme team, led by Dr Bojana Žegura, comprises 11 researchers,

Raziskovalni program P4-0407, »Okoljska in aplikativna virologija: virusi, prijatelji in sovražniki« izvaja organizacijska enota FITO. V programski skupini, ki jo vodi dr. Ion Gutierrez Aguirre, sodeluje osem raziskovalcev in pet MR. Program je uvrščen v LS9;

Raziskovalni program P4-0432, »Morska in mikrobna biotehnologija« izvaja organizacijska enota MBP. V programski skupini, ki jo vodi dr. Ana Rotter, sodelujeta dva raziskovalca, dva tehnična sodelavca in en MR. Program je uvrščen v LS9.

NIB je v letu 2023 sodeloval še v dveh programih kot soizvajalec:

Raziskovalni program 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. Sodeluje organizacijska enota MBP (en raziskovalec in en upokojeni raziskovalec). Program je uvrščen v PE4;

Raziskovalni program P4-0431, »Kmetijstvo naslednje generacije«. Nosilec programa je Kmetijski inštitut Slovenije, vodja Jaka Razinger. Sodeluje organizacijska enota FITO (en raziskovalec, en MR). Program je uvrščen v LS9.

Poleg aktivnosti, financiranih v okviru stabilnega financiranja (en infrastrukturni program, šest raziskovalnih programov kot nosilec in dva kot partner ter 26 mladih raziskovalcev), je NIB v letu 2023 izvajal 44 temeljnih, 10 aplikativnih, osem podoktorskih, osem CRP projektov, tri mednarodne projekte (ERC in VA), tri druge projekte (NOO) in 12 bilateralnih projektov, ki se financirajo ali sofinancirajo iz proračuna pristojnega ministrstva neposredno ali posredno prek ARIS in iz proračunov drugih ministrstev. Iz preglednice 1 je razvidno, da je NIB v letu 2023 poleg nacionalnih projektov aktivno izvajal tudi številne evropske centralizirane in decentralizirane ter druge mednarodne projekte in se potegoval ter uspešno pridobival tudi tržne projekte.

Dodatno si je NIB v letu 2023 prizadeval pridobivati sredstva iz čim širšega nabora potencialnih shem za financiranje projektov. Oddane so bile številne prijave na nacionalne in mednarodne razpise, financirane iz programa Horizon Europe in drugih EU shem financiranja.

2 retired researchers, 4 technical assistants and 4 YR. The programme is classified as LS9.

The research programme P4-0407, "Environmental and applied virology: viruses, friends and foes" is carried out by the FITO organisational unit. The programme group, led by Ion Gutierrez Aguirre, comprises eight researchers and five YR. The programme is classified as LS9.

The research programme P4-0432, "Marine and microbial biotechnology" is carried out by the MBS organisational unit. The programme team, led by Dr Ana Rotter, comprises 2 researchers, 2 technical assistants and 1 YR. The programme is classified as LS9.

The NIB participated in two more programmes in 2023 as co-implementer:

Research programme P1-0143, "Cycling of substances in the environment, mass balances, modelling of environmental processes and risk assessment". The programme promoter is the Jožef Stefan Institute, headed by Dr Milena Horvat. The MBS organisational unit is involved (1 researcher and 1 retired researcher). The programme is classified as PE4.

Research programme P4-0431, "Next Generation Agriculture". The programme promoter is the Agricultural Institute of Slovenia, headed by Jaka Razinger. The FITO organisational unit is collaborating (1 researcher, 1 YR). The programme is classified as LS9.

In addition to the activities funded under stable funding (one infrastructure programme, six research programmes as promoter and two as partner, and 26 young researchers), in 2023 the NIB was carrying out 44 basic, 10 applicative, eight postdoctoral, eight CRP, three international (ERC and VA), three NOO and 12 bilateral projects funded or co-funded from the budget of the competent ministry, directly or indirectly through ARIS, as well as from the budgets of other ministries. Table 1 shows that in addition to national projects, the NIB actively implemented a number of European centralised and decentralised projects and other international projects in 2023, as well as competing for and successfully winning commercial projects.

In addition, in 2023, the NIB sought to raise funds from the widest possible range of potential project funding schemes.

V okviru projekta 5xPRO je projektna pisarna NIB v letu 2023 organizirala in izvedla interno delavnico glede različnih shem financiranja EU projektov za zainteresirane prijavitelje na NIB. Usposabljanje na temo Financiranja programa Obzorje Evropa s poudarkom na shemi Evropskega raziskovalnega sveta (ERC) je bilo namenjeno krepitvi kompetenc strokovnih sodelavcev projektnih pisarn oz. vseh, ki sodelujejo v procesu projektnega managementa, in usmerjeno v novosti s področja financiranja HEU-ERC.

Na NIB je bilo v letu 2023 pod okriljem projektne pisarne organiziranih in izvedenih osem internih dogodkov – izobraževalnih delavnic in svetovanj s področja upravljanja projektov in posameznih razpisov za raziskovalce (npr. za ARIS razpis, za Twinning, Excellence Hub idr.), delavnica o projektnih financah na vseh OE idr.

Numerous applications were submitted to national and international tenders funded by Horizon Europe and other EU funding schemes.

In the context of the 5xPRO project, in 2023 the NIB Project Office organised and held an internal workshop on the different EU project funding schemes for interested applicants at the NIB. The training on the Horizon Europe Programme Funding focusing on the European Research Council (ERC) scheme was aimed at strengthening the competences of project office staff and all those involved in the project management process and focused on new developments in the field of HEU-ERC funding.

Eight internal events were organised and carried out at the NIB in 2023 under the auspices of the Project Office – training workshops and consultancy sessions on project management and individual tenders for researchers (e.g. for the ARIS tender, for Twinning, Excellence Hub, etc.), a workshop on project finance at all OUs, etc.

Rumeni strnad.
Foto: D. Tome

Yellowhammer.
Photo: D. Tome

Znanstvenoraziskovalna dejavnost za leto 2023

Vrsta projekta	Nosilec, koordinator	Sodelujoči, partner	SKUPAJ
ZNANSTVENORAZISKOVALNA DEJAVNOST ZA LETO 2023 IZ NASLOVA STABILNEGA FINANCIRANJA			
Infrastrukturni steber - ISF			
ARIS– infrastrukturni program	1	0	1
Programski steber - PFS			
ARIS – raziskovalni programi	6	2	8
ARIS – mladi raziskovalci	27		27
Razvojni steber - RFS			
Podpora novim raziskovalnim področjem	2	2	
Spodbujanje prijav koordinatorskih projektov na razpise/sheme OP HEU	2	2	
Spodbujanje prijav mednarodnih/evropskih patentov s popolnim preskusom	1	1	
Podpora razvojnim aktivnostim, ki vodijo v ustanovitev novih podjetij oz. prodajo znanja	1	1	
ZNANSTVENORAZISKOVALNA DEJAVNOST ZA LETO 2023 IZ DRUGIH VIROV FINANCIRANJA			
Projekti, ki se financirajo preko ARIS			
ARIS – temeljni projekti	24	20	44
ARIS – aplikativni projekti	5	5	10
ARIS – podoktorski projekti	8		8
ARIS – ciljni raziskovalni programi	5	3	8
ARIS – mednarodni projekti (ERC in VA)	3		3
ARIS – mednarodni projekti; NOO mobilnost	3		3
ARIS – mednarodni projekti; bilateralni projekti	12		12
Projekti, ki se financirajo ali sofinancirajo iz proračuna MVZI in drugih ministrstev ter agencij (brez ARIS)			
MVZI (NOO, Partnerstva - Biodiversa, Unesco,…)	2	5	7
Druga ministrstva in agencije (NOO, Partnerstva – Metrology,…)		4	4
EU IN MEDNARODNI PROJEKTI			
Evropski projekti Okvirni Program (HEU in H2020)	2	9	11
Drugi evropski centralizirani projekti (LIFE, EMPIR, EMFAF, ERASMUS+, EU4H, EDF, projekti generalnih direktoratov npr. DG MARE, DG ENVIRONMENT, DG SANTE in drugi npr: Eco Innovation, EURAMET …		9	9
Mednarodni decentralizirani projekti Npr. Evropsko teritorialno sodelovanje (interregionalno, transnacionalno, čezmejno) (npr. projekti INTERREG, ICGEB)		6	6
Drugi mednarodni projekti (Npr. COST akcije, Norveški in EGP mehanizem, EFSA …)	18		18
TRŽNI PROJEKTI			
Domači trg – javna služba (Domači naročniki; državne inštitucije, javni zavodi, društva ipd.)	25		25
Domači trg – gospodarstvo *(Domači naročniki; gospodarske družbe, samostojni podjetniki ...)	23		23
Tuji trg (Tuji naročniki storitev, EESA)	8		8
SKUPAJ	**178**	**63**	**235**

(ESRR – Evropski sklad za regionalni razvoj, ESS – Evropski socialni sklad, KS – Kohezijski sklad, Evropski sklad za pomorstvo in ribištvo (ESPR), Evropski kmetijski sklad za razvoj podeželja (EKSRP), NOO – Načrt za okrevanje in odpornost)

* Storitve GSO analize, bakterijske analize in analize mikroorganizmov se vsaka posamezno upošteva kot en projekt, pri čemer je bilo za to skupino storitev izvedenih 85 naročil v segmentu Domači trg – gospodarstvo in 10 naročil na segmentu Tuji trg. Podobno velja za storitve GLP, kjer bilo izvedenih storitev skupaj za 6 naročil.

Scientific research activities in 2023

Type of project	Promoter, co-ordinator	Participant, partner	TOTAL
SCIENTIFIC RESEARCH ACTIVITY IN 2023 UNDER STABLE FUNDING			
Infrastructure pillar – ISF			
ARIS – Infrastructure Programme	1	0	1
Programme pillar – PFS			
ARIS – research programmes	6	2	8
ARIS – young researchers	27		27
Development pillar – RFS			
Support for new research areas	2		2
Encouraging applications of co-ordination projects to HEU OP tenders/schemes	2		2
Encouraging international/European patent applications with full testing	1		1
Support for development activities leading to the creation of new companies or the sale of knowledge	1		1
SCIENTIFIC RESEARCH ACTIVITY IN 2023 FROM OTHER SOURCES OF FUNDING			
Project funded through ARIS			
ARIS – basic projects	24	20	44
ARIS – applied projects	5	5	10
ARIS – postdoctoral projects	8		8
ARIS – targeted research programmes	5	3	8
ARIS – international projects (ERC and VA)	3		3
ARIS – international projects; NOO mobility	3		3
ARIS – international projects; bilateral projects	12		12
Projects funded or co-funded from the MVZI budget and budgets of other ministries and or agencies (without ARIS)			
MVZI (NOO, Partnerships – Biodiversa, UNESCO, …)	2	5	7
Other ministries and agencies (NOO, Partnerships – Metrology, …)		4	4
EU AND INTERNATIONAL PROJECTS			
European projects – Framework Programme (HEU and H2020)	2	9	11
Other European centralised projects (LIFE, EMPIR, EMFAF, ERASMUS+, EU4H, EDF, DG projects e.g. DG MARE, DG ENVIRONMENT, DG SANTE and others e.g. Eco Innovation, EURAMET, etc.)		9	9
International decentralised projects, e.g. European Territorial Co-operation (interregional, transnational, cross-border; e.g. INTERREG, ICGEB projects)		6	6
Other international projects (e.g. COST Actions, Norwegian and EEA Mechanism, EFSA, etc.)	18		18
MARKETABLE PROJECTS			
Domestic market – public service (domestic clients; state institutions, public institutions, associations, etc.)	25		25
Domestic market – business* (domestic clients; companies, sole traders, etc.)	23		23
Foreign market (foreign clients, EESA)	8		8
TOTAL	**178**	**63**	**235**

(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)

* The services of GMO analysis, bacterial analysis and micro-organism analysis are each considered individually as one project; for this group of services, 85 orders were carried out in the Domestic Market business segment and 10 orders for the Foreign Market segment. The same applies to GLP services, where a total of six orders were carried out.

Poleg znanstvenoraziskovalnega dela pa NIB izvaja tudi strokovne naloge za javno pravne naročnike.

NIB je zaradi vrhunskega znanja, sodobne opreme in vpeljanih sistemov kakovosti s strani Evropske komisije imenovan v dva evropska referenčna laboratorija ter s strani nacionalnih pristojnih organov kot nacionalni referenčni in uradni laboratorij. V okviru strokovnih nalog so se v letu 2023 na NIB, podobno kot v preteklih letih, izvajale številne strokovne in razvojne naloge v okviru imenovanj. V okviru izvajanja strokovnih nalog za javnopravne naročnike pa NIB že vrsto let poleg strokovnih nalog izvaja tudi projekte in raziskave na fitosanitarnem področju za Euphresco, ki je organiziran v okviru Evropske in mediteranske organizacije za varstvo rastlin – EPPO.

Poleg tega NIB izvaja številne strokovne naloge tudi za naročnike s statusom javnih organizacij, kot so ministrstva in njihove agencije, javni zavodi, občine ipd. Pretežni del strokovnih nalog, ki jih je NIB izvajal v letu 2023, je bil povezan z okoljskim monitoringom (vrednotenjem določenih parametrov v okolju) in monitoringom izbranih vrst, vključujoč ukrepe in cilje varstva ter obnove biotske raznovrstnosti glede na potrebe naročnika.

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.

NIB si je v letu 2023 prizadeval tudi za vključitev v biobančni konzorcij BBMRI.SI oz. priključitev v slovensko vozlišče BBMRI-ERIC, ki je del evropske raziskovalne infrastrukture za biobančništvo. S podpisom Aneksa št. 1 k Sporazumu o ustanovitvi konzorcija, predvidoma v januarju 2024, je NIB postal član konzorcija BBMRI.SI, ki je slovensko vozlišče BBMRI-ERIC, ta pa del evropske raziskovalne infrastrukture za biobančništvo.

In addition to its scientific research work, the NIB also carries out expert assignments for public-law clients.

Thanks to its top-class know-how, modern equipment and proven quality systems, the NIB has been appointed by the European Commission into two European Reference Laboratories and by the national competent authorities as a National Reference and Official Laboratory. In the area of expert tasks, several professional and development tasks in the context of appointments were carried out in 2023 at the NIB, as in previous years. In the context of expert tasks for public law clients, the NIB has for many years also been carrying out projects and research in the field of plant protection for Euphresco, which is organised within the framework of the European and Mediterranean Plant Protection Organisation – EPPO.

In addition, the NIB also carries out a number of expert tasks for clients with the status of public organisations, such as ministries and their agencies, public institutions, municipalities, etc. The majority of the expert tasks carried out by the NIB in 2023 were related to environmental monitoring (evaluation of certain parameters in the environment) and monitoring of selected species, including measures and targets for the protection and restoration of biodiversity according to clients' needs.

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.

In 2023, the NIB was 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. By signing Annex 1 to the Consortium Agreement in January 2024 the NIB became a member of the BBMRI.SI consortium, which is the Slovenian node of BBMRI-ERIC, which is part of the European biobanking research infrastructure.

Vključenost v raziskovalne infrastrukture oziroma projekte v letu 2023

Št.	Raziskovalna infrastruktura	Opis	Vodja na NIB
1	LifeWatch ERIC	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 ter 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 in MONGOOS	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 zagotavlja visoko kakovost storitev in produktov.	Branko Čermelj

Involvement in research infrastructures or projects in 2023

No.	Research infrastructure	Description	Head at the NIB
1	LifeWatch ERIC	The NIB is a member of LIFEWATCH, the European Research Infrastructure Consortium providing e-Science research facilities to scientists investigating biodiversity and ecosystem functions and services. Through the Slovenian LifeWatch-SI consortium, the NIB contributes marine data and participates in the consortium's joint activities.	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 research of life sciences 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, the 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	With its large electron microscopy infrastructure, the NIB 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 and MONGOOS	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	EMODnet	The databases within the IC MBS form the basis for integration into European infrastructure links such as EMODnet, which provides access to public marine data and metadata in a unified way, while ensuring high-quality services and products.	Branko Čermelj

Investicijska vlaganja
Investments

V letu 2023 je NIB uspešno zaključil izjemno pomembno investicijo, ki sta jo sestavljali dve investicijski operaciji: »Biotehnološko stičišča Nacionalnega inštituta za biologijo (BTS-NIB)« in »Nakup raziskovalne opreme NIB« ter izvedel druga investicijska vlaganja v obliki nabav osnovnih sredstev.

In 2023, the NIB successfully completed an extremely important investment consisting of two investment operations: "Biotechnology Hub of the National Institute of Biology (BTS-NIB)" and "Acquisition of NIB research equipment" and made other investments in the form of fixed asset purchases.

Zaključena gradnja
Biotehnološkega stičišča.
Foto: M. Kambič

Completed construction
of the Biotechnological Hub.
Photo: M. Kambič

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

Gradnja objekta BTS-NIB se je pričela izvajati julija 2021 in je bila v letu 2023 v celoti zaključena. Sofinancirana je bila s strani Evropskega sklada za regionalni razvoj in Ministrstva za visoko šolstvo, znanost in inovacije ter EU.

V letih 2021 in 2022 so se izvajala gradbeno-obrtniška in inštalacijska dela na prvi etapi gradnje novega objekta BTS-NIB, ki je bila z vso pripadajočo komunalno in energetsko infrastrukturo, ureditvijo okolja in notranjo pohištveno ter tehnološko opremo zaključena jeseni 2022. Po pridobljenem uporabnem dovoljenju v začetku decembra 2022 je bila izvedena preselitev zaposlenih iz pisarniških kontejnerjev »Vhodnega objekta«, v drugi polovici decembra pa so se pričeli uporabljati novo zgrajeni prostori prve etape objekta BTS-NIB.

Po preselitvi v nove prostore prve etape novega objekta BTS-NIB se je pričela gradnja druge etape. Zaključena je bila konec oktobra 2023, ko je bilo pridobljeno pravnomočno uporabno dovoljenje. Od decembra 2023, ko je bila zaključena preselitev zaposlenih tudi v drugi del objekta, je ta pričel delovati kot celota.

Objekt, ki meri v dolžino dobrih 152 m in širino 23,5 m, ima 6.600 m^2 uporabne površine ter obsega pritličje, nadstropje in tehnično etažo, na kateri je na severni strani rastlinjak, na južni pa čebelarij. Skupna vrednost investicije BTS-NIB je znašala 28.917.389,78 EUR.

The construction of the BTS-NIB started in July 2021 and was completed in 2023. It was co-funded by the European Regional Development Fund, the Ministry of Higher Education, Science and Innovation, and the EU.

In 2021 and 2022, construction and installation work was carried out in the first construction phase of the new BTS-NIB building, which was completed in autumn 2022, with all associated utility and energy infrastructure, landscaping and interior furniture and technological equipment. Following the operating permit obtained in early December 2022, the relocation of staff from the office containers from the "Entrance facility" was carried out and the newly built premises of the first phase of the BTS-NIB were put into use in the second half of December.

After the relocation into the new premises of the first phase of the new BTS-NIB building, construction of the second phase commenced. It was completed at the end of October 2023, when the final operating permit was obtained. Since December 2023, when the relocation of staff to the second part of the building was completed, it has been functioning as a whole.

The building, which measures 152 m in length and 23.5 m in width, has a usable surface area of 6,600 sq. m and comprises a ground floor, a first floor and a technical floor, with a greenhouse on the northern side and a bee laboratory on the southern side. The total investment value of the BTS-NIB was EUR 28,917,389.78.

Sodobni laboratoriji
Biotehnološkega stičišča.
Foto: M. Kambič

State-of-the-art laboratories
at the Biotechnological Hub.
Photo: M. Kambič

Ostala investicijska vlaganja v letu 2023
Other Investments in 2023

V investicijski operaciji »Nakup raziskovalne opreme NIB«, ki se je izvajala kot 2. faza v sklopu enotnega projekta BTS-NIB, je NIB nabavil novo raziskovalno opremo v vrednosti 6.098.943,94 EUR, od tega v letu 2023 v vrednosti 746.958,29 EUR. S to raziskovalno opremo, ki je nadgradila obstoječo raziskovalno infrastrukturo, bo NIB še naprej ustvarjal vrhunsko znanje ter razvijal tehnologije in izdelke na področju bioloških in sorodnih naravoslovnih ved. Nova raziskovalna oprema bo omogočala krepitev znanstvene odličnosti na mednarodnem nivoju, vzpostavila inovativno okolje, privlačno tako za domače kot tudi tuje raziskovalce, krepila sodelovanje z drugimi slovenskimi raziskovalnimi ustanovami in evropskimi raziskovalnimi infrastrukturami ter spodbujala povezave z mednarodnimi raziskovalnimi organizacijami. Nova visokokvalitetna raziskovalna oprema omogoča tudi tesnejše povezovanje z gospodarskim sektorjem ter nudi odlično podporo nacionalnim programom monitoringa in ministrstvom z najsodobnejšimi znanji.

Poleg zgoraj navedenih nabav nove raziskovalne opreme je NIB v letu 2023 realiziral še za 7.519.726 EUR drugih nabav osnovnih sredstev. Skupaj z osnovnimi sredstvi v višini 804.427 EUR, ki so konec leta 2022 ostala v pridobivanju, je bilo v letu 2023 aktiviranih za 8.324.153,31 EUR osnovnih sredstev.

In the investment operation "Acquisition of NIB research equipment", carried out as phase 2 of the BTS-NIB unified project, NIB purchased new research equipment in the amount of EUR 6,098,943.94, of which EUR 746,958.29 in 2023. With this research equipment, which is an upgrade of the existing research infrastructure, the NIB will continue to generate cutting-edge know-how and develop technologies and products in biological and related natural sciences. The new research equipment will help to strengthen scientific excellence at the international level, create an innovative environment attractive to both domestic and foreign researchers, strengthen co-operation with other Slovenian research institutions and European research infrastructures, and encourage connections with international research organisations. The new high-quality research equipment also allows closer connections with the business sector and provides excellent support to national monitoring programmes and ministries with state-of-the-art expertise.

In addition to the above purchases of new research equipment, the NIB has made other fixed asset purchases in the amount of EUR 7,519,726 in 2023. Together with fixed assets in the amount of EUR 804,427 remaining to be acquired at the end of 2022, EUR 8,324,153.31 of fixed assets was activated in 2023.

Zaposleni v letu 2023
Employees in 2023

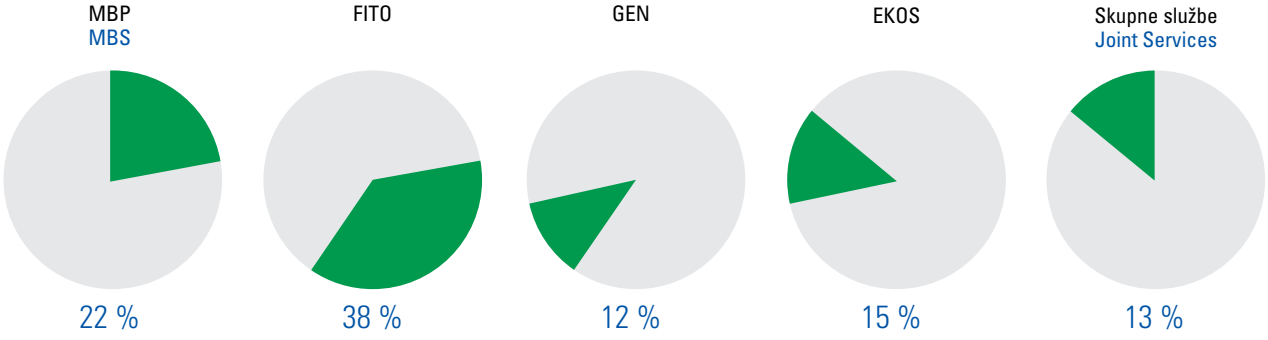
Na NIB je bilo na dan 31. 12. 2023 194 zaposlenih, od tega 132 žensk in 62 moških. 87 je bilo raziskovalcev, 24 mladih raziskovalcev, 83 pa strokovno-tehničnih in administrativnih sodelavcev.

NIB je bil v letu 2023 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. 2023 zaposloval 74 sodelavcev, enota Morska biološka postaja Piran 42, Oddelek za genetsko toksikologijo in biologijo raka 24, Oddelek za raziskave organizmov in ekosistemov 28, Skupne službe pa 26 sodelavcev.

As at 31/12/2023, the NIB Group had 194 employees, 132 women and 62 men. Eighty-seven were researchers, 24 young researchers and 83 technical and administrative staff members.

In 2023, the NIB consisted of four research units and Corporate Services. Employees in the two largest units represent 60% of the total NIB workforce. As at 31 December 2023, the Department of Biotechnology and Systems Biology had 74 staff members, the Marine Biology Station Piran 42, the Department of Genetic Toxicology and Cancer Biology 24, the Department of Organisms and Ecosystems Research 28 and Corporate Services 26.

Stanje po organizacijskih enotah na dan 31. 12. 2023
Staff Headcount by Organisational Unit as at 31/12/2023

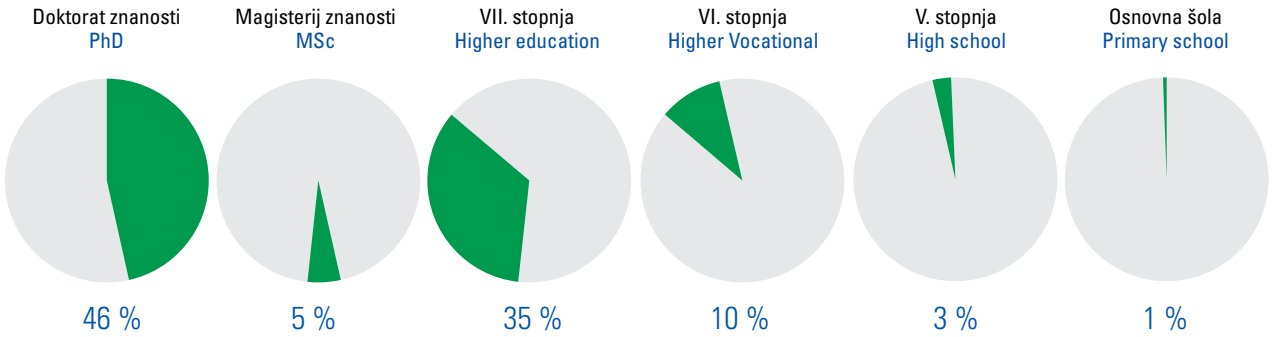


Izobrazbena struktura
Educational Structure

Na dan 31. 12. 2022 je bilo na NIB zaposlenih 46,4 % z doktoratom znanosti, 39,7 % zaposlenih pa je imelo zaključen znanstveni magisterij oz. VII/2. stopnjo izobrazbe.

As at 31 December 2022, 46.4% of the NIB's staff had a doctoral degree and 39.7% had a master's degree or a level VII/2 education.

Izobrazbena struktura na dan 31. 12. 2023
Educational Structure as at 31/12/2023



CERTIFIKAT »DRUŽBENO ODGOVOREN DELODAJALEC«

V letu 2023 je bila sprejeta Zaveza vodstva k družbeni odgovornosti, ki se glasi:

»Vodstvo Nacionalnega inštituta za biologijo ima že v svojem DNK-ju zapisano, da deluje s širšo družbo in življenjskim okoljem ter za njun razvoj in dobrobit. Znanost je tukaj zato, da naša življenja in življenja zanamcev na eni strani bogati, na drugi strani pa posreduje znanja za zdrav in trajnosten način življenja. Še toliko bolj znanost, ki jo razvijamo na našem inštitutu, saj ta temelji na proučevanju procesov v naravi. Naši raziskovalni programi zasledujejo cilje zagotoviti orodja in znanje za trajnostno rabo naravnih virov, za sonaravno življenje prihodnosti.

»SOCIALLY RESPONSIBLE EMPLOYER« CERTIFICATE

In 2023, a Management Commitment to Social Responsibility was adopted, which reads as follows:

"The DNA of the management of the National Institute of Biology says that it works together with the wider society and living environment and for their development and well-being. Science is here to enrich our lives and the lives of our descendants on the one hand, and to provide knowledge for a healthy and sustainable way of life on the other. This applies even more to the science we develop at our Institute, which is based on the study of processes in nature. Our research programmes aim to provide the tools and knowledge to use natural resources sustainably, for a sustainable future.

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.

Družbena odgovornost je pri nas vtkana v vse pore delovanja. Začne se pri vrednotah, med katerimi imajo osrednje mesto etičnost, kakovost in premišljen napredek. Skrb za razvoj novega znanja in veščin ter širjenje tega znanja prispevata k odgovornemu razvoju. Naša družbena odgovornost temelji na uveljavljanju, internacionalizaciji in modernizaciji raziskovalno-razvojnih, izobraževalno-akademskih in poslovnih standardov pri doseganju splošne blaginje družbe. Okoljska odgovornost nas zavezuje k varovanju vseh vidikov naravnega okolja, vključujoč raziskave podnebnih in drugih sprememb na Zemlji. Zato je naše poslovanje pregledno in transparentno. NIB s trajnostno naravnanim delovanjem podpira varovanje okolja in smernice zelene družbe. Tudi novo Biotehnološko stičišče je zgrajeno po načelih nizkoogljične, energetsko učinkovite, zelene in trajnostne gradnje.

Odgovornost uresničujemo tudi pri medosebnih odnosih, ki temeljijo na medsebojnem spoštovanju, razumevanju in pripadnosti. Na NIB se zavedamo, da so kakovostni in motivirani kadri med najpomembnejšimi pogoji za učinkovito delovanje organizacije. Na vsakem koraku delovnega procesa se trudimo pridobiti mnenja zaposlenih in stališča učinkovito usklajevati. 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 doprineseta k odličnim poslovnim rezultatom ter vsestranskemu zdravju zaposlenih in institucije.

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.«

Tudi v letu 2023 je NIB nadaljeval z izvajanjem vseh sprejetih ukrepov, pridobljenih na področju usklajevanja poklicnega in zasebnega življenja, ki je izbrano področje certificiranja.

Social responsibility is woven into every aspect of our activity. This begins with values – central are ethics, quality and deliberate progress. The development of new knowledge and skills and the dissemination of this knowledge contribute to responsible development. Our social responsibility is based on implementing, internationalising and modernising standards of research, development, education, academic work and business for the overall welfare of society. Environmental responsibility commits us to protecting all aspects of the natural environment, including research into climate and other changes on Earth. For this reason, our operations are transparent and clear. Through its sustainable activities, the NIB supports environmental protection and green society guidelines. The new Biotechnology Hub is also built according to the principles of low-carbon, energy-efficient, green and sustainable construction.

We also exercise responsibility in our interpersonal relations, which are based on mutual respect, understanding and loyalty. At the NIB, we are aware that high-quality and highly motivated human resources are among the most important conditions for the effective functioning of an organisation. At each step of the work process, we strive to get the opinions of our employees and efficiently harmonise the views. 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.

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."

In 2023, the NIB continued to implement all the actions adopted in the area of work-life balance as the chosen area of certification.

Doktorati, magisteriji in diplome v letu 2023
Doctoral Dissertations, Master's Theses and Undergraduate Theses in 2023

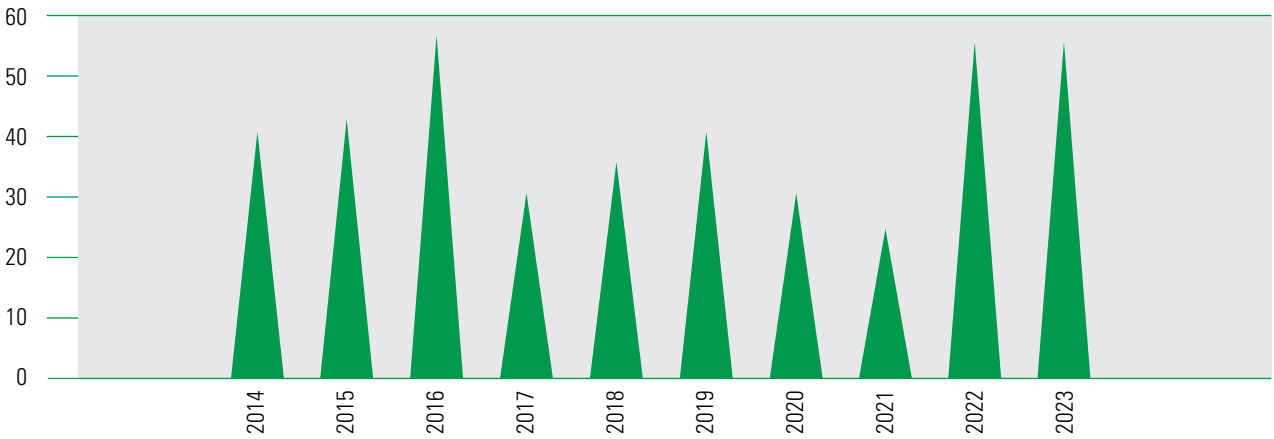
Svojo doktorsko disertacijo so pripravili pod (so)mentorstvom raziskovalcev z NIB in jo zagovarjali v letu 2023:

Doctoral dissertations under the (co)supervision of NIB researchers in 2023:

ŠTUDENT STUDENT	(SO) MENTOR (CO)SUPERVISOR
dr. Ana Fortič (MBP MBS)	mentor supervisor prof. dr. Lovrenc Lipej (MBP MBS), somentor co-supervisor doc. dr. Borut Mavrič (MBP MBS)
dr. Mojca Juteršek (FITO)	mentorica supervisor doc. dr. Špela Baebler (FITO)
dr. Olivera Maksimović	mentor supervisor dr. Ion Gutiérrez Aguirre (FITO), somentor co-supervisor doc. dr. Denis Kutnjak (FITO)
dr. Tjaša Matjašič	mentorica supervisor dr. Nataša Mori (EKOS), somentorici co-supervisors Tatjana Simčič (EKOS), Tanja Dreo (FITO)
dr. Urška Ratajc	mentor supervisor doc. dr. Al Vrezec (EKOS)
dr. Lara Valentić	mentorja supervisors prof. dr. Tanja Pipan in izr. prof. dr. Oliver Bajt (MBP MBS)

Število diplomskih, magistrskih in doktorskih nalog pod(so)mentorstvom raziskovalcev z Nacionalnega inštituta za biologijo v obdobju 2014-2023

Number of Undergraduate Theses, Master's Theses and Doctoral Dissertations under (co)supervision of NIB researchers in 2014-2023



Število zagovarjanih magistrskih in doktorskih nalog ter mentorstev in somentorstev s strani zaposlenih na NIB v letu 2023
Number of Master's Theses, Doctoral Dissertations, Supervisions and Co-supervisions by NIB Employees in 2023

magistska naloga / Master's Thesis	0
doktorska disertacija / Doctoral Dissertation	2
mentor pri doktorskih disertacijah / Supervisor for Doctoral Dissertations	6
mentor pri magistrskih delih / Supervisor for Master's Thesis	20
mentor pri diplomskih delih / Supervisor for Undergraduate Theses	10
somentor pri doktorskih disertacijah / Co-Supervisor for Doctoral Dissertations	4
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 2023
Publications and Citations in 2023

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:

Number of published scientific articles (COBISS typology 1.01, 1.02 and 1.03) by year of publication, h-index over the last ten years by year of publication and CI10 - number of pure citations by Web of Science/Scopus:

LETO YEAR	ŠTEVILO OBJAVLJENIH ZNANSTVENIH ČLANKOV / NUMBER OF PUBLISHED SCIENTIFIC ARTICLES	H-INDEKS V ZADNJIH 10 LETIH GLEDE NA LETO OBJAVE / H-INDEX IN H-INDEX IN THE LAST 10 YEARS IN RELATION TO THE YEAR OF PUBLICATION	CI10 – ŠTEVILO ČISTIH CITATOV ZNANSTVENIH DEL V ZADNJIH 10 LETIH / NUMBER OF PURE CITATIONS OF SCIENTIFIC PAPERS IN THE LAST 10 YEARS
2018	109	64	22735
2019	119	70	28475
2020	125	75	34106
2021	168	81	38995
2022	173	85	42736
2023	111	76	34433

Najvplivnejše objave v letu 2023
The Most Influential Publications in 2023

NIB VODILNI PARTNER V RAZISKAVI
THE NIB AS CO-ORDINATOR IN RESEARCH

BOGOŽALEC KOŠIR, Alexandra, MULLER, Sabine, ŽEL, Jana, MILAVEC, Mojca, MALLORY, Allison C., DOBNIK, David. Fast and accurate multiplex identification and quantification of seven genetically modified soybean lines using six-color digital PCR. *Foods*. Nov. 2023, iss. 22, art. no. 4156, str. [1]-17, ilustr. ISSN 2304-8158. DOI: 10.3390/foods12224156. [COBISS.SI-ID 173360131] IF 5.2

BOŠKOVIĆ, Neda, JOKSIMOVIĆ, Danijela, BAJT, Oliver. Content of trace elements and human health risk assessment via consumption of commercially important fishes from Montenegrin coast. Foods. Feb. 2023, vol. 12, iss. 4, str. [1]-13, ilustr., zvd. ISSN 2304-8158. DOI: 10.3390/foods12040762. [COBISS.SI-ID 142035715] IF 5.2

FILIPIĆ, Arijana, DOBNIK, David, GUTIÉRREZ-AGUIRRE, Ion, RAVNIKAR, Maja, KOŠIR, Tamara, BAEBLER, Špela, ŠTERN, Alja, ŽEGURA, Bojana, PETKOVŠEK, Martin, DULAR, Matevž, MOZETIČ, Miran, ZAPLOTNIK, Rok, PRIMC, Gregor. Cold plasma within a stable supercavitation bubble - a breakthrough technology for efficient inactivation of viruses in water. *Environment international*. [Print ed.]. 2023, vol. 182, str. 108285-1-108285-10. ISSN 0160-4120. DOI: 10.1016/j.envint.2023.108285. [COBISS.SI-ID 170521347] IF 11.8

KOVAČ, Nives, VIERS, Jerome, FAGANELI, Jadran, BAJT, Oliver, POKROVSKY, Oleg S. Elemental composition of plankton exometabolites (Mucous Macroaggregates) : control by biogenic and lithogenic components. *Metabolites*. 2023, vol. 13, no. 6, str. 1–15, ilustr. ISSN 2218-1989. https://www.mdpi.com/2218-1989/13/6/726, DOI: 10.3390/metabo13060726. [COBISS.SI-ID 156239619] IF 4.1

LUKAN, Tjaša, ŽUPANIČ, Anže, MAHKOVEC POVALEJ, Tjaša, BRUNKARD, Jacob O., KMETIČ, Mirjam, JUTERŠEK, Mojca, BAEBLER, Špela, GRUDEN, Kristina. Chloroplast redox state changes mark cell-to-cell signaling in the hypersensitive response. *The new phytologist*. Jan. 2023, vol. 237, iss. 2, str. 548-562, ilustr. ISSN 1469-8137. DOI: 10.1111/nph.18425. [COBISS.SI-ID 121824771] IF 9.4

MATJAŠIČ, Tjaša, MORI, Nataša, HOSTNIK, Irma, BAJT, Oliver, KOVAČ VIRŠEK, Manca. Microplastic pollution in small rivers along rural–urban gradients : variations across catchments and between water column and sediments. *Science of the total environment*. Feb. 2023, vol. 858, [1]-11 str., ilustr. ISSN 0048-9697. DOI: 10.1016/j.scitotenv.2022.160043. [COBISS.SI-ID 129475843] IF 9.8

PITACCO, Valentina, MAVRIČ, Borut, LIPEJ, Lovrenc. A preliminary study of soft bottom benthic communities in an area affected by intense maritime traffic (Slovenian Sea, Northern Adriatic). *Marine pollution bulletin*. Mar. 2023, vol. 188, str. [1]-8, ilustr., zvd. ISSN 0025-326X. DOI: 10.1016/j.marpolbul.2023.114672. [COBISS.SI-ID 141712387] IF 5.8

RATAJC, Urška, LOURENÇO, Rui, ESPÍN, Silvia, SÁNCHEZ VIROSTA, Pablo, BIRRER, Simon, STUDLER, Dani, WERNHAM, Chris, VREZEC, Al. The importance of population contextual data for large-scale biomonitoring using an apex predator : the Tawny Owl (Strix aluco). *Science of the total environment*. 20. Feb. 2023, vol. 860, str. [1]-18, ilustr., zvd. ISSN 0048-697. DOI: 10.1016/j.scitotenv.2022.160530. [COBISS.SI-ID 136534275] IF 9.8

RIVAREZ, Mark Paul Selda, PECMAN, Anja, BAČNIK, Katarina, MAKSIMOVIĆ, Olivera, VUČUROVIĆ, Ana, SELJAK, Gabrijel, MEHLE, Nataša, GUTIÉRREZ-AGUIRRE, Ion, RAVNIKAR, Maja, KUTNJAK, Denis. In-depth study of tomato and weed viromes reveals undiscovered plant virus diversity in an agroecosystem. *Microbiome*. 2023, vol. 11, art. 60, str. [1]-24, ilustr. ISSN 2049-2618. DOI: 10.1186/s40168-023-01500-6. [COBISS.SI-ID 148647683] IF 15.5

SENDRA, Marta, ŠTAMPAR, Martina, FRAS, Katarina, NOVOA, Beatriz, FIGUERAS, Antonio, ŽEGURA, Bojana. Adverse (geno)toxic effects of bisphenol A and its analogues in hepatic 3D cell model. *Environment international*. [Print ed.]. Jan. 2023, vol. 171, str. [1]-19, ilustr. ISSN 0160-4120. DOI: 10.1016/j.envint.2022.107721. [COBISS.SI-ID 136357123] IF 11.8

TINTA, Tinkara, ZHAO, Zihao, BAYER, Barbara, HERNDL, Gerhard J. Jellyfish detritus supports niche partitioning and metabolic interactions among pelagic marine bacteria. *Microbiome*. 2023, vol. 11, art. no. 156, str. [1]-22, ilustr. ISSN 2049-2618. DOI: 10.1186/s40168-023-01598-8. [COBISS.SI-ID 160881667] IF 15.5

VIRANT-DOBERLET, Meta, STRITIH PELJHAN, Nataša, ŽUNIČ KOSI, Alenka, POLAJNAR, Jernej. Functional diversity of vibrational signaling systems in insects. *Annual review of entomology*. Jan. 2023, vol. 68, str. 191-210, ilustr. ISSN 1545-4487. DOI: 10.1146/annurev-ento-120220-095459. [COBISS.SI-ID 126481923] IF 23.8

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

ALEJANDRE, Elizabeth M., SCHERER, Laura, GUINÉE, Jeroen B., AIZEN, Marcelo A., ALBRECHT, Matthias, BALZAN, Mario V., BARTOMEUS, Ignasi, BEVK, Danilo, et al. Characterization factors to assess land use impacts on pollinator abundance in life cycle assessment. Environmental science & technology. [Print ed.]. 2023, vol. 57, iss. 8, str. 3445-3454. ISSN 0013-936X DOI: *10.1021/acs.est.2c053*. [COBISS.SI-ID *142397955*] IF 11.4

COLLINS, Andrew, MØLLER, Peter, GAJSKI, Goran, VODENKOVÁ, Soňa, ABDULWAHED, Abdulhadi, ANDERSON, Diana, BANKOGLU, Ezgi Eyluel, BONASSI, Stefano, BOUTET-ROBINET, Elisa, BRUNBORG, Gunnar, NOVAK, Matjaž, ŽEGURA, Bojana, et al. Measuring DNA modifications with the comet assay : a compendium of protocols. *Nature protocols*. [Online ed.]. 2023, vol. 18, str. 929-989, ilustr. ISSN 1750-2799. DOI: 10.1038/s41596-022-00754-y. [COBISS.SI-ID 140001027] IF 14.8

DRUMMOND, Jennifer D, GONÇALVES, José, AQUINO, Tomás, BERNAL, Susan A., GACIA, Esperança, GUTIÉRREZ-AGUIRRE, Ion, TURK, Valentina, RAVNIKAR, Maja, KRAUSE, Stefan, MARTÍ ROCA, Eugenia. Benthic sediment as stores and sources of bacteria and viruses in streams : a comparison of baseflow vs. stormflow longitudinal transport and residence times. *Water research*. 15 Oct. 2023, vol. 245, art. no. 120637, str. 1-10, ilustr. ISSN 0043-1354. DOI: 10.1016/j.watres.2023.120637. [COBISS.SI-ID 168814595] IF 12.8

KOVAČIČ, Ana, MODIC, Martina, HOJNIK, Nataša, ŠTAMPAR, Martina, GULIN, Martin Rafael, NANNOU, Christina, KORONAIOU, Lelouda-Athanasia, HEATH, David John, WALSH, James L., ŽEGURA, Bojana, LAMBROPOULOU, Dimitra A., CVELBAR, Uroš, HEATH, Ester. Degradation and toxicity of bisphenol A and S during cold atmospheric pressure plasma treatment. *Journal of Hazardous Materials*. [Online ed.]. 2023, vol. 454, art. 131478, str. [1]-12, ilustr. DOI: 10.1016/j.jhazmat.2023.131478. [COBISS.SI-ID 150358787] IF 13.6

LECLERCQ, Nicolas, MARSHALL, L., WEEKERS, T., BASU, P., BENDA, D., BEVK, Danilo, BHATTACHARYA, Rina, BOGUSCH, P., et al. Global taxonomic, functional, and phylogenetic diversity of bees in apple orchards. Science of the total environment. 25. Nov. 2023, vol. 901, art. 165933, str. [1]-12, ilustr., zvd. ISSN 0048-9697. DOI: *10.1016/j.scitotenv.2023.165933* [COBISS.SI-ID *160681731*] IF 9.8

PLOHL, Olivija, KOKOL, Vanja, FILIPIĆ, Arijana, FRIC, Katja, KOGOVŠEK, Polona, PERŠIN FRATNIK, Zdenka, VESEL, Alenka, KUREČIČ, Manja, ROBIČ, Jure, GRADIŠNIK, Lidija, MAVER, Uroš, FRAS ZEMLJIČ, Lidija. Screen-printing of chitosan and cationised cellulose nanofibril coatings for integration into functional face masks with potential antiviral activity. *International journal of biological macromolecules.* [Online ed.]. 1 May 2023, vol. 236, [article no.] 123951, str. 1-15, ilustr. ISSN 1879-0003. DOI: 10.1016/j.ijbiomac.2023.123951. [COBISS.SI-ID 145805059] IF 8.2

ZHANG, Shuang, GHATAK, Arindam, BAZARGANI, Mitra Mohammadi, KRAMML, Hannes, ZANG, Fujuan, GAO, Shuang, RAMŠAK, Živa, GRUDEN, Kristina, VARSHNEY, Rajeev K., JIANG, Dong, CHATURVEDI, Palak, WECKWERTH, Wolfram. Cell-type proteomic and metabolomic resolution of early and late grain filling stages of wheat endosperm. *Plant biotechnology journal.* 2023, vol., iss., str. 1-17, ilustr. ISSN 1467-7644. DOI: 10.1111/pbi.14203. [COBISS.SI-ID 177668867] IF 13.8

ZUPANC, Mojca, ZEVNIK, Jure, FILIPIĆ, Arijana, GUTIÉRREZ-AGUIRRE, Ion, JEŠELNIK, Meta, KOŠIR, Tamara, ORTAR, Jernej, DULAR, Matevž, PETKOVŠEK, Martin. Inactivation of the enveloped virus phi6 with hydrodynamic cavitation. *Ultrasonics Sonochemistry.* May 2023, vol. 95, str. 1-8, ilustr. ISSN 1350-4177. DOI: 10.1016/j.ultsonch.2023.106400. [COBISS.SI-ID 148619523] IF 8.4

Školjčišče v Strunjanskem zalivu.
Foto: T. Makovec

Mussel farm in the Strunjan Bay.
Photo: T. Makovec

Bibliografija inštituta v letih 2014 – 2023 (analitični podatki)
Institute's Bibliography in 2014 – 2023 (Analytical Data)

TIP DOKUMENTA TYPE OF DOCUMENT	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	SKUPAJ TOTAL
znanstveni članki z IF scientific papers with IF	79	80	82	97	91	99	109	139	150	92	1018
znanstveni članki brez IF other scientific papers	13	18	16	16	18	20	16	29	23	19	188
strokovni in poljudni članki expert and popular articles	45	43	62	58	49	44	60	66	70	68	565
objavljeni prispevki s kongresov published conference papers	16	17	16	24	17	11	9	6	7	17	140
povzetki s kongresov published conference paper abstracts	166	156	149	159	178	178	72	93	199	177	1527
poglavja v knjigah book chapters	11	9	7	18	8	30	63	55	30	9	240
knjige books	6	1	6	5	1	2	3	17	5	5	51
poročila reports	23	35	38	51	51	40	33	33	28	36	368
doktorska dela doctoral dissertations	8	4	4	2	6	2	2	6	3	2	39
magistrska dela master's theses	2	1	2	1	5		3	3	3	0	20
patenti patents	2	2		1	1	2	2	6	5	1	22
razno other	138	161	151	217	250	198	207	314	254	294	2184
SKUPAJ TOTAL	**509**	**527**	**533**	**649**	**675**	**626**	**579**	**767**	**777**	**720**	**6362**

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 2023
Achievements, Prizes and Awards in 2023

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

MIROSLAV ZEI 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, 10/01/2023

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 Awards are 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.

Na slavnostni otvoritvi novih prostorov BTS-NIB so trak so prerezali minister MVZI dr. Igor Papič, dr. Tamara Lah Turnšek (NIB), dr. Matjaž Kuntner (NIB) in direktorica NIB dr. Maja Ravnikar. Foto: STA

At the opening ceremony of the new premises of the BTS-NIB, the ribbon was cut by the Minister of Higher Education, Science and Innovation Dr Igor Papič, Dr Tamara Lah Turnšek (NIB), Dr Matjaž Kuntner (NIB) and the Director of the NIB Dr Maja Ravnikar. Photo: STA

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.

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.

PREDSTAVITEV KNJIGE »PODOBE IZ MODRINE«

Koper, 24. marec 2023

NIB je v soorganizaciji s Primorskimi novicami, Društvom za opazovanje in proučevanje ptic Slovenije (DOPPS) in Naravnim rezervatom Škocjanski zatok NIB organiziral predstavitev knjige prof. dr. Lovrenca Lipeja »Podobe iz modrine«. Dogodek se je odvil v Naravnem rezervatu Škocjanski zatok v Kopru. Predavanju prof. dr. Lovrenca Lipeja je sledil pogovor z avtorjem, v katerem sta sodelovala še izr. prof. dr. Simon Kerma, Fakulteta za turistične študije – Turistica v Portorožu, Univerza na Primorskem, in dr. Martina Orlando Bonaca, NIB, Morska biološka postaja Piran. Pogovor je vodil novinar Sašo Dravinec s Primorskih novic.

The Miroslav Zei Awards 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 Award for Life Work in the NIB's activities was awarded 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 Awards for outstanding scientific research achievements in the area of the NIB's activities were awarded to Assist. Prof. Dr Špela Baebler and Dr Iva Hafner-Bratkovič.

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

NIB awards were also presented 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.

PRESENTATION OF THE BOOK "IMAGES FROM THE BLUE"

Koper, 24/03/2023

Together with Primorske novice, DOPPS – BirdLife Slovenia (Društvo za opazovanje in proučevanje ptic Slovenije = Association for Birdwatching and Bird Studies of Slovenia) and the Škocjanski zatok Nature Reserve, the NIB organised the presentation of the book "Images from the Blue" by Prof. Dr Lovrenc Lipej. The event took place at the Škocjanski zatok Nature Reserve in Koper. The lecture by Prof. Dr Lovrenc Lipej was followed by a discussion with the author together with Assoc. Prof. Dr Simon Kerma, Faculty of Tourism Studies – Turistica in Portorož, University of Primorska, and Dr Martina Orlando Bonaca, NIB, Marine

NAGRADA ZLATI ZNAK JOŽEFA STEFANA

Ljubljana, marec 2023

Dr. Arijana Filipić je bila ena od prejemnic Zlatega znaka Jožefa Stefana za doktorsko delo z naslovom »Inaktivacija virusov v vodi s hladno atmosfersko plazmo« na predlog doc. dr. Davida Dobnika z NIB. Zlati znak se podeljuje najodmevnejšim doktoratom na področju naravoslovno-matematičnih in tehniških ved ter ved o življenju. Doktorska naloga Arijane Filipić obravnava enega večjih problemov današnjega časa, to je pomanjkanje čiste vode, in uporabo hladne plazme kot nove, okolju prijazne tehnologije za čiščenje vode. Rezultati njenih raziskav so pokazali izjemno uspešno inaktivacijo različnih vrst virusov v kratkem času in so objavljeni v več revijah, vključno z eno najboljših revij na področju biotehnologije, *Trends in Biotechnology*.

DIREKTORICA V IZBORU NAJVPLIVNEJŠIH ŽENSK

Ljubljana, 6. 4. 2023

Direktorica Nacionalnega inštituta za biologijo prof. dr. Maja Ravnikar se je kot nominiranka v izboru Ona 365 udeležila slavnostne razglasitve nagrad Ona 365. Strokovna komisija izbora jo je uvrstila med deset žensk, ki so pomembno zaznamovale preteklo leto.

ČLANEK O SVILOGOJSTVU V SLOVENIJI PREJEL PRIZNANJE BEST EDIT REVIJE NATIONAL GEOGRAPHIC

Ljubljana, maj 2023

V majski številki slovenske izdaje revije National Geographic je objavljen članek z besedilom prof. dr. Marine Dermastia, predsednice Znanstvenega sveta NIB: »500 let svilogojstva in svilarstva na Slovenskem«. Članek je s strani ameriškega uredništva prejel priznanje Best Edit, ki ga podeljujejo najboljšim člankom v lokalnih izdajah, s čimer si pridobijo vstopnico do drugih izdaj. Članek je pospremljen s fotografijami Arneja Hodaliča in Katje Bidovec ter Bojana Šeneta in Marka Trebušaka. V maju je NIB pripravil tudi virtualno razstavo teh fotografij.

Biology Station Piran. The discussion was moderated by journalist Sašo Dravinec from Primorske novice.

JOŽEF STEFAN GOLDEN EMBLEM AWARD

Ljubljana, March 2023

Dr Arijana Filipić was one of the recipients of the Jožef Stefan Golden Emblem for her doctoral thesis "Inactivation of viruses in water by cold atmospheric plasma", following a proposal by Assist. Prof. Dr David Dobnik. The Golden Emblem is awarded to the most outstanding doctoral theses in natural, mathematical, engineering and life sciences. Dr Filipić's doctoral thesis addresses one of the major problems of our time, the lack of clean water, and the use of cold plasma as a new, environmentally friendly technology for water purification. The results of her research have shown remarkable success in inactivating various types of viruses in a short time and have been published in several journals, including one of the top journals in biotechnology, *Trends in Biotechnology*.

OUR DIRECTOR NAMED ONE OF THE MOST INFLUENTIAL WOMEN

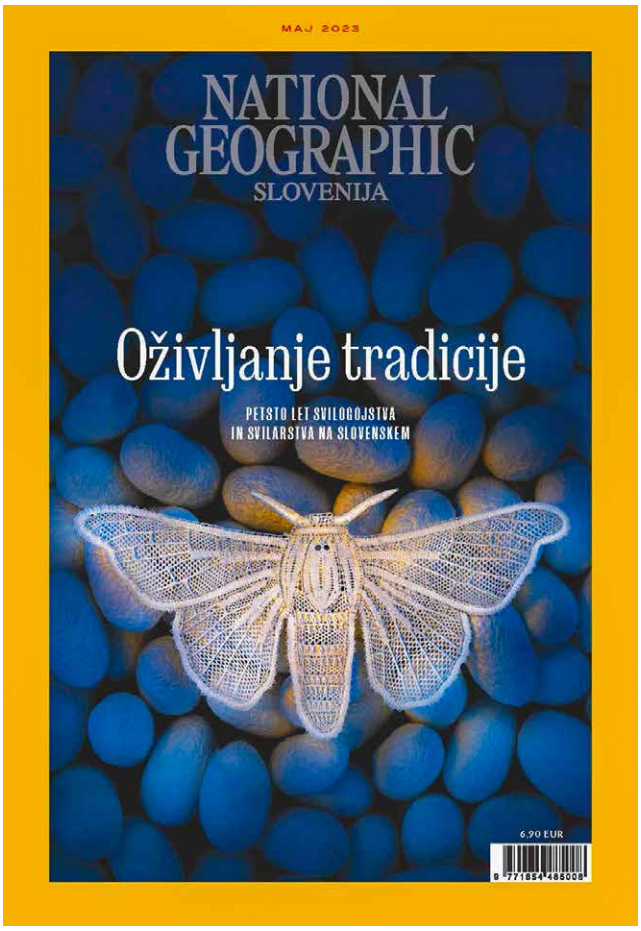
Ljubljana, 06/04/2023

The Director of the National Institute of Biology, Prof. Dr Maja Ravnikar, attended the Ona 365 awards ceremony as a nominee in the Ona 365 selection. She was selected by the expert jury as one of the ten women who have made a significant impact over the past year.

AN ARTICLE ON SERICULTURE IN SLOVENIA RECEIVED THE BEST EDIT AWARD FROM NATIONAL GEOGRAPHIC MAGAZINE

Ljubljana, May 2023

The May issue of the Slovenian edition of National Geographic published an article by Prof. Dr Marina Dermastia, Chair of the NIB Scientific Council: "500 years of sericulture and silk industry in Slovenia". The article won the Best Edit award from the US editorial board, which is given to the best articles in local editions, giving them a ticket to other editions. The article was accompanied by photographs by Arne Hodalič and Katja Bidovec, Bojan Šene and



Članek o svilogojstvo na naslovnici revije National Geographic.
Foto: A. Hodalič

Article on sericulture on the cover of National Geographic.
Photo: A. Hodalič

NIB PREJEMNIK PRIZNANJ PROMETEJ ZNANOSTI

Ljubljana, 30. maj 2023

Dr. Davorin Tome in asist. dr. Maja Opalički Slabe sta za knjigo »Neverjetna« prejela priznanje Prometej znanosti za odličnost v komuniciranju za leto 2022. Doc. dr. Tina Eleršek in Maša Zupančič sta s spletno platformo Ciano SLO postali finalistki izbora za priznanje Prometej znanosti za odličnost v komuniciranju 2022. Nosilec listine Finalist nacionalnega izbora Komunikator znanosti leta 2022 pa je postal prof. dr. Lovrenc Lipej, in sicer za knjigo esejev s področja znanosti o morju z naslovom »Podobe iz modrine«, ki je bila objavljena leta 2022.

Marko Trebušak. In May, the NIB presented a virtual exhibition of these photographs.

NIB RECEIVED PROMETHEUS OF SCIENCE AWARDS

Ljubljana, 30/05/2023

Dr Davorin Tome and Assist. Dr Maja Opalički Slabe received the Prometheus of Science Award for Excellence in communication for 2022 for the book "Neverjetna" (Incredible). Assist. Prof. Dr Tina Eleršek and Maša Zupančič have been selected as finalists for the Prometheus of Science Award for Excellence in Communication for 2022 for their web platform Ciano SLO. Prof. Dr Lovrenc Lipej was named a finalist of the national selection for Communication of Science in 2022 for his book of essays on marine science "Images from the Blue", published in 2022.

PREGLOVA NAGRADA KEMIJSKEGA INŠTITUTA
Ljubljana, junij 2023

Izr. prof. dr. Bojana Žegura, vodja Oddelka za genetsko toksikologijo in biologijo raka, je prejemnica Preglove nagrade Kemijskega inštituta za izjemne dosežke. Je vodilna raziskovalka na področju proučevanja toksikoloških lastnosti cianobakterijskih toksinov, preučuje pa tudi druge pomembne skupine spojin, kot so mikotoksini, bisfenoli, prehranski mutageni, nanodelci in ostanki citostatikov v okolju. Z namenom zmanjšanja števila poskusov na živalih je dr. Žegura s svojo raziskovalno skupino med prvimi razvila jetrne in vitro 3D celične modele za proučevanje genotoksičnega delovanja kemikalij. S svojo raziskovalno skupino je razvila nov pristop za določanje mehanizmov škodljivega delovanja kemikalij, ki prepleta tehnologije mikroskopije, pretočne citometrije in toksikogenomike na osnovi kvantitativnih metod molekularne biologije.

PREDSTAVITEV KNJIGE ZNANSOPOTNIKA
Ljubljana, 14. 9. 2023

Knjiga ZNANSOPOTNIKA je prva avtobiografija dveh naravoslovcev, znanstvenikov, raziskovalcev in univerzitetnih učiteljev v Sloveniji. Knjigo sta izdala prof. dr. Marina Dermastia in prof. dr. Tom Turk ter jo v družbi novinarja in pisatelja Marjana Žiberne ter vrhunskih dramskih umetnikov Ajde Smrekar in Borisa Ostana predstavila javnosti v prostorih Biološkega središča.

MBP, NIB SODELUJE PRI POMEMBNI RAZISKOVALNI ODPRAVI NA VZHODNEM PACIFIKU
Vzhodni Pacifik, julij-avgust 2023

Sodelavca Morske biološke postaje Piran, dr. Tinkara Tinta in Tihomir Makovec, sta sodelovala pri raziskovalni odpravi na vzhodni Pacifik z novim raziskovalnim plovilom R/V Falkor (too) v sklopu misije inštituta Schmidt Ocean Institute (SOI). Med odpravo so prišli do izjemnega odkritja novega ekosistema v vulkanskih votlinah pod hidrotermalnimi izviri sicer dobro raziskanega podvodnega vulkana na vzpetini vzhodnega Tihega oceana ob Srednji Ameriki. Prelomno

PREGL PRIZE OF THE INSTITUTE OF CHEMISTRY
Ljubljana, June 2023

Assoc. Prof. Dr Bojana Žegura, head of the Department of Genetic Toxicology and Cancer Biology, received the Pregl Prize of the Institute of Chemistry for outstanding achievements. She is a leading researcher on the toxicological properties of cyanobacterial toxins and studies other important groups of compounds such as mycotoxins, bisphenols, dietary mutagens, nanoparticles and cytostatic residues in the environment. In order to reduce the number of animal experiments, Dr Žegura and her research team were among the first to develop in vitro 3D liver cell models to study the genotoxic effects of chemicals. She and her research team have developed a novel approach for determining the mechanisms of adverse effects of chemicals, combining methodologies based on microscopy, flow cytometry and toxicogenomics.

PRESENTATION OF THE BOOK ZNANSOPOTNIKA
Ljubljana, 14/09/2023

The book Znansopotnika is the first autobiography of two natural scientists, researchers and university teachers in Slovenia. The book was published by Prof. Dr Marina Dermastia and Prof. Dr Tom Turk who presented it together with the journalist and writer Marjan Žiberna and top actors Ajda Smrekar and Boris Ostan at the premises of the Biological Centre.

PARTICIPATION OF THE MBS OF THE NIB IN AN IMPORTANT RESEARCH EXPEDITION IN THE EASTERN PACIFIC
Eastern Pacific, July–August 2023

Dr Tinkara Tinta and Dr Tihomir Makovec from the Marine Biology Station Piran participated in a research expedition to the eastern Pacific with the new research vessel R/V Falkor (too) as part of the Schmidt Ocean Institute (SOI) mission. During this expedition, they made the remarkable discovery of a new ecosystem in volcanic caverns beneath hydrothermal vents of an otherwise well-studied underwater volcano on a high plateau in the eastern Pacific Ocean off Central America. The ground-breaking 30-day expedition

30-dnevno odpravo je vodila prof. dr. Monika Bright z Univerze na Dunaju skupaj z mednarodno znanstveno ekipo iz Združenih držav Amerike (Univerza Harvard in Woods Hole Oceanographic Institution – WHOI), Nemčije (Max Planck Institut (MPI) za morsko mikrobiologijo), Nizozemske (Kraljevi nizozemski inštitut za raziskave morja – NIOZ), Francije (Centre National pour la Recherche Scientifique – CNRS), Kostarike in Slovenije (NIB-MBP).

was led by Prof. Dr Monika Bright from the University of Vienna, together with an international scientific team from the United States (Harvard University and Woods Hole Oceanographic Institution – WHOI), Germany (Max Planck Institute (MPI) for Marine Microbiology), the Netherlands (Royal Netherlands Institute for Marine Research – NIOZ), France (Centre National pour la Recherche Scientifique – CNRS), Costa Rica and Slovenia (NIB-MBS).

Odprava na vzhodni Pacifik z novim raziskovalnim plovilom R/V Falkor (too).
Foto: Schmidt Ocean Institute

Expedition to the eastern Pacific with the new research vessel R/V Falkor (too).
Photo: Schmidt Ocean Institute

BTS-NIB KOT VZORČNI PROJEKT EVROPSKE KOMISIJE OBIŠČE EVROPSKA KOMISIJA
Ljubljana, 10. 11. 2023

Biotehnološko stičišče Nacionalnega inštituta za biologijo (BTS-NIB) je Evropska komisija prepoznala kot vzorčni projekt Operativnega programa za izvajanje evropske kohezijske

BTS-NIB VISITED BY THE EUROPEAN COMMISSION AS A MODEL PROJECT OF THE EUROPEAN COMMISSION
Ljubljana, 10/11/2023

The Biotechnology Hub of the National Institute of Biology (BTS-NIB) has been recognised by the European Commission as a model project of the Operational Programme for

politike v obdobju 2014–2020, ki predstavlja vrhunsko znanstveno infrastrukturo, ki bo Nacionalnemu inštitutu za biologijo omogočila pospešek v razvoju doma in v regiji. Zaradi tega prestižnega priznanja je BTS-NIB 10. 11. obiskala delegacija Evropske komisije v Sloveniji. Petčlansko delegacijo DG REGIO, ki so se ji pridružili strokovnjaki Ministrstvo za kohezijo in regionalni razvoj ter Ministrstvo za visoko šolstvo, znanost in inovacije, je sprejela prof. dr. Maja Ravnikar, direktorica NIB. Raziskovalci NIB in projektna skupina, ki je vodila to pomembno nacionalno naložbo v znanstveno infrastrukturo, financirano iz sredstev EU, in tehnično zelo zahtevno gradnjo, so predstavili BTS-NIB. Gostje so si ogledali nove prostore Inštituta – laboratorije in novo raziskovalno opremo – ter se seznanili, kako vrhunska oprema, tehnologije in sodobna znanstvena infrastruktura pomagajo NIB-u pri še bolj ambicioznih ter prebojnih prihodnjih znanstvenih dosežkih.

NIB PREJEL NAGRADE ODLIČNI V ZNANOSTI

Ljubljana, 21. 11. 2023

Javna agencija za znanstvenoraziskovalno in inovacijsko dejavnost Republike Slovenije (ARIS) je kot odlična dosežka izbrala kar dva dosežka NIB (od treh) na področju biotehnologije. Rezultate odličnih raziskav sta na dogodku Odlični v znanosti 2023 predstavila: dr. Denis Kutnjak (Viromske raziskave za odkrivanje nepoznane raznolikosti rastlinskih virusov v kmetijskih ekosistemih) in dr. Jan Zrimec (Učenje principov regulacije genskega izražanja v rastlinah s pristopi umetne inteligence).

Pregledni članek z naslovom »Functional Diversity of Vibrational Signaling Systems in Insects«, ki je izšel v začetku 2023 pri reviji Annual Review of Entomology (avtorji: Meta Virant-Doberlet, Nataša Stritih-Peljhan, Alenka Žunič-Kosi in Jernej Polajnar) je bil izbran kot izstopajoči znanstveni dosežek za področje biologije v izboru Odlični v znanosti 2023. Delo je predstavila prva avtorica na dogodku Dan ARIS 2023 v Grand Hotelu Union.

the Implementation of the European Cohesion Policy 2014–2020, which represents a state-of-the-art scientific infrastructure that will enable the National Institute of Biology to accelerate its development at home and in the region. Because of this prestigious award, a delegation from the European Commission in Slovenia visited the BTS-NIB on 10 November. The five-member delegation from DG REGIO, joined by experts from the Ministry of Cohesion and Regional Development and the Ministry of Higher Education, Science and Innovation, was welcomed by Prof. Dr Maja Ravnikar, Director of the NIB. The NIB researchers and the project team that managed this major national investment into scientific infrastructure, funded by the EU, and the technically very complex construction, presented the BTS-NIB. The guests visited the Institute's new facilities (laboratories and new research equipment) and learned how cutting-edge equipment, technologies and modern scientific infrastructure are helping the NIB be even more ambitious and make breakthroughs in future scientific achievements.

THE NIB RECEIVED EXCELLENT IN SCIENCE AWARDS

Ljubljana, 21/11/2023

The Slovenian Research and Innovation Agency (ARIS) has selected as excellent two achievements of the NIB (out of three) in the field of biotechnology. The results of the excellent research were presented at the Excellent in Science event by Dr Denis Kutnjak (Virome research for discovering the unknown diversity of plant viruses in agricultural ecosystems) and Dr Jan Zrimec (Learning the principles of gene expression regulation in plants using artificial intelligence approaches).

The review article "Functional Diversity of Vibrational Signalling Systems in Insects", published at the beginning of 2023 in the Annual Review of Entomology (authors: Meta Virant-Doberlet, Nataša Stritih-Peljhan, Alenka Žunič-Kosi and Jernej Polajnar), was selected as an outstanding scientific achievement for the field of biology for the Excellent in Science 2023 awards. The paper was presented by the lead author at the event ARIS 2023 Day at Grand Hotel Union.

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.

S ciljem večjega spodbujanja nadaljevanja raziskav v smeri njihove uporabnosti na trgu smo na NIB v letu 2023 začeli s pripravo prenovljenega Pravilnika o upravljanju z izumi in inovacijam z glavnim poudarkom na uvedbi nagrade za inovatorje, ki so izenačene s tistimi za izumitelje.

V fazi pilotnega evidentiranja tehnoloških inovaciji je bilo v letu 2023 evidentiranjih šest inovacij.

Na koncu leta 2023 je bilo v naboru NIB aktivnih sedem patentnih prijav NIB. Od tega tri na Evropskem patentnem uradu, ena na WIPO, dve na patentnem uradu ZDA in ena na Slovenskem uradu za intelektualno lastnino. Na Evropskem patentnem uradu je bila realizirana ena patentna prijava. S strani Slovenskega urada za intelektualno lastnino je bila podeljena ena patentna prijava in prav tako je bila podeljena ena patentna prijava s strani patentnega urada ZDA (USPTO).

Posebna pozornost je bila v letu 2023 namenjena patentni zaščiti in komercializaciji rešitev na (1) področju varstva rastlin in (2) patentirane tehnologije, ki združuje hidrodinamsko kavitacijo in hladno plazmo za učinkovito čiščenje vode.

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 the 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.

With the aim of encouraging continued research towards market applicability, the NIB started the preparation of a revised Invention and Innovation Management Act in 2023, with the main focus on the introduction of an Innovators' Remuneration that equals the remuneration for inventors.

In the pilot phase of disclosing technological innovations, six innovations were disclosed and recorded in 2023.

Seven NIB patent applications were active in the NIB pipeline at the end of 2023. Of these, three are at the European Patent Office, one at WIPO, two at the US Patent Office and one at the Slovenian Intellectual Property Office. One patent application was completed at the European Patent Office. One patent application has been granted by the Slovenian Intellectual Property Office (SIPO), and one patent application has been granted by the US Patent Office (USPTO).

In 2023, particular attention was paid to patent protection and commercialisation of solutions in (1) the area of plant protection, and (2) patented technology combining hydrodynamic cavitation and cold plasma for efficient water purification.

Prenos znanja v gospodarstvo
Transferring Knowledge to Business

V okviru aktivnosti prenosa tehnologij na NIB smo tako tudi v letu 2023 sledili ciljem in ukrepom Resolucije o znanstveno-raziskovalni 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.

Predstavniki Službe za prenos tehnologij so v letu 2023:

- sodelovali pri vzpostavitvi RRI Stičišča - fizične in digitalne stične točke deležnikov slovenskega RRI ekosistema, posebej pri zasnovi vzpostavitve enotnega sistema zbiranja podatkov in spremljanja ključnih kazalnikov za vrednotenje strategij in ukrepov na področju raziskav, razvoja in inovacij in prenosu znanja iz raziskovalne sfere v družbo;
- sodelovali v okviru delovne skupine za pripravo Nacionalne strategije varstva intelektualne lastnine do leta 2030 (URSIL).

Pomemben segment aktivnosti na področju prenosa tehnologij je bil v letu 2023 vzpostavitev sodelovanj in povezav s sorodnimi inštitucijami v tujini.

Predstavnik Službe za prenos tehnologij se je v novembru 2023 udeležil IVLP programa U.S. Department of State na področju modelov prenosa tehnologij na ameriških akademskih in raziskovalnih inštitucijah.

In the context of technology transfer activities at the NIB in 2023, we followed the objectives and measures of the Resolution on the Scientific Research and Innovation Strategy of Slovenia 2030 in connection with the identification and development of potentials in areas of research at the NIB that can contribute to the development of society as a whole, the promotion of close co-operation 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 Pact for Research and Innovation, especially in the areas of knowledge valorisation and the building of national and regional innovation ecosystems.

In 2023, representatives from the Technology Transfer Office:

- participated in the establishment of the Development, Research and Innovation Hub – a physical and digital hub of stakeholders from the Slovenian DRI ecosystem, in particular in the formulation of the establishment of a unified system for data collection and monitoring of key indicators for evaluating strategies and measures in research, development, innovation and knowledge transfer from the research sphere into society.
- participated in the framework of the working group for the preparation of the National Strategy for the Protection of Intellectual Property 2030 (SIPO).

An important segment of activities in technology transfer in 2023 was the establishment of collaborations and connections with TT institutions abroad.

DOMAČA TRŽNA DEJAVNOST, KI JO FINANCIRAJO GOSPODARSKI SUBJEKTI

Obseg sodelovanja z domačimi gospodarskimi subjekti je v letu 2023 v primerjavi z letom 2022 upadel za skoraj 30 %. Ta upad je bil pričakovan spričo odprodaje dveh pomembnih tehnologij in sicer sistema za kvantitativno karakterizacijo virusov za gensko zdravljenje (ustanovitev spin-out podjetja) in sistema za analizo materialov za zaščitne maske. Pri tem se je ta upad dela tržne dejavnosti v večji meri nadoknadil z več kot 50 % povečanju prihodkov iz tujega trga.

Najpomembnejši del tržne dejavnosti za domača podjetja (skupaj okvirno devetdeset naročil v letu 2023) ostaja izvedba nalog s področij določanja gensko spremenjenih organizmov, diagnostike virusov in fitoplazem ter analiz na področju diagnostike bakterij in raziskave celičnih smrti v celičnih bankah, večinoma za farmacevtska in biotehnološka podjetja.

Sodelovanja s podjetji so se v letu 2023 izvajala tudi v okviru aplikativnih ARIS projektov, sofinanciranih s strani industrijskih partnerjev, 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;
- vrednotenja varnosti kanabidiolov;
- visokozmogljivega sekvenciranja mikrobnih genomov za aplikacije v rastlinski patologiji;
- zgodnjega zaznavanje in upravljanja z boleznimi vinske trte.

NIB je različne strokovno-razvojne naloge v letu 2023 izvajal tudi za gospodarske družbe na področju monitoringa ogroženih vrst, analiz okoljskih dejavnikov, modeliranja ter analiz mutageničnosti in citotoksičnosti.

Za slovenske podjetja smo izvajali svetovanja s področja molekularne in sintezne biologije ter bioinformatike, vključno z optimizaciji PCR reakcij in vzpostavitvijo postopkov dekodiranja z uporabo HTS.

In November 2023, a representative from the Technology Transfer Office participated in the U.S. Department of State's IVLP programme on technology transfer models at US academic and research institutions.

DOMESTIC MARKET ACTIVITY FINANCED BY ECONOMIC OPERATORS

The scope of the NIB's co-operation with domestic business entities in 2023 decreased by almost 30% compared to 2022. The decrease was expected due to the sale of two important technologies – a system for the quantitative characterisation of viruses for gene therapy (establishment of a spin-off company) and a system for the analysis of materials for protective masks. This decrease of a part of commercial activity was mainly compensated with the 50% increase in revenues from the foreign market.

The main part of the commercial activity for domestic companies (totalling around ninety orders in 2023) remains the execution of tasks in identifying genetically modified organisms, virus and phytoplasma diagnostics and analyses in bacteria diagnostics and the research of cell death in cell banks, mostly for pharmaceutical and biotechnology companies.

In 2023, collaborations with companies were also carried out in the context of applicative ARIS (SIovenian Research and Innovation Agency) 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
- evaluation of the safety of cannabidiols
- high-throughput sequencing of microbial genomes for applications in plant pathology
- early detection and management of vine diseases

In 2023, the NIB also carried out various R&D tasks for companies in the monitoring of endangered species, environmental factor analysis, modelling and mutagenicity and cytotoxicity analysis.

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

TRŽNA DEJAVNOST ZA TUJE NAROČNIKE

Obseg tržne dejavnosti za tuje naročnike se je v letu 2023, glede na leto 2022 povečal za 50 %.

Največji delež storitev so zajemale:

- karakterizacije referenčnih materialov, določanje njihove stabilnosti in število kopij DNA,
- analitske storitve za tuja podjetja na področju razvoja molekularnih metod za karakterizacijo in kvantifikacijo virusov ki niso bile predmet prenosa licenčne pogodbe ter
- izvajanje GSO analiz za Norwegian Veterinary Institute.

Skupaj s švicarskim podjetjem aQuaTox-Solutions se je v letu 2023 nadaljevalo sodelovanje na področju razvoja sistemov ekotoksikoloških testov z uporabo metod umetne inteligence za testiranje varnosti kemikalij brez poskusov na živalih.

TRŽENJE PRODUKTOV IN STORITEV

S trženjem produktov in storitev se NIB sistemsko ukvarja od leta 2010, ko je bila ustanovljena Pisarna za prenos tehnologij, ki se je v začetku leta 2022 preimenovala v Službo za prenos tehnologij (SPT).

SPT je v letu 2023 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 2023 namenjena patentni zaščiti in komercializaciji rešitev na (1) področju varstva rastlin in (2) patentirane tehnologije, ki združuje hidrodinamsko kavitacijo in hladno plazmo za učinkovito čiščenje vode.

Na področju sodelovanja z gospodarstvom je bilo v letu 2023 realiziranih okrog 30 projektov, od tega četrtina s podjetji v tujini. Dodatno so bile realizirane tudi storitve na

For Slovenian companies, we provided molecular and synthetic biology and bioinformatics consulting, including optimisation of PCR reactions and establishment of decoding procedures using HTS.

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

MARKET ACTIVITY FOR FOREIGN CLIENTS

The scope of the commercial activity for foreign clients increased by 50% in 2023 compared to 2022.

The main portion of services included:

- characterisation of reference materials, determination of their stability and number of DNA copies.
- analytical services for foreign companies in the development of molecular methods for characterising and quantifying viruses that were not subject to the transfer of a licence agreement.
- carrying out GMO analyses for the Norwegian Veterinary Institute.

Together with the Swiss company aQuaTox-Solutions, the collaboration in developing ecotoxicological test systems using artificial intelligence methods to test the safety of chemicals without animal testing continued in 2023.

MARKETING OF PRODUCTS AND SERVICES

Since 2010, the marketing of products and services has been handled systematically at the NIB by the Technology Transfer Office, which was established in 2010.

In 2023, the TTO provided support for researchers 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 2023, particular attention was paid to patent protection and commercialisation of solutions in (1) the area of plant protection, and (2) patented technology combining

področjih analiz GSO, bakterijskih analiz, analiz mikroorganizmov in analiz v okviru GLP, pri čemer gre dodatno za okvirno 100 naročil.

Večji del teh nalog je bilo opravljenih za podjetja, s katerimi je bilo sodelovanje vzpostavljeno že v preteklosti.

NIB je v letu 2023 v sodelovanju z drugimi partnerji konzorcija KTT organiziral za raziskovalce izobraževanja s področij izdelave poslovnih načrtov, trženja produktov in storitev ter obvladovanja intelektualne lastnine ter predstavitve rezultatov raziskav s tržnim potencialom.

Raziskovalci NIB so svoje prebojne raziskovalne dosežke predstavili v okviru Festivala UNI MINDS - 5. Lekov dan za raziskovalce (Univerza v Ljubljani, Univerza v Mariboru, Univerza na Primorskem), na 16. Mednarodni konferenci o prenosu tehnologij (IJS) ter na Dnevu ARIS 2023 (ARIS, SPIRIT)).

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

V letu 2023 so se nadaljevale aktivnosti za identifikacijo projektov NIB s tržnim potencialom za pridobivanje sredstev iz sklada tveganega kapitala CEETT (Central Eastern European Technology Transfer - CEETT Platform) »Proof of concept« SID banke, Hrvaške banke za obnovo in razvoj in Evropskega investicijskega sklada EIF.

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

DELOVANJE PRI UPRAVLJANJU ORGANIZACIJ

NIB je soustanovitelj dveh pravnih oseb:

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

NIB je v letu 2023 sodeloval pri upravljanju obeh pravnih subjektov. Predstavnik NIB je bil imenovan in izvoljen za člana Sveta SIS EGIZ za mandatno obdobje 2023–2025.

Tehnološki park Ljubljana (TP) je v letu 2023 nadaljeval z realizacijo ciljev povezanih s podporo vrhunskim Start-up-om in SME-jem, vse z vizijo, da postane najboljši prostor in

hydrodynamic cavitation and cold plasma for efficient water purification.

In co-operation with business, around 30 projects were carried out in 2023, a quarter of them with companies abroad. In addition, services in the areas of GMO analysis, bacteria analysis, micro-organism analysis and GLP analysis were provided with around 100 orders.

Most of these tasks were provided for companies with which co-operation had been established in the past.

In 2023, together with other KTT consortium partners, the NIB organised several training sessions for researchers in the areas of business plan development, marketing of products and services, intellectual property management and presenting research results with commercial potential.

NIB researchers presented their breakthrough research achievements at the UNI MINDS Festival – 5th Lek Day for Researchers (University of Ljubljana, University of Maribor, University of Primorska), at the 16th International Technology Transfer Conference (IJS), and at the ARIS Day 2023 (ARIS, SPIRIT).

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

In 2023, activities continued to identify NIB projects with market potential to obtain funding from the CEET venture capital fund of SID Bank (Central Eastern European Technology Transfer – CEETT Platform) "Proof of concept", the Croatian Bank for Reconstruction and Development (CEBRD) and the European Investment Fund (EIF).

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

ACTIVITIES IN ORGANISATION MANAGEMENT

The 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).

najboljša tehnološka skupnost za vrhunska tehnološka podjetja.

Tako so v letu 2023 nadaljevali z okrepljenimi aktivnostmi za sodelovanje s podjetji (XR, Blockchain, zdravje, modra bioekonomija) ter z inštituti (Pisarne za prenos znanja) za sledenje dolgoročnega cilja nudenja podpore odcepljenim podjetjem.

V okviru SIS EGIZ je bil v letu 2023 ključni mejnik uspešna prijava za nadaljevanje sofinanciranja konzorcija SRIP Zdravje. Raziskovalci NIB so se v okviru aktivnosti SRIP Zdravje posebej angažirali za vzpostavitev slovenske platforme vseh relevantnih deležnikov na področju zdravljenja raka.

In 2023, the NIB participated in the governance of both legal entities. A representative of the NIB was appointed as member of the SIH EEIG council for the term of office 2023–2025.

In 2023, Technology Park Ljubljana (TP) continued the implementation of objectives related to the support of top start-ups and SMEs, all with the vision of becoming the best place and the best tech community for top tech companies.

In 2023, they continued strengthened collaboration activities with companies (XR, Blockchain, health, blue bioeconomy) and institutes (Knowledge Transfer Offices) to pursue the long-term objective of supporting spin-offs.

At SIH EEIG, the key milestone in 2023 was the successful application to continue the co-funding of the SRIP Health consortium. In the context of SRIP Health activities, researchers from the NIB engaged in the establishment of a Slovenian platform of all relevant stakeholders in cancer treatment.

Biotehnološko stičišče NIB.
Foto: M. Kambič

Biotechnological Hub of NIB.
Photo: M. Kambič

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 carries 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, Corporate Services out support activities for the research organisational units, in particular administrative and technical support for project management and support for knowledge and technology transfer.

Corporate Services also includes the Biological Library managed by the 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.

Komore za gojenje rastlin Plant growing chambers.
Foto: M. Kambič

Plant growing chambers.
Photo: M. Kambič

Foto Photo: Ž. Cerkvenik | Photo: Ž. Cerkvenik

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Plos, Mitja

KNJIŽNJICA LIBRARY
Černač, Barbara
Glavač, Lučka
Ipavec, Vesna Mia

Morska biološka postaja Piran Marine Biology Station

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 ARIS »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 ARIS 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 on the Intergovernmental Panel on Harmful Algal Blooms (UNESCO/IOC HAB Programme).

VODJA: DOC. DR. **BORUT MAVRIČ**
HEAD: ASSIST. PROF. DR **BORUT MAVRIČ**

Doc. dr. **Borut Mavrič** je z mesecem majem 2023 prevzel nalogo vodenja OE Morska biološka postaja Piran. Je raziskovalec z doktoratom iz varstva naravne in kulturne dediščine, ki se ukvarja z raziskovanjem morskih pridnenih habitatnih tipov in njihove biodiverzitete. Vpet je tudi v implementacijo evropskih vodnih politik, kot sta Okvirna direktiva o morski strategiji in Okvirna vodna direktiva.

Assist. Prof. Dr **Borut Mavrič** took over the leadership of the Marine Biology Station Piran in May 2023. He is a doctoral researcher in the conservation of natural and cultural heritage, focusing on marine benthic habitat types and their biodiversity. He is also involved in the implementation of European water policies such as the Marine Strategy Framework Directive and the Water Framework Directive.

"In the end, we will conserve only what we love, we will love only what we understand, and we will understand only what we are taught."

Baba Dioum, 1968

Tržaški zaliv je svetovna zibelka raziskovanja morske biodiverzitete. V zimskem času je ta najsevernejši del Sredozemskega morja obdan z zasneženi vrhovi alp in dolomitov.
Foto: T. Makovec

The Gulf of Trieste is the world's cradle of marine biodiversity research. In winter, this northernmost part of the Mediterranean is surrounded by the snow-capped peaks of the Alps and Dolomites.
Photo: T. Makovec

KLJUČNE DEJAVNOSTI

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

Z interdisciplinarnim pristopom in sodelovanjem z drugimi inštitucijami in posamezniki v lokalnem in mednarodnem prostoru, razvijamo na znanosti temelječe rešitve in naslavljamo pomembne okoljske in 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 ARIS 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 ARIS program »Morska in mikrobna biotehnologija« (P4-0432), 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

KEY ACTIVITIES

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

Through our interdisciplinary approach and collaboration with other institutions and individuals in the local and international space, we develop science-based solutions and address important environmental and 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 ARIS programme "Coastal marine research" (P1-0237), which is somewhat complemented by the research programme P1-0143 that mostly runs at IJS. In 2022, the new ARIS programme "Marine and microbial biotechnology" (P4-0432) was launched, opening a new research area both at the NIB and in Slovenia in general, supporting the Blue Growth strategy.

SPECIFIC RESEARCH AREAS AND OTHER ACTIVITIES OF THE MBS

- Studying the different levels of biodiversity – from genes through individuals and populations to the diversity of habitats and life communities (plankton, benthic invertebrates, macroalgae, coastal fish communities, underwater 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.

Združba obrasti z značilnimi filtratorskimi organizmi (spužvami, mahovnjaki, črvi cevkarji, plaščarji), ki se pojavlja na umetnih strukturah v slovenskem obalnem morju.
Foto: L. L. Zamuda

A fouling community with typical filter feeders (sponges, bryozoans, tubeworms, tunicates) found on artificial structures in the Slovenian coastal sea.
Photo: L. L. Zamuda

in globalni ravni (podnebne spremembe, bioinvazija, onesnaževanje, evtrofikacija, urbanizacija, promet, marikultura).

- Proučevanje biogeokemije vodnega stolpca in sedimenta, 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.

- 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).
- Research of the biogeochemistry of 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.

- 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 ARIS 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 in izvajanju 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 marikulture.

Povezujemo se v mrežo evropskih morskih bioloških postaj (MARS), smo člani združenja EuroMarine ter EuroGOOS in MONGOOS in njunih delovnih skupin (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. Prav tako sodelujemo v različnih strokovnih telesih Evropske unije (npr. TG SEABED (tehnična skupina za morsko dno)) ali drugih mednarodnih združenj in konvencij. V letu 2023 smo poleg tega postali člani BIC (Bio-based Industries Consortium), kar nam omogoča vključevanje v konzorcije za CBE JU (Circular Bio-based Europe Joint Undertaking), ki imajo aplikativne razpise (pod okriljem Horizon Europe). Prav tako smo postali tudi člani tematske platforme za implementacijo strategije pametne specializacije za področje trajnostnega modrega gospodarstva. To je strateško

- 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 ARIS 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 (ODMS 2008/56/EC and ODV 2000/60/EC); we also participate in the formulation and implementation 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, 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 fishing and mariculture.

We are part of the Network of European Marine Biology Stations (MARS) and 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, we are connected to the European e-Science and Technology Infrastructure for Biodiversity and Ecosystem Research – LifeWatch-ERIC. We also collaborate in various expert bodies of the European Union (e.g. TG SEABED (task group for the seabed)) and other international associations

partnerstvo izjemnega pomena, odobreno s strani Evropske komisije (DG REGIO) in je potrjevanje sodelovalnih mrež, ki so nastale v okviru že zaključenega Interreg Med projekta B-Blue.

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.

and conventions. In 2023, we became members of the BIC (Bio-based Industries Consortium), which allows us to participate in consortiums for CBE JU (Circular Bio-based Europe Joint Undertaking) that have applicative calls for tenders (under the umbrella of Horizon Europe). We also became members of the Thematic Smart Specialisation Platform for Strategies for a Sustainable Blue Economy. This strategic partnership is of the utmost importance and approved by the European Commission (DG REGIO); it means a confirmation of collaboration networks that were created in the context of the now completed Interreg Med project B-Blue.

Potapljači MBP NIB pod vodo postavljajo strukture za spremljanje rasti sredozemske kamene korale (*Cladocora caespitosa*).
Foto: B. Mavrič

The divers from the MBS NIB erect underwater structures to monitor the growth of the Mediterranean cushion coral (*Cladocora caespitosa*).
Photo: B. Mavrič

GLAVNI DOSEŽKI V LETU 2023

Projekti

Leta 2023 smo na novo zaposlili slovenskega raziskovalca, ki je pridobil triletni projekt **TREMBLE** (**TRace EleMent Bioavailability from hydrothermaL vEnts**) iz ARIS sheme NOO-mobilnost. Prvi dve leti bo raziskovalec delo opravljal v Španiji (institucija je CSIC-ICM iz prijave na MSCA razpis, ki ni bila financirana, je pa prešla prag za komplementarno shemo), zadnje leto pa na MBP. Tema projekta je doprinos podvodnih hidrotermalnih izvirov k masni bilanci biorazpoložljivih kovin in njihov vpliv na lokalno primarno produkcijo, kar se umešča v program »Raziskave obalnega morja«.

V januarju smo pričeli izvajanjem projekta **Community-4Nature**, ki bo potekal do konca leta 2029. Gre za upravljavski projekt (governance project), ki je financiran v okviru sheme Interreg Euro-MED in v katerem sodeluje 10 inštitucij iz devetih sredozemskih držav. Cilj projekta je doseči usklajevanje (med različnimi ravnmi) znanja, najboljših praks in načel za pristop k izzivom varstva biotske raznovrstnosti in blažitve oz. prilagajanja podnebnim spremembam. Izboljšati usklajevanje med deležniki na več ravneh, kot so javni organi, področni organi, šole, akademski in raziskovalni centri, nevladne organizacije itd. na območju Sredozemlja.

V sklopu programa »Biodiversa+ 2021–2022« je stekel projekt **PETRI-MED** (***Plankton biodiversity through remote sensing and omics 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.

V juliju 2023 smo začeli izvajati 18-mesečni projekt **Copernicus Marine User Engagement 22050-COP-INNO USER**, katerega cilj je razviti operativne numerične modele visoke ločljivosti za napoved porazdelitve površinskih morskih tokov in razpršitve odpadne vode iz čistilnih naprav v morje. Projekt je financiran iz programa Evropske unije

Through various ongoing activities, such as the Open Day at the Marine Biology Station Piran, articles in popular and expert 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 expert and lay public.

MAIN ACHIEVEMENTS IN 2023

Projects

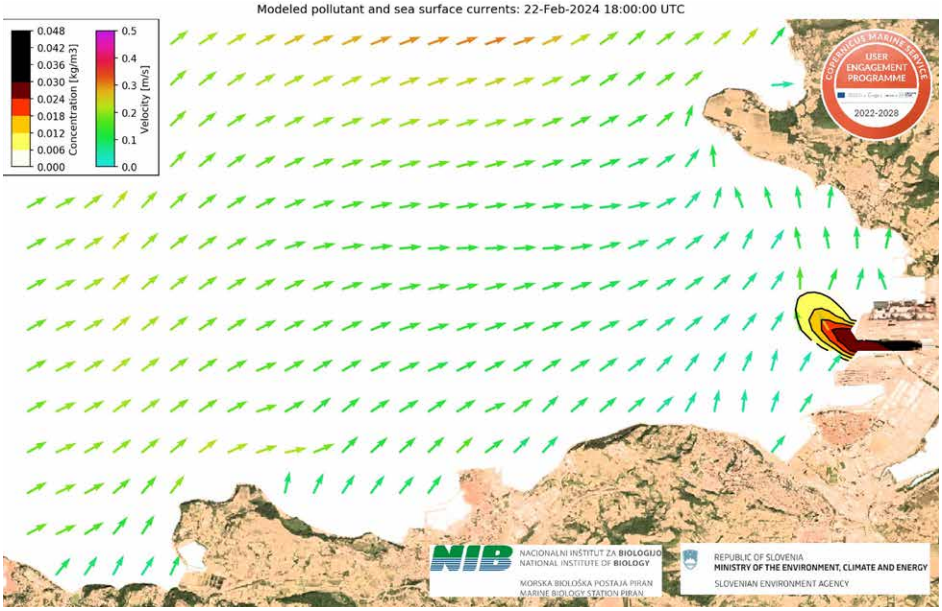
In 2023, we newly employed a Slovenian researcher who obtained the three-year project **TREMBLE** (**TRace EleMent Bioavailability from hydrothermaL vEnts**) from the ARIS scheme NOO-mobility. The researcher will work in Spain for the first two years (the institution is CSIC-ICM from the application to the MSCA tender which was not funded but passed the complementary scheme threshold), and for the last year at the MBS. The project theme is the contribution of underwater hydrothermal vents to the mass balance of bioavailable metals and their impact on local primary production, which is part of the "Coastal Marine Research" programme.

In January, we began to implement the project **Community4Nature**, which will run until the end of 2029. This is a governance project funded in the framework of the Interreg Euro-MED scheme, involving 10 institutions from nine Mediterranean countries. The project aims to harmonise (different levels of) knowledge, best practices and principles for approaching the challenges of biodiversity conservation and climate change mitigation/adaptation. Improving co-ordination between stakeholders on several levels, e.g. public authorities, sectoral bodies, schools, academic and research centres, NGOs, etc. in the Mediterranean area.

The project **PETRI-MED (Plankton biodiversity through remote sensing and omics in the Mediterranean Sea)** has been launched in the context of the programme "Biodiversa+ 2021–2022"; it is co-ordinated 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 situation and trends in the diversity of microbial plankton in the Mediterranean

Polip sredozemske kamene korale (*Cladocora caespitosa*). Obarvanost tkiva je posledica endosimbiontskih mikroalg.
Foto: L. L. Zamuda

Polyp of Mediterranean cushion coral (*Cladocora caespitosa*). The tissue is stained by endosymbiotic microalgae.
Photo: L. L. Zamuda



Izris modeliranega sledenja onesnažil iz Centralne čistilne naprave Koper.
Pripravil: B. Petelin

Plot of the modelled tracking of pollutants from the Central Wastewater Treatment Plant Koper.
Prepared by B. Petelin

Copernicus in implementiran preko Mercator Ocean. Pri izvajanju sodeluje tudi Agencija Republike Slovenije za okolje (ARSO).

Novembra 2023 je bil za financiranje odobren projekt **2B-Blue (»Boosting the Blue Biotechnology community in the Mediterranean«)**, financiran iz sheme Interreg Euro-MED. Projekt je nadaljevanje uspešno zaključenega projekta B-Blue za nadaljnji razvoj in krepitev morske biotehnologije in bo trajal 33 mesecev.

Timotej Turk Dermastia je pridobil **štipendijo Fulbright za postdoktorske raziskovalce.** V okviru štipendije bo v letu 2024 gostoval v ZDA na Univerzi Rutgers v New Jerseyju pri prof. Kay Bidle.

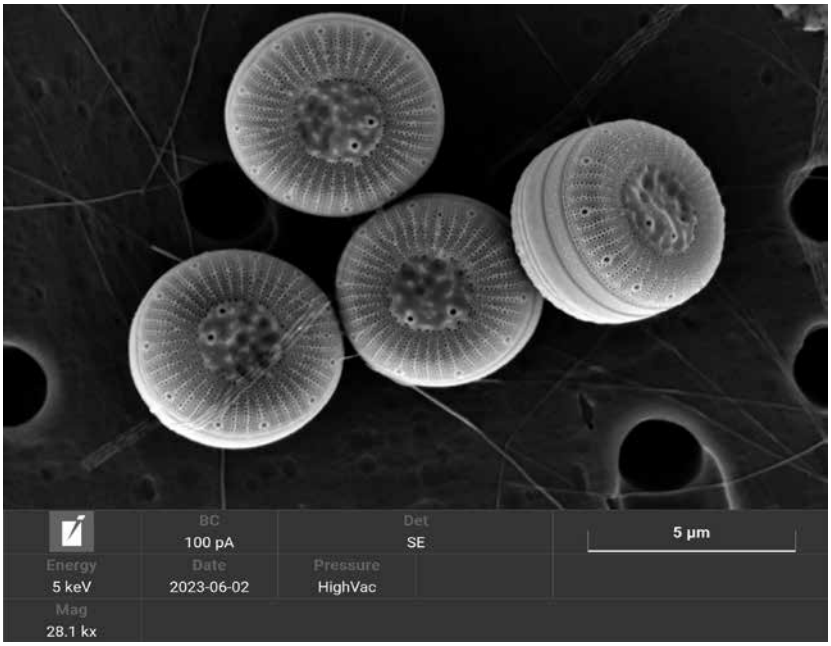
Znanstvene objave

V letu 2023 smo objavili 44 znanstvenih člankov, od tega 38 v revijah s faktorjem vpliva (IF). Kar 22 člankov je kategoriziranih kot veliki znanstveni dosežki (A'), osem kot izjemni dosežki (A''), dva pa sta pregledna. Objavili smo tudi en samostojni znanstveni sestavek oz. poglavje v monografski publikaciji.

Sea as support for the assessment of the impact of the connection of ecosystems on the local biodiversity and the functioning of marine ecosystems.

In July 2023, we started the implementation of the 18-month project **Copernicus Marine User Engagement 22050-COP-INNO USER**; its aim is to develop operative numerical high-resolution models for predicting the distribution of surface marine currents and the dispersion of wastewater from sewage treatment plants into the sea. The project is funded from the European Union Copernicus programme and implemented through Mercator Ocean. The Environmental Agency of the Republic of Slovenia (ARSO) is also participating in the implementation.

In November 2023, the project **2B-Blue ("Boosting the Blue Biotechnology community in the Mediterranean")** was approved for funding from the Interreg Euro-MED scheme. The project is a continuation of the successfully completed project B-Blue for the further development and strengthening of marine biotechnology and will last for 33 months.



Planktonska diatomeja vrste *Cyclotella* sp.,
ki se močno namnoži v spomladanskih mesecih.
Slika narejena s SEM: P. Slavinec

Planktonic diatom of *Cyclotella sp.*,
which proliferates heavily during the spring months.
Image made with SEM: P. Slavinec

Med članki izpostavljamo prispevek (*Jellyfish detritus supports niche partitioning and metabolic interactions among pelagic marine bacteria*), ki sodi v kategorijo A'' in je bil objavljen v reviji Microbiome. Prva avtorica Tinkara Tinta je s kolegi pripravila podroben vpogled v proces mikrobne razgradnje odmrle biomase meduz. Cilj je bil razumeti odziv mikrobne združbe na raztopljeno organsko snov meduznega izvora, ključne predstavnike mikrobne združbe v tem procesu ter končne produkte mikrobne razgradnje, ki se sprostijo v okolje. Raziskava pomeni pomemben korak k razumevanju interakcij med mikrobi in meduzami, kar je ključno za pravilno vključevanje meduz v modele kroženja snovi v morju.

TINTA, Tinkara, ZHAO, Zihao, BAYER, Barbara, HERNDL, Gerhard J. Jellyfish detritus supports niche partitioning and metabolic interactions among pelagic marine bacteria. Microbiome. 2023, vol. 11, art. no. 156, str. [1]–22, ilustr. ISSN 2049-2618. https://doi.org/10.1186/s40168-023-01598-8, DOI: 10.1186/s40168-023-01598-8. [COBISS.SI-ID 160881667]

Oliver Bajt je s kolegi iz Črne gore v reviji Foods (kategorija A'') objavil prispevek (*Content of trace elements and human health risk assessment via consumption of commercially important fishes from Montenegrin coast*), v katerem so obravnavali vsebnost elementov v sledovih v komercialno pomembnih vrstah rib, ujetih v črnogorskem morju, in oceno tveganja za zdravje ljudi.

BOŠKOVIĆ, Neda, JOKSIMOVIĆ, Danijela, BAJT, Oliver. Content of trace elements and human health risk assessment via consumption of commercially important fishes from Montenegrin coast. Foods. Feb. 2023, vol. 12, iss. 4, str. [1]–13, ilustr., zvd. ISSN 2304-8158. https://doi.org/10.3390/foods12040762, DOI: 10.3390/foods12040762. [COBISS.SI-ID 142035715]

Trije avtorji delovne enote za biodiverziteto so v reviji, ki spada v kategorijo A', objavili preliminarno študijo o združbi bentoških nevretenčarjev mehkega dna na širšem območju Koprskega zaliva, ki je pod močnim vplivom zaradi ladijskega prometa in luških dejavnosti. Članek predstavlja izhodišče za ugotavljanje vpliva teh dejavnosti na morsko dno in tam prisotno združbo.

Timotej Turk Dermastia has been awarded the **Fulbright scholarship for post-doctoral researchers**. As part of the scholarship, he will stay as visiting scholar at Rutgers University in New Jersey with Prof. Kay Bidle in 2024.

Scientific publications

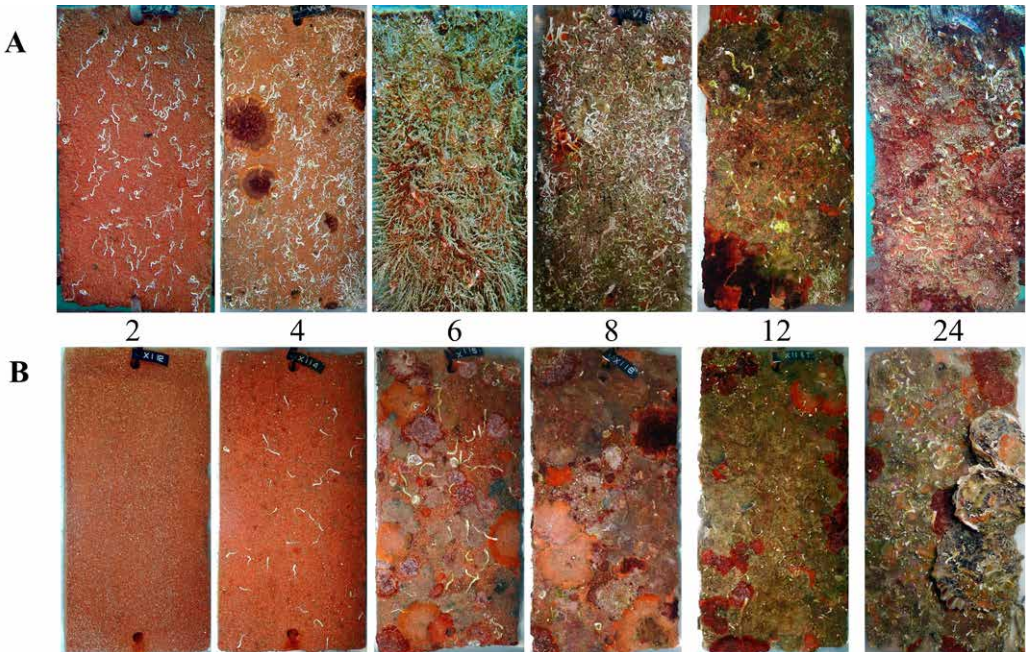
In 2023, we published 44 scientific articles, 38 of them in impact factor (IF) journals. Twenty-two articles are categorised as major scientific achievements (A'), eight as outstanding achievements (A''); two are review articles. We also published one independent scientific paper, i.e. a chapter in a monographic publication.

Among the articles, we would like to highlight the paper (*Jellyfish detritus supports niche partitioning and metabolic interactions among pelagic marine bacteria*), which is classified in the A'' category and was published in the *Microbiome* journal. The lead author Dr Tinkara Tinta and her colleagues prepared a detailed insight into the microbial degradation of dead jellyfish biomass. The aim was to understand the response of the microbial community to dissolved organic matter of jellyfish origin, the key representatives of the microbial community in this process and the final products of microbial degradation released into the environment. This research is an important step towards understanding the interactions between microbes and jellyfish, which is crucial for the correct integration of jellyfish into marine substance cycling models.

TINTA, Tinkara, ZHAO, Zihao, BAYER, Barbara, HERNDL, Gerhard J. Jellyfish detritus supports niche partitioning and metabolic interactions among pelagic marine bacteria. Microbiome. 2023 VOL % 11, art. no. 156, p. [1]–22, illustr. ISSN 2049-2618. https://doi.org/10.1186/s40168-023-01598-8, DOI: 10.1186/s40168-023-01598-8. [COBISS.SI-ID 160881667]

Oliver Bajt with colleagues from Montenegro published the paper *Content of trace elements and human health risk assessment via consumption of commercially important fishes from Montenegrin coast* in *Foods* (category A''); they addressed the trace element content of commercially important fish species caught in the Montenegrin Sea and the assessment of the risk to human health.

BOŠKOVIĆ, Neda, JOKSIMOVIĆ, Danijela, BAJT, Oliver. Content of trace elements and human health risk assessment via



Fotografije ploščic z obrastjo oz. njeno sukcesijo v obdobju dveh let, ki jih je v svojem doktoratu raziskovala Ana Fortič. Niz A je bil pod vodo postavljen v poletnem, niz B pa v zimskem obdobju.
Pripravila: A.Fortič,
foto: B. Mavrič in T.Makovec

Photos of plates with fouling and its succession over the period of two years, researched by Ana Fortič in her doctoral thesis. Group A was placed under water in summer and Group B in winter.
Prepared by: A. Fortič,
photo: B. Mavrič and T. Makovec

PITACCO, Valentina, MAVRIČ, Borut, LIPEJ, Lovrenc. A preliminary study of soft bottom benthic communities in an area affected by intense maritime traffic (Slovenian Sea, Northern Adriatic). Marine pollution bulletin. Mar. 2023, vol. 188, str. [1]–8, ilustr., zvd. ISSN 0025-326X. https://doi.org/10.1016/j.marpolbul.2023.114672, DOI: 10.1016/j.marpolbul.2023.114672. [COBISS.SI-ID 141712387]

V letu 2023 je svoje doktorsko delo z naslovom »Struktura in sukcesija združbe morskih nevretenčarjev obrasti in njena filtracijska učinkovitost« zaključila mlada raziskovalka Ana Fortič. Zanj je prejela tudi nagrado Miroslava Zeia za izjemno doktorsko delo.

Številni raziskovalci so delovali kot redni ali gostujoči uredniki znanstvenih revij, npr. Frontiers in Marine Science, Drugs, Ocean science, Studia Marina, Diversity, Acta Adriatica, Annales: anali za istrske in mediteranske študije, Series historia naturalis in Natura Sloveniae.

consumption of commercially important fishes from Montenegrin coast. Foods. Feb. 2023, vol. 12, iss. 4, p. [1]–13, illustr., doi. ISSN 2304-8158. https://doi.org/10.3390/foods12040762, DOI: 10.3390/foods12040762. [COBISS.SI-ID 142035715]

Three authors from the biodiversity working unit published a preliminary study on the soft-bottom benthic invertebrate community of the wider area of the Gulf of Koper, which is heavily impacted by maritime traffic and port activities, in an A' journal. This article is a starting point for assessing the impact of these activities on the seabed and the community present there.

PITACCO, Valentina, MAVRIČ, Borut, LIPEJ, Lovrenc. A preliminary study of soft bottom benthic communities in an area affected by intense maritime traffic (Slovenian Sea, Northern Adriatic). Marine Pollution Bulletin. Mar. 2023, vol. 188, p. [1]–8, illustr., doi. ISSN 0025-326X. https://doi.org/10.1016/j.marpolbul.2023.114672, DOI: 10.1016/j.marpolbul.2023.114672. [COBISS.SI-ID 141712387]

Raziskovalci so kot mentorji sodelovali pri dveh doktorskih dizertacijah, enem magistrskem delu (po starem študijskem programu) in sedmih magistrskih delih (bolonjski študij) ter osmih diplomskih nalogah, ki so se zaključili v letu 2023.

Dogodki

Med dogodki velja izpostaviti tudi mednarodne ekspedicije, ki so se jih v letu 2023 udeležili naši raziskovalci. V septembru je potekala ekspedicija podvodnega popisovanja biodiverzitete v morskem delu Nacionalnega parka Brioni, ki jo je organiziral prof. dr. Roland Melzer (Berlin, Nemčija) in je bila že deveta v nizu. Tokrat smo v okviru ekspedicije tudi postavili tokomer in preliminarno merili pridnene tokove na območju rodolitnega dna. V oktobru so bili v okviru projekta ADRICOR, ki ga vodi prof. dr. Petar Kružić (PMF, Zagreb, Hrvaška), izvedeni tereni v Nacionalnih parkih Mljet, Kornati in Telaščica, kjer smo sodelovali pri proučevanju koral in koraligena ter vpliva povišanih temperatur nanje. V okviru projekta PoGo (JERICO-S3 – mednarodni

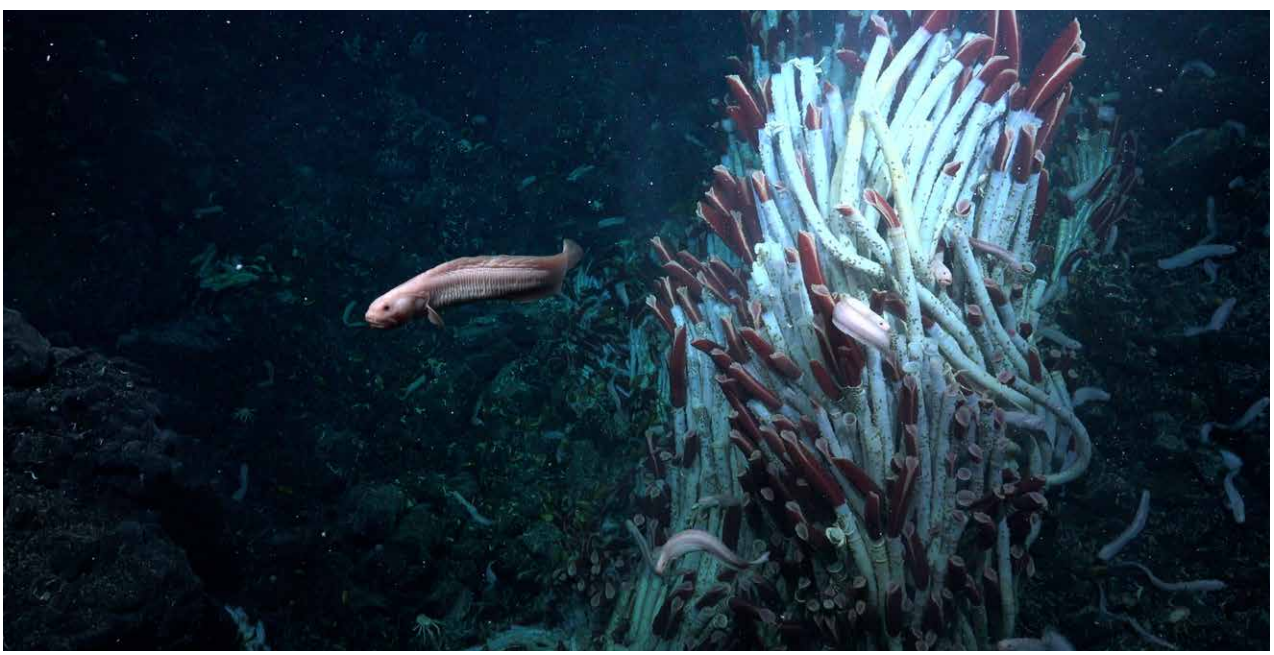
In 2023, the young researcher Ana Fortič completed her doctoral work "Structure and succession of marine invertebrate fouling community and its filtration efficiency". She was awarded the Miroslav Zei Award for her outstanding doctoral thesis.

Many researchers acted as regular or guest editors of scientific journals, e.g. *Frontiers in Marine Science,* Drugs, *Ocean Science*, *Studia Marina*, *Diversity*, *Acta Adriatica*, *Annales: Annals for Istrian and Mediterranean Studies*, *Series historia naturalis* and *Natura Sloveniae*.

Researchers have been involved as supervisors in two doctoral theses, one master's thesis (under the old study programme), seven master's theses (Bologna programme) and eight bachelor theses completed in 2023.

Events

Among the events, we should mention the international expeditions in which our researchers took part in in 2023.



Življenje v Fava Flow Suburbs, območju na globini 2500 metrov, na vzpetini v vzhodnem Tihem oceanu. Tu so v letu 2023 raziskovalci pod vodstvom prof. dr. Monike Bright, vključno s sodelavcema MBP NIB, dr. Tinkaro Tinta in Tihomirjem Makovcem, izvajali glavnino svojih raziskav.
Foto: CC-BY-NC-SA Schmidt Ocean Institute

Life in the Fava Flow Suburbs, an area at a depth of 2,500 metres on a high plateau in the eastern Pacific. Here, the researchers led by Prof. Dr Monika Bright, including the MBS NIB employees Dr Tinkara Tinta and Dr Tihomir Makovec, carried out the majority of their research in 2023.
Photo: CC-BY-NC-SA Schmidt Ocean Institute

dostop do morskih opazovalnih struktur, Horizon 2020) smo v juliju in septembru 2023, v sodelovanju s CNR ISMAR, opravili vzorčenja na postaji S1-GB v bližini ustja reke Pad in merjenje tokov z akustičnim merilnikom. Med drugim vzorčenjem smo testirali prototip CTD sonde s kamero, ki jo razvijamo na NIB. Najodmevnejša med vsemi je bila enomesečna raziskovalna odprava na Tihem oceanu pod vodstvom prof. dr. Monike Bright z Univerze na Dunaju, ki sta se je udeležila Tihomir Makovec in dr. Tinkara Tinta. Ekspedicija je potekala na raziskovalnem plovilu R/V Falkor (too) v sklopu misije kalifornijskega inštituta Schmidt Ocean Institute (SOI), kjer so raziskovali raznolikost biosfere pod dnom globokomorskih hidrotermalnih vrelcev, od virusov do živali. Med odpravo so prišli do izjemnega odkritja novega habitata v vulkanskih votlinah pod hidrotermalnimi izviri, sicer dobro raziskanega podvodnega vulkana na vzpetini vzhodnega Pacifika ob Srednji Ameriki.

V letu 2023 smo (so)organizirali številne znanstvene in strokovne dogodke. Med drugim je bil dr. Matjaž Ličer

The ninth underwater biodiversity inventory expedition in the marine part of Brijuni National Park was organised by Prof. Dr Roland Melzer (Berlin, Germany) in September. As part of the expedition, we set up a current meter and took preliminary measurements of bottom currents in the rhodolith seabed. In October, in the context of the ADRICOR project led by Prof. Dr Petar Kružić (PMF, Zagreb, Croatia), fieldwork was carried out in the National Parks of Mljet, Kornati and Telaščica, where we participated in the study of corals and coralligen and the impact of elevated temperatures on them. In July and September 2023, in the context of the project PoGo (JERICO-S3 – international access to marine observatory structures, Horizon 2020), we performed sampling at station S1-GB near the mouth of the River Po in collaboration with CNR ISMAR and measured the currents with an acoustic gauge. During the sampling we also tested the probe prototype CTD with a camera, the development of which is in progress at the NIB. The most notable of them was the one-month research expedition to

Raziskovalci OE MBP NIB na delovnem obisku v Palmanovi pri kolegih iz ARPA FVG.
Foto: Arhiv MBP

Researchers from the NIB OU MBS during their working visit to Palmanova with colleagues from the ARPA FVG.
Photo: MBS archives

Posnetki izvajanja poskusa »Čarobni fižolčki globoko na dnu oceana«, ki so ga zasnovali učenci OŠ Cirila Kosmača v Piranu. Foto: CC-BY-NC-SA Schmidt Ocean Institute

Recording of the experiment "Magic beans deep at the bottom of the ocean" conceived by the pupils of the Ciril Kosmač Primary School, Piran. Photo: CC-BY-NC-SA Schmidt Ocean Institute

soorganizator sekcije na EGU General Assembly 2023: Extremes in marine environment: analysis of multi-temporal and multi-scales dynamics using observations, models and machine learning techniques. Dr. Martin Vodopivec in dr. Tinkara Tinta sta bila predlagatelja in sovoditelja sekcije na kongresu ASLO (angl. Association for the Sciences of Limnology and Oceanography) z naslovom Jellyfish in the Changing Ocean – Resilience and Recovery of Aquatic Systems, ki je potekal v Palmi de Mallorci, Španija (ASLO). Na MBP je potekal Genetski kolokvij Slovenskega genetskega društva, pri soorganizaciji katerega je sodelovala dr. Andreja Ramšak. MBP je pripravilo tudi mednarodno srečanje s 60 udeleženci iz sredozemskih držav (predstavniki ministrstev, agencij, raziskovalnih organizacij ...), ki so ga organizirali dr. Ana Rotter in Ernesta Grigalionyte-Bembič s sodelavci v okviru projekta Community4Nature. Konec leta smo izvedli tudi dvostransko srečanje OE MBP in okoljske agencije ARPA FVG s predstavitvijo dejavnosti, vezanih na raziskave in spremljanje stanja morja. Srečanje je potekalo na sedežu ARPA FVG v Palmanovi, tudi v okviru podaljšanja dvostranskega sporazuma o sodelovanju.

Prav tako smo izvedli številne aktivnosti, povezane s promocijo in popularizacijo znanosti. Med stalne promocijske in izobraževalne dejavnosti sodi Dan odprtih vrat Morske biološke postaje Piran (DOV MBP), s katerim obeležujemo svetovni dan oceanov. DOV je zelo pomemben za približevanje znanosti o morju otrokom in mladini kot tudi širši javnosti. Na ta način pomembno in uspešno širimo znanje in rezultate raziskovalnega dela. DOV 2023 je bil s strani UNESCO označen tudi kot ena od akcij Desetletja oceanov pri ZN (2021–2030). Sodelovali smo tudi na Dnevu odprtih vrat Nacionalnega inštituta za biologijo in Dnevu očarljivih

the Pacific Ocean led by Prof. Dr Monika Bright from the University of Vienna, with the participation of Dr Tihomir Makovec and Dr Tinkara Tinta. The expedition took place on board the research vessel R/V Falkor (too) as part of a mission by the Schmidt Ocean Institute (SOI) from California to study the diversity of the biosphere beneath the bottom of deep-sea hydrothermal vents, from viruses to animals. During this expedition, they made the remarkable discovery of a new habitat in volcanic caverns beneath hydrothermal vents of an otherwise well-studied underwater volcano on a high plateau in the eastern Pacific off Central America.

In 2023, we (co-)organised numerous scientific and expert events. Among others, Dr Matjaž Ličer was a co-organiser of the section at the EGU General Assembly 2023: Extremes in marine environment: analysis of multi-temporal and multi-scales dynamics using observations, models and machine learning techniques. Dr Martin Vodopivec and Dr Tinkara Tinta were the proposers and co-leaders of the section at the ASLO congress (Association for the Sciences of Limnology and Oceanography) with the title Jellyfish in the Changing Ocean – Resilience and Recovery of Aquatic Systems, held at Palma de Mallorca, Spain (ASLO). The Genetics Colloquium of the Genetic Society of Slovenia, co-organised by Dr Andreja Ramšak, was held at the MBS. The MBS also prepared an international meeting with 60 participants from Mediterranean countries (representatives of ministries, agencies, research organisations, etc.) organised by Dr Ana Rotter and Ernesta Grigalionyte-Bembič with colleagues in the context of the Community4Nature project. At the end of the year, we also organised a bilateral meeting between the OU MBS and the environmental agency ARPA FVG with a presentation of activities

rastlin. Med dejavnosti izobraževanja in ozaveščanja javnosti, ki jim namenjamo poseben poudarek, sodijo tudi poučna predavanja o morju za šole in širšo javnost, ki prispevajo k dvigu morske pismenosti vseh starostnih skupin. V letu 2023 smo tudi prvič organizirali tematske dneve za srednješolce, ki so obsegali predavanja in delavnice z vnaprej določeno temo z namenom, da poglobijo znanje o morju in da jih usmerijo na nadaljnji karierni poti. Prav tako veliko pozornosti namenimo pripravljanju prispevkov v dnevnem časopisju in poljudnoznanstvenih revijah ter sodelovanju z novinarji (intervjuji, izjave …), kjer poskušamo javnost seznanjati in osveščati o aktualnem dogajanju v morju ter naših dejavnostih, povezanih z raziskovanjem, upravljanjem in ohranjanjem morja. V letu 2023 je v okviru odprave na Tihi ocean potekala tudi posebna izobraževalno promocijska aktivnost, ki ga je zasnovala prof. dr. Monika Bright, z naslovom »Življenje v razpokah zemeljske skorje« (angl. Life in the Cracks on the Crust). V okviru tega smo se na OE MBP in pod okriljem IOC UNESCO povezali z Osnovno šolo Cirila Kosmača Piran, katere učenci so si med drugim zamislili poskus z naslovom »Čarobni fižolčki globoko na dnu oceana«, ki so ga med odpravo nato izvedli na krovu R/V Falkor (too) in 2500 m pod morsko gladino s pomočjo daljinsko vodenega plovila SuBastian. Vse dejavnosti v zvezi z odpravo so imele izjemno mednarodno odzivnost in so bile povzete v več kot 400 svetovnih medijih, v 39 jezikih. Predvsem v slovenskih medijih so bili predstavljeni tudi omenjeni program komunikacije znanosti otrokom in eksperimenti, izvedeni v okviru IOC UNESCO.

related to marine research and monitoring. This meeting was held at the head offices of ARPA FVG in Palmanova, in the framework of the extension of the bilateral co-operation agreement.

We also carried out several activities connected with the promotion and popularisation of science. One of the regular promotional and educational activities is the Open Day at the Marine Biology Station Piran (DOV MBS) which marks World Oceans Day. The Open Day is very important for bringing marine science to children and young people, as well as to the general public. In this way we significantly and successfully spread knowledge and the results of research work. UNESCO named Open Day 2023 as one of the actions of the UN Decade of the Oceans 2021–2030. We also participated in the Open Day of the National Institute of Biology and the Fascination of Plants Day. The educational and public awareness activities which are our particular focus, include educational lectures on the sea for schools and the general public, which contribute to raising marine literacy among all age groups. In 2023, we also organised the first thematic days for secondary school students, consisting of lectures and workshops with a pre-defined theme aimed at deepening their knowledge of the sea and guiding them on their future career paths. We also devote considerable attention to preparing articles for daily newspapers and popular science magazines, and work together with journalists (interviews, statements, etc.) to inform and raise public awareness of current developments in the sea and our activities related to marine research, management and conservation. In 2023, in connection with the Pacific expedition, there was a special educational and promotional activity created by Dr Monika Bright, called "Life in the Cracks on the Crust". In this context, the OU MBS under the auspices of IOC UNESCO worked together with the Ciril Kosmač Primary School, Piran, whose pupils conceived for example an experiment called "Magic beans deep at the bottom of the ocean", which was then carried out during the expedition on board the R/V Falkor (too) and 2500 m below sea level with the help of the remotely operated vehicle SuBastian. All the activities related to the expedition met with an extraordinary international response and have been covered by more than 400 media outlets worldwide in 39 languages. In particular, the Slovenian media featured the mentioned Communicating Science to Children programme and the experiments carried out in the framework of UNESCO's IOC.

Ognjeni črv (*Hermodice carunculata*) je toploljubna vrsta, ki zaradi segrevanja morja širi svoj areal pojavljanja, prav tako pa naj bi se povečevalo tudi njihovo število.
Foto: L. L. Zamuda

The fireworm (*Hermodice carunculata*) is a warm-water species that is expanding its range as the sea warms and is thought to be increasing in numbers.
Photo: L. L. Zamuda

Skupek filtratorskih organizmov na pešečenm dnu Tržaškega zaliva.
Foto: B. Mavrič

A clump of filter-feeding organisms on the sandy bottom of the Gulf of Trieste.
Photo: B. Mavrič

BIBLIOGRAFIJA

31 Izvirni znanstveni članek (1.01)
1 Pregledni znanstveni članek (1.02)
2 Drugi znanstveni prispevek (1.03)
7 Strokovni članek (1.04)
8 Poljudni članek (1.05)
10 Objavljeni znanstveni prispevek na konferenci (1.08)
2 Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje) (1.10)
30 Objavljeni povzetek znanstvenega prispevka na konferenci (1.12)
3 Samostojni strokovni sestavek ali poglavje v monografski publikaciji (1.17)
15 Intervju (1.22)
2 Strokovna monografija (2.02)
1 Doktorska disertacija (2.08)
7 Končno poročilo o rezultatih raziskav (2.12)
3 Elaborat, predštudija, študija (2.13)
7 Radijska ali televizijska oddaja (2.19)
1 Strokovni film, videoposnetek ali zvočni posnetek (2.33)
8 Radijski ali TV dogodek (3.11)
5 Prispevek na konferenci brez natisa (3.15)
2 Vabljeno predavanje na konferenci brez natisa (3.16)
9 Uredništvo

BIBLIOGRAPHY

31 original scientific articles (1.01)
1 scientific review article (1.02)
2 other scientific contributions (1.03)
7 expert articles (1.04)
8 popular articles (1.05)
10 published scientific paper at a conference (1.08)
2 published summaries of a scientific paper at a conference (lecture by invitation) (1.10)
30 published summaries of a scientific paper at a conference (1.12)
3 stand-alone expert papers or chapters in a monographic publication (1.17)
15 interviews (1.22)
2 expert monographs (2.02)
1 doctoral thesis (2.08)
7 final reports on research results (2.12)
3 essays, pre-study, study (2.13)
7 radio or TV broadcasts (2.19)
1 expert film, video or sound recording (2.33)
8 radio or TV events (3.11)
5 papers at a conference without printing (3.15)
2 lectures at conference upon invitation without printing (3.16)
9 editorial boards

Foto: arhiv MBP | Photo: MBSc archive

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Oddelek za biotehnologijo in sistemsko biologijo
Department of Biotechnology and Systems Biology

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

Prof. dr. Kristina Gruden, znanstvena svetnica, je bila v letu 2023 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, računalništvom in matematiko.

Prof. Dr Kristina Gruden, a scientific councillor, served as the head of FITO in 2023. She is a full professor at the University of Ljubljana and the Jožef Stefan International Graduate School. Her primary research focus is on understanding plant functions at the molecular level, particularly their interactions with microorganisms and responses to environmental stresses such as drought, heat or floods. She develops advanced tools and methodologies that integrate biology with statistics, computer science and mathematics, employing a multidisciplinary approach.

»Gremo naprej, odpiramo nova vrata in delamo nove stvari, ker smo radovedni, in radovednost nas vodi po novih poteh.«

Walt Disney (1901–1966),
začetnik industrije risanih filmov

"We keep moving forward, opening new doors, and doing new things, because we're curious and curiosity keeps leading us down new paths."

Walt Disney (1901–1966),
a pioneer of the American animation industry

Dnevi FITO, Terme Čatež.
Foto: arhiv FITO

FITO Days, Čateške toplice.
Photo: FITO archive

Povečane kapacitete rastnih komor in karantenski rastlinjak dajejo nov zagon raziskavam odziva poljščin na vremenske ekstreme in napade škodljivih organizmov.
Foto: A. Hodalič in K. Bidovec

The increased capacity of the growth chambers and the quarantine greenhouse give new impetus to research on the response of crops to weather extremes and pest attacks.
Photo: A. Hodalič and K. Bidovec

KLJUČNE DEJAVNOSTI

Glavne raziskovalne usmeritve FITO so:

- **Preučevanje odzivov rastlin na vremenske ekstreme in škodljivce.** Preučevati odzive rastlin v kompleksnih okoljih z uporabo kombinacije celične, sistemske in sintetične biologije na molekulski ravni in prostorsko-časovni ločenosti.
- **Mikrobna biologija in diverziteta.** Preučevati biologijo, raznolikost, epidemiologijo, razvoj in razširjanje patogenih in nepatogenih mikrobov, povezanih z rastlinami. Razvijati napredne in zanesljive tehnološke platforme in teste za njihovo detekcijo ter določanje njihovih lastnosti.
- **Varstvo rastlin in varna hrana.** Razvijati nove strategije varstva rastlin in strategije za prehransko varnost, ki temeljijo na trajnostnih biotehnoloških metodah.
- **Mikrobi v različnih okoljih.** Pridobiti boljši vpogled v prisotnost in potencialno vlogo mikrobov, s poudarkom na virusih, v različnih okoljih, kot so voda, zrak in zemlja, ter raziskati njihov pomen za zdravje ljudi in rastlin.
- **Sistemska biologija in orodja molekularne biologije.** Nadgraditi tehnološko platformo za podporo novemu razvoju orodij sistemske in kvantitativne molekularne biologije ter razviti napredno, meroslovno zanesljivo tehnološko podporo za ta orodja, ki so lahko uporabna na področjih farmakologije, zdravja ljudi in okolja.
- **Gensko spremenjeni organizmi (GSO) in nove genske tehnike (NGT)**. Razvijati napredne in zanesljive tehnološke platforme ter teste za določanje GSO in NGT.
- **Sistemi za deaktivacijo mikrobov.** Razvijati učinkovite, okolju prijazne sisteme deaktivacije ali uničevanja mikrobov.
- **Določanje lastnosti virusov.** Razviti holističen pristop določanja virusnih lastnosti na molekulski in morfološki ravni.
- **Biomedicinski proizvodni procesi.** V biomedicinskih proizvodnih procesih, kot sta proizvodnja cepiv in virusnih vektorjev za gensko terapijo, izboljšati določanje virusnih lastnosti.

KEY ACTIVITIES

The main research areas of FITO are:

- **Exploring plant responses to weather extremes and pests.** Investigating plant responses in complex environments using a combination of cell, systems and synthetic biology at the molecular level with spatiotemporal separation.
- **Microbial biology and diversity.** Studying the biology, diversity, epidemiology, evolution and spread of pathogenic and non-pathogenic plant-related microbes. Developing reliable, state-of-the-art technology platforms and assays to detect and characterise these microbes.
- **Crop protection and food safety.** Creating new strategies for crop protection and food safety based on sustainable biotechnological methods.
- **Microbial presence in diverse environments.** Gaining deeper insights into the presence and potential roles of microbes, with an emphasis on viruses, in environments such as water, air and soil. Exploring their significance to human and plant health.
- **Systems biology and molecular biology tools.** Improving technology platforms to support the redevelopment of systems biology and quantitative molecular biology tools. Developing advanced, metrologically reliable technological support for these tools for applications in pharmacology, human health and environmental science.
- **Genetically modified organisms (GMOs) and new genetic techniques (NGT).** Developing advanced and reliable technological platforms and tests for the detection of GMOs and NGTs.
- **Microbial inactivation systems.** Developing effective systems to inactivate or destroy microbes in various matrices.
- **Viral property determination.** Formulating a holistic approach to determine viral properties at molecular and morphological levels.
- **Biomedical production processes.** Enhancing viral property determination in biomedical production processes, such as vaccine production and viral vectors for gene therapy.

- **Partnersko sodelovanje.** Vzpostaviti partnersko sodelovanje z drugimi raziskovalnimi skupinami na NIB ali zunaj njega v Sloveniji in po svetu pri komplementarnih raziskavah za pridobivanje vrhunskega znanja.
- **Industrijsko in akademsko sodelovanje.** Partnersko povezovanje z državnimi in evropskimi institucijami, visokošolskimi organizacijami in industrijo za skupni prispevek k reševanju aktualnih problemov s področja delovanja oddelka.

GLAVNI DOSEŽKI V LETU 2023

Naši rezultati so del svetovne zakladnice znanja

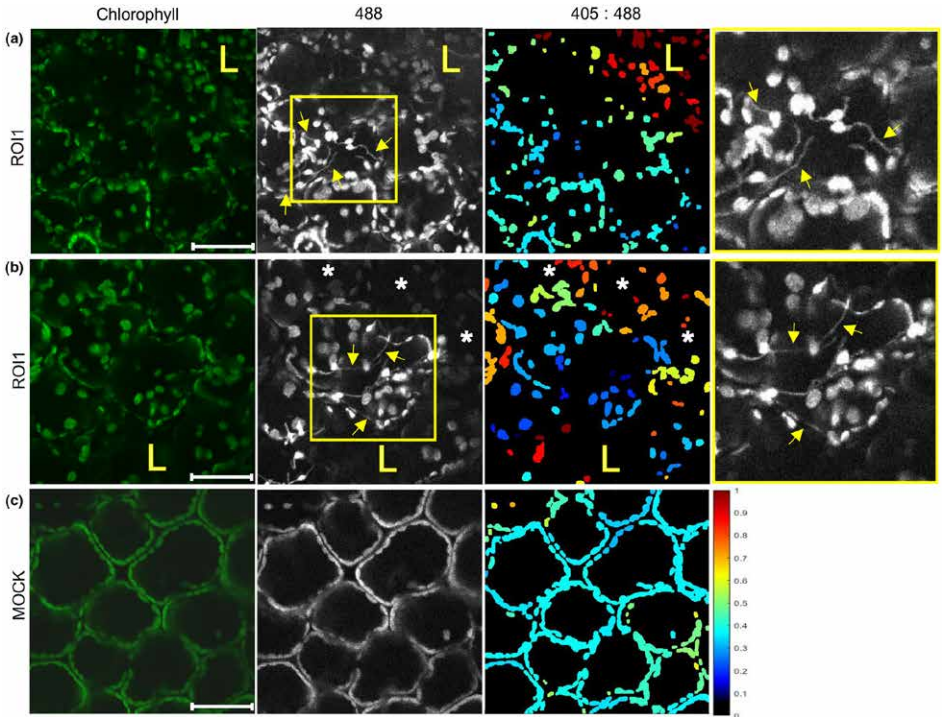
»Pomembna je kakovost, ne količina.«
Seneka, (okrog 4 pr. n. št. – 65),
starorimski filozof in državnik

- **Collaborative partnerships.** Engaging in co-operative partnerships with other research groups within or outside the NIB, in Slovenia and globally, to acquire cutting-edge knowledge through complementary research.
- **Industry and academic collaborations.** Partnering with Slovenian and European institutions, academic organisations and industries to collaboratively address current challenges within the department's fields of activity.

MAJOR ACHIEVEMENTS IN 2023

Our results are part of the global treasure trove of knowledge

"It is quality rather than quantity that matters."
Seneca (c. 4 BC – AD 65),
philosopher and statesman in Ancient Rome



Stromule, izjemno dinamični cevasti izvihki kloroplastov, nastajajo ob mestu preobčutljivostne reakcije na robu območja mrtvih celic v listni povrhnjici krompirja, okuženega s krompirjevim virusom Y.
Vir: *The New Phytologist* 2023, doi: 10.1111/nph.18425.

Stromules are highly dynamic, tube-like projections extending from the surface of chloroplasts. They are induced in cells adjacent to the hypersensitive response cell death zone in the leaf epidermis of potato plants infected with PVY.
Source: *The New Phytologist* 2023, doi: 10.1111/nph.18425.

V letu 2023 smo na vseh področjih dejavnosti FITO dosegli nekaj prebojnih rezultatov, ki so bili objavljeni v odličnih revijah, označenih z A''.

Naredili smo pomemben korak k razumevanju reaktivnih kisikovih zvrsti v kloroplastih celic krompirja, okuženega s krompirjevim virusom Y, in pokazali njihovo povezavo s signalizacijo salicilne kisline in preobčutljivostnega odgovora.

Nadaljevali smo z razvojem naprednih laboratorijskih testov za določanje gensko spremenjenih organizmov z uporabo digitalnega PCR in možnostjo sočasnega določanja več tarč ter novih pristopov za optimizacijo analize podatkov.

Linearnost šestpleksnega testa za vsako posamezno tarčo. *Foods* 2023, doi: 10.3390/foods12224156.

Človeški, živalski in rastlinski virusi v vodi so velikansko zdravstveno, okoljsko in finančno breme. Skupaj s Fakulteto za strojništvo Univerze v Ljubljani in Inštitutom Jožef Stefan smo sodelovali pri izdelavi posebne naprave, ki združuje hladno plazmo s superkavitacijo, in evalvirali njeno učinkovitost pri dekontaminaciji vode, s poudarkom na vodi, okuženi z virusi. V letu 2023 smo skupaj s partnerjema naše znanje o dezinfekciji vode tudi patentirali.

In 2023, we achieved several groundbreaking results across all areas of FITO activities, which were published in top-rated journals marked A''.

We made significant progress in understanding reactive oxygen species in the chloroplasts of potato plants infected with potato virus Y, and demonstrated their connection to salicylic acid signalling and the hypersensitive response.

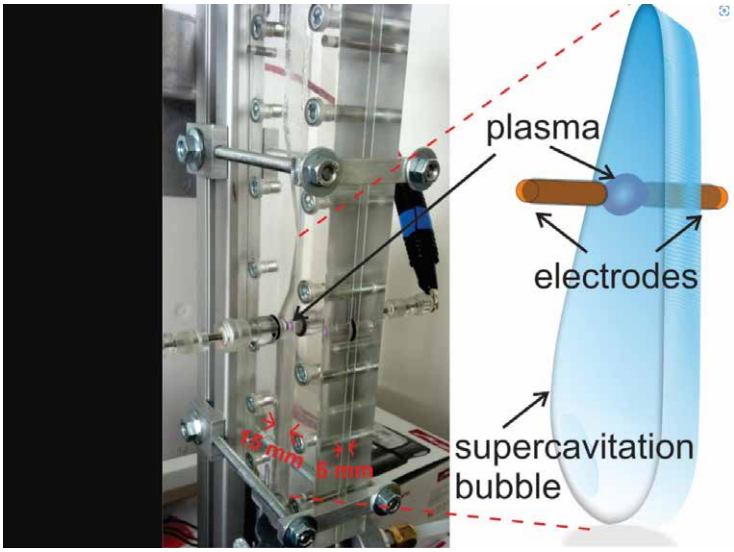
We continued to develop advanced laboratory tests for detecting genetically modified organisms using digital PCR, with the capability for simultaneous detection of multiple targets, and new approaches for optimising data analysis.

Linearity of 6-plex assay for each individual target. *Foods* 2023, doi: 10.3390/foods12224156.

Human, animal and plant viruses in water are a major health, environmental and financial burden. Together with the Faculty of Mechanical Engineering at the University of Ljubljana and the Jožef Stefan Institute, we built a special device that combines cold plasma with supercavitation, and evaluated its effectiveness in decontaminating water, focusing on virus-infected water. In 2023, we also patented our knowledge on water disinfection together with our partners.

Testiranje prisotnosti gensko spremenjenih semen oljne ogrščice.
Foto: arhiv FITO

Testing for the presence of genetically modified rapeseed seeds.
Photo: FITO archive



Hladna plazma v stabilnem superkavitacijskem mehurčku med dvema elektrodama
Vir: *Environment international* 2023, doi: 10.1016/j.envint.2023.108285.

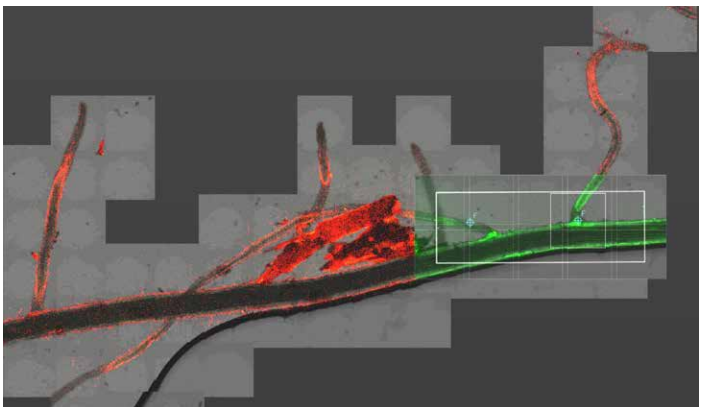
Cold plasma in a stable supercavitation bubble between two electrodes.
Source: *Environment international* 2023, doi: 10.1016/j.envint.2023.108285.

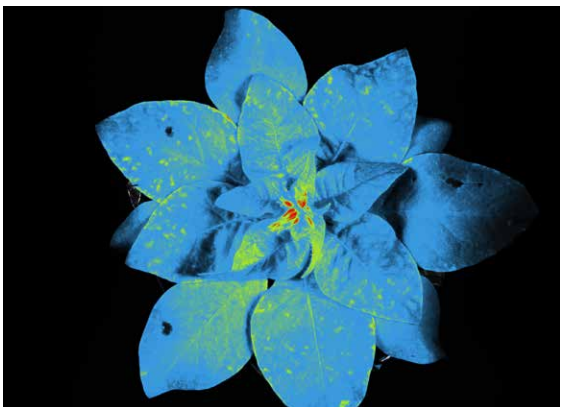
Z viromiko, s katero lahko iz ogromnih podatkov visokozmogljivega sekvenciranja bolje razumemo biologijo in ekologijo virusov v kmetijskih in divjih rastlinah, smo na kmetijskih območjih Slovenije odkrili 125 virusov, vključno z 79 novimi vrstami, od katerih je bilo 65 najdenih izključno v plevelih. Virusi so bili iz 21 višjih taksonov, pri čemer so prevladovali *Potyviridae*, *Rhabdoviridae* in *Tombusviridae*, ter štiri družine nerastlinskih virusov. Zaznali smo viruse gostiteljev, ki niso rastline, in sekvence, podobne viroidom, ter pokazali infektivnost novega tobamovirusa v rastlinah iz družine Solanaceae.

Using viromics to better understand the biology and ecology of viruses in agricultural and wild plants from the huge amounts of high-throughput sequencing data, we have discovered 125 viruses in agricultural areas of Slovenia, including 79 new species, 65 of which were found exclusively in weeds. The viruses were from the 21 higher taxa, with prevalent *Potyviridae*, *Rhabdoviridae* and *Tombusviridae*, and four families of non-plant viruses. We have detected viruses from non-plant hosts and viroid-like sequences and demonstrated the infectivity of a new tobamovirus in plants of the Solanaceae family.

Odkriti virusi (+)ssRNA iz družine *Virgaviridae* v trpotcu, slaku in paradižniku.
Vir: Microbiome 2023, doi 10.1186/s40168-023-01500-6.

The novel (+)ssRNA viruses from the Virgaviridae family were found in plantain, bindweed and tomato.
Source: Microbiome 2023, doi 10.1186/s40168-023-01500-6.





Z najsodobnejšo opremo pridobivamo nov vpogled v sožitje rastlin in njim koristnih bakterij. Na sliki levo opazujemo bakterije, označene z zelenim fluorescentnim proteinom v koreninici krompirja, na sliki desno pa razširjanje zelo nevarnega fluorescentno označenega krompirjevega virusa Y po rastoči rastlini preko daljšega obdobja. Foto: arhiv FITO

With state-of-the-art equipment, we are gaining new insights into the symbiosis between plants and their beneficial bacteria. In the image on the left, we observe bacteria labelled with green fluorescent protein in a potato root, while the image on the right shows the spread of the highly dangerous fluorescently labelled potato virus Y throughout a growing plant over an extended period. Photo: FITO archive

Odpiramo vrata mladim

We open the doors to young adults

V veliko veselje nam je bilo, po obdobju covida-19 in gradnje biotehnološkega stičišča, svoje znanje spet predstaviti 450 dijakom slovenskih srednjih šol. Foto: arhiv FITO

It was a great pleasure for us to once again share our knowledge with 450 students from Slovenian high schools, followingthe period of COVID and the construction of the biotechnology hub. Photo: FITO archive

Z našim znanjem oblikujemo boljši svet za vse

V letu 2023 smo še naprej organizirali uspešne mednarodne delavnice.

Kot konzorcijski partner Evropskega referenčnega laboratorija za viruse, viroide in fitoplazme (EURL-Virology) smo pripravili nadaljevanje delavnice za preskušanje usposobljenosti laboratorijev *Detection of phytoplasmas listed in Annex II, Part A of Commission Implementing Regulation (EU) 2021/2285* in za evropske laboratorije izvedli test preskušanja usposobljenosti laboratorijev za določanje virusa CSNV.

V okviru projekta CBS Epidemiology (EFSA) smo za partnerje iz Tunizije izvedli tridnevno delavnico o pripravi vzorcev za ugotavljanje prisotnosti karantenske glive *P. citricarpa* v nasadih agrumov.

Za partnerje iz skupine ELIXIR smo izvedli dvodnevno mednarodno delavnico o načelih FAIR v sistemski biologiji.

V okviru CRP Met4Lab smo organizirali delavnico Meroslovna podpora v biologiji in kemiji s poudarkom na metodah PCR.

Skupaj z Univerzo na Dunaju smo organizirali minikonferenco *Crops for the future – breeding for resilience 2023*, kjer so domači in tuji znanstveniki predstavili izsledke več evropskih projektov.

V soorganizaciji z Gospodarsko zbornico Slovenije smo izvedli znanstveni posvet: *Pogled znanosti na trajnost živilskih sistemov kot temelj prehranske varnosti in okoljske vzdržnosti*.

»Ni pomembno, kolikokrat prejmeš nagrado, vedno je nekaj posebnega.«

Zinedine Zidane, francoski nogometaš

Dr. Arijana Filipić je številnim nagradam in priznanjem v letu dodala še Zlati znak Jožefa Stefana za najodmevnejši doktorat na področju naravoslovno-matematičnih in tehniških ved ter ved o življenju.

With our knowledge we help shape a better world for all

In 2023, we continued to organise successful international workshops.

As a consortium partner of the European Reference Laboratory for Viruses, Viroids, and Phytoplasmas (EURL-Virology), we prepared a follow-up workshop on laboratory proficiency testing titled Detection of Phytoplasmas Listed in Annex II, Part A of Commission Implementing Regulation (EU) 2021/2285 and conducted a proficiency testing trial for European laboratories to detect the CSNV virus.

As part of the CBS Epidemiology project (EFSA), we conducted a three-day workshop for partners from Tunisia on sample preparation for the detection of the quarantine fungus *P. citricarpa* in citrus orchards.

For partners from the ELIXIR group, we held a two-day international workshop on FAIR principles in systems biology.

Within the framework of the CRP Met4Lab project, we organised a workshop on Metrological Support in Biology and Chemistry with a focus on PCR methods.

Together with the University of Vienna, we organised the mini-conference *Crops for the Future – Breeding for Resilience 2023*, where domestic and international scientists presented findings from several European projects.

In co-organisation with the Chamber of Commerce of Slovenia, we held a scientific conference titled *The Science Perspective on the Sustainability of Food Systems as the Foundation of Food Security and Environmental Sustainability.*

"It doesn't matter how many times you win an award, it is always very special."

Zinedine Zidane, French football player

Dr Arijana Filipić added the Golden Jožef Stefan Award for the most influential doctoral thesis in the fields of natural sciences, mathematics, engineering and life sciences to her numerous awards and recognitions this year.

Foto: osebni arhiv Arijane Filipić

Photo: Personal archive of Dr Arijana Filipić

Novim dogodivščinam naproti

V letu 2023 se je upokojila naša legendarna tehnična sodelavka Lidija Matičič.

Towards new adventures

In 2023, our legendary technical associate Lidija Matičič retired.

Foto: arhiv FITO

Photo: FITO archive

BIBLIOGRAFIJA

31 Izvirni znanstveni članek (1.01)
3 Pregledni znanstveni članek (1.02)
5 Drugi znanstveni prispevek (1.03)
8 Strokovni članek (1.04)
13 Poljudni članek (1.05)
2 Objavljeni znanstveni prispevek na konferenci (1.08)
7 Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje) (1.10)
82 Objavljeni povzetek znanstvenega prispevka na konferenci (1.12)
2 Intervju (1.22)
1 Znanstvena monografija (2.01)
1 Strokovna monografija (2.02)
1 Doktorska disertacija (2.08)
21 Končno poročilo o rezultatih raziskav (2.12)
4 Elaborat, predštudija, študija (2.13)
22 Radijska ali televizijska oddaja (2.19)
3 Strokovni film, videoposnetek ali zvočni posnetek (2.33)
1 Radijski ali TV dogodek (3.11)
27 Prispevek na konferenci brez natisa (3.15)
12 Vabljeno predavanje na konferenci brez natisa (3.16)
14 Uredništvo

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31 original scientific articles (1.01)
3 scientific review articles (1.02)
5 other scientific contributions (1.03)
8 expert articles (1.04)
13 popular articles (1.05)
2 published scientific papers at a conference (1.08)
7 published summaries of a scientific paper at a conference (lecture by invitation) (1.10)
82 published summaries of a scientific paper at a conference (1.12)
2 interviews (1.22)
1 scientific monograph (2.01)
1 expert monograph (2.02)
1 doctoral thesis (2.08)
21 final reports on research results (2.12)
4 essays, pre-study, study (2.13)
22 radio or TV broadcasts (2.19)
3 expert films, videos or sound recordings (2.33)
1 radio or TV events (3.11)
27 papers at a conference without printing (3.15)
12 lectures at conference upon invitation without printing (3.16)
14 editorial boards

V laboratorijih za endofite proučujemo bakterije in gljive, ki domujejo v rastlinah in bi lahko imele pomembno vlogo pri trajnostnih rešitvah v kmetijstvu, npr. pri zmanjšanju uporabe gnojil in pesticidov. Foto: M. Kambič

In the laboratories for endophytes, we study bacteria and fungi that reside within plants and could play an important role in sustainable solutions for agriculture, for example, in reducing the use of fertilizers and pesticides. Photo: M. Kambič

Izlet oddelka v Kulturno središče evropskih vesoljskih tehnologij (KSEVT) v Vitanju. Foto: FITO arhiv

Excursion to the Cultural Centre of European Space Technologies (KSEVT) in Vitanje. Photo: FITO archive

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Oddelek za genetsko toksikologijo in biologijo raka
Department of Genetic Toxicology and Cancer Biology

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, nanomaterialov, 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 ostankov zdravil na okolje in zdravje ljudi.

Assoc. Prof. Dr **Bojana Žegura**, Scientific Councillor, 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 fields include the research of mechanisms of genotoxic and potentially carcinogenic effects of anthropogenic and natural environmental and food pollutants, nanomaterials, the investigation of potential antigenotoxic substances, and the development of new *in vitro* test systems for genotoxicity studies. Her research has also made important contributions to environmental science, in particular to understanding the adverse effects of drug residues on the environment and human health.

KAKOVOST OKOLJA IN ZDRAVJE LJUDI STA NELOČLJIVA.

»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

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

"All things are poison,
and nothing is without poison;
only the dose permits
something not to be poison."

Paracelsus, born Theophrastus Philippus Aureolus Bombastus von Hohenheim (1493–1534), the "father" of toxicology

Nova pridobitev Oddelka za genetsko toksikologijo in biologijo raka, je poseben sistem akvarijev, v katerih gojijo ribe cebrice.
Foto: A. Hodalič, K. Bidovec

A new acquisition of the Department of Genetic Toxicology and Cancer Biology, is a special system of aquariums in which zebrafish, a tropical fish.
Photo: A. Hodalič, K. Bidovec

KLJUČNE DEJAVNOSTI

Raziskovalno delo na Oddelku za genetsko toksikologijo in biologijo raka poteka v okviru raziskovalnega programa ARIS (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:

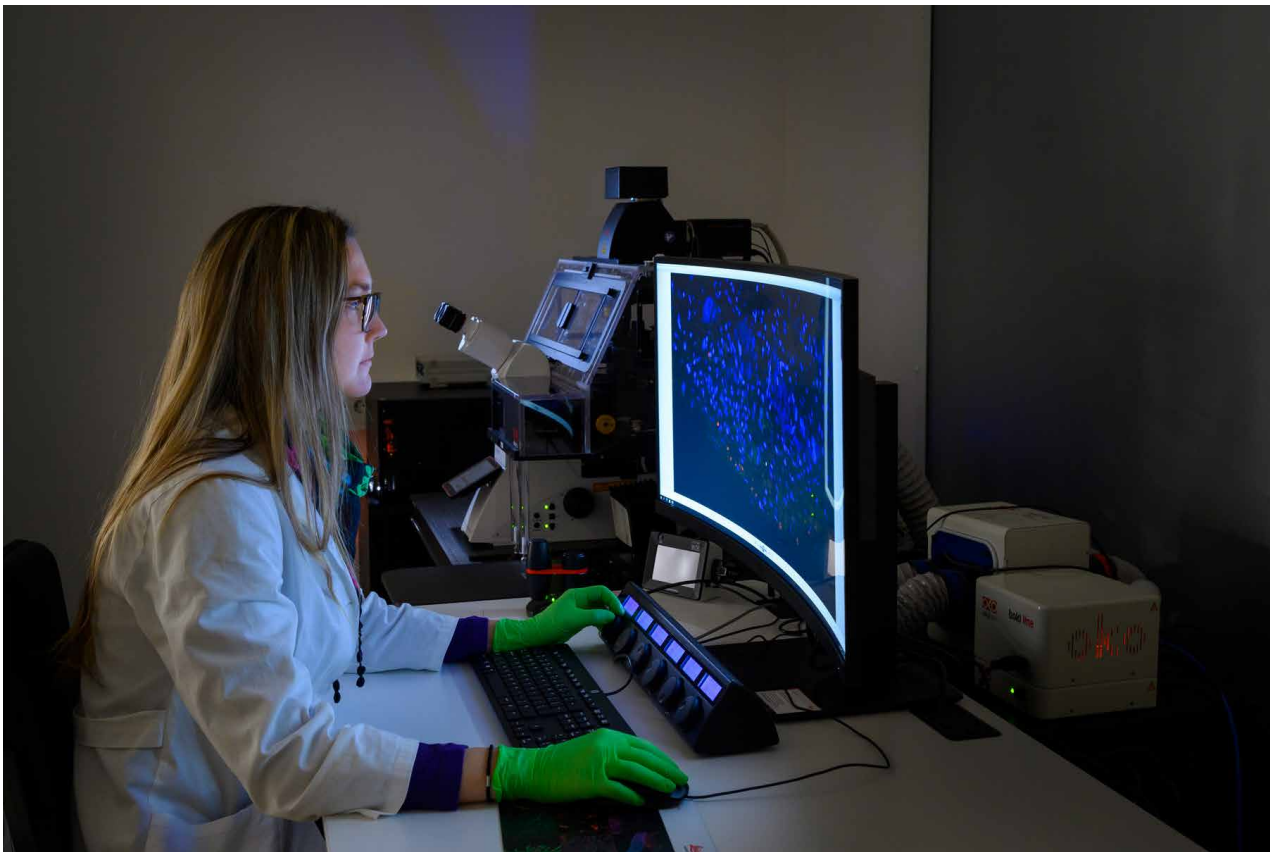
- Raziskave molekularnih mehanizmov toksičnega in genotoksičnega delovanja okoljskih onesnažil. Osredotočamo se na preučevanje potencialnih škodljivih učinkov posameznih onesnažil (genotoksični in negenotoksični

KEY ACTIVITIES

The research work at the Department of Genetic Toxicology and Cancer Biology is carried out in the context of the ARIS research programme entitled "Ecotoxicology, toxicological genomics and carcinogenesis" (P1-0245) and several national and international research projects. The research focuses on the understanding of the complex mechanisms through which the environment impacts the human health, 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 adverse effects of individual pollutants (genotoxic and non-genotoxic carcinogens,



Konfokalni mikroskop.
Foto: M. Kambič

Confocal microscope.
Photo: M. Kambič

karcinogeni, 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 in diagnostike raka, avtoimunskih bolezni, pretiranih imunskih odzivov na okužbe ter vrste drugih imunskih pomanjkljivosti in okvar zahteva podrobno preučevanje celičnih in molekularnih mehanizmov. V skupini za imunologijo in celično imunoterapijo (ICI) vzpostavljamo platforme za poglobljeno analizo imunskih celic in razvijamo inovativne celične imunoterapije naslednje generacije z izboljšano učinkovitostjo oz. 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. Preko preučevanja funkcije in disfunkcije imunskih celic v bolezenskih stanjih lahko lastnosti, ki spodbujajo ali omejujejo želeno funkcijo, uporabimo za razvoj celičnih imunoterapij.
- 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 načelih OECD in preizkušanje biološke združljivosti medicinskih pripomočkov skladno s standardom ISO 10993-5.

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.
- Cancer research focusing on aggressive glioma brain tumours, glioblastoma stem cells and their role in growth and resistance to treatments. 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 and defects requires detailed studies of cellular and molecular mechanisms. In the Immunology and Cellular Immunotherapy (ICI) group, 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. By studying the function and dysfunction of immune cells in disease states, the properties that promote or limit the desired function can be used to develop cell-based immunotherapies.
- 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 businesses. We carry out product safety testing for registration purposes (mutagenicity testing according to the principles of good laboratory practice – GLP) according to the OECD principles and biocompatibility testing of medical devices according to ISO 10993-5.

GLAVNI RAZISKOVALNI DOSEŽKI V LETU 2023

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 snovi vplivajo na organizme, kar nam preprečuje ustrezno oceno tveganja za okolje in zdravje ljudi, zlasti za nastanek in razvoj rakavih obolenj. 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. Biodiverzitetne vzorce cianobakterij v alpski regiji smo povzeli v izvirnem originalnem članku v priznani reviji Hydrobiologia. ilustr. (https://doi.org/10.1007/s10750-023-05423-z).

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. 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 okviru ARIS programa (P1-0245), ARIS projekta (J1-8140) in podoktorskega projekta (Z1-1854) smo proučevali letalne in subletalne učinke tirozin kinaznih inhibitorjev na netarčni jetrni celični liniji rib cebric (ZFL) (*Danio rerio*) (https://www.mdpi.com/1422-0067/24/4/3894).

MAIN RESEARCH ACHIEVEMENTS IN 2023

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 substances 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 are ubiquitous and are increasingly found in aquatic environments in the temperate zone due to increased eutrophication of inland waters and global warming. The biodiversity patterns of cyanobacteria in the Alpine region were summarised in an original paper in the renowned journal *Hydrobiologia. illustr.* (https://doi.org/10.1007/s10750-023-05423-z).

In recent decades, concerns have significantly increased regarding a particular group of emerging pollutants, such as pharmaceutical residues, which occur in the environment, especially in water bodies. Pharmaceutical residues (e.g. anticancer drugs) can cause a number of 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, pharmaceutical residues can cause changes associated with endocrine disruption and are considered reproductive and developmental toxins. Although pharmaceutical residues are mostly present in the environment at low concentrations, they pose a potential risk to human health and the organisms that live in these environments, as such compounds can be highly active at low concentrations. In the context of the ARIS programme P1-0245,

Mikroskopska slika različnih vrst potencialno strupenih cianobakterij.
Foto: T. Eleršek

A microscopic image of different potentially toxic cyanobacterial species.
Photo: T. Eleršek

Druga skupina onesnažil današnjega časa so bisfenol A (BPA) in njegovi analogi. BPA je znan motilec hormonov, vse več pa je podatkov, da ima tudi genotoksične lastnosti, zaradi česar se vse bolj nadomešča s številnimi analogi, za katere pa so toksikološki podatki zelo pomanjkljivi. V sodelovanju z Univerzo Burgos in CSIC iz Španije smo v okviru ARIS programa in projektov (J1-2465, Z1-3191) ter HEU projektov CutCancer in PARC proučili škodljive (geno)toksične učinke BPA in njegovih petih analogov na naprednem tri (3D) dimenzionalnem modelu, ki smo ga razvili iz celic humanega hepatocelularnega karcinoma (HepG2). Izsledke smo objavili v A'' članku v prestižni reviji Environment International (https://doi.org/10.1016/j.envint.2022.107721). Poleg tega smo v sodelovanju s Fakulteto za farmacijo in biokemijo Univerze v Zagrebu v okviru ARIS programa in ARIS projektov (J1-2465, Z1-3191) ter HEU projekta CutCancer raziskali kombinirane toksične učinke BPA in njegovih dveh analogov

ARIS project J1-8140 and the post-doctoral project Z1-1854, we studied lethal and sub-lethal effects of tyrosine kinase inhibitors on non-target zebrafish (*Danio rerio*) liver (ZFL) cells (https://www.mdpi.com/1422-0067/24/4/3894).

Another group of emerging pollutants are bisphenol A (BPA) and its analogues. BPA is a well-known hormone disruptor, and there is growing evidence that it also has genotoxic properties, therefore it is increasingly replaced by a number of analogues for which toxicological data are very scarce. In collaboration with the University of Burgos and CSIC, Spain, we investigated the adverse (gene)toxic effects of BPA and its five analogues in an advanced three-(3D)-dimensional model developed from human hepatocellular carcinoma (HepG2) cells, with support from the ARIS programme and projects J1-2465 and Z1-3191 and the HEU CutCancer and PARC projects,. The findings were published in an A'' article in the prestigious journal

BPAP in BPC na 3D HepG2 celičnem modelu (https://www.mdpi.com/1420-3049/28/7/3085). Razgradnjo BPA in BPS s hladno atmosfersko plazmo ter toksično aktivnost razgradnih produktov smo proučevali v sodelovanju z JSI, izsledke raziskave pa smo objavili v prestižni reviji (A'') Journal of Hazardous Materials (https://doi.org/10.1016/j.jhazmat.2023.131478).

V okviru programa ARIS smo v sodelovanju s kolegi s Fakultete za farmacijo in biokemijo iz Zagreba proučevali, ali mikotoksina deoxynivalenol in zearalenone škodljivo vplivata na celične procese (https://doi.org/10.3390/ijms24044082).

Environment International (https://doi.org/10.1016/j.envint.2022.107721). In addition, together with the Faculty of Pharmacy and Biochemistry of the University in Zagreb, within the framework of the ARIS programme and ARIS projects J1-2465 and Z1-3191 and the HEU project CutCancer, we researched the combined toxic effects of BPA and its two analogues BPAP and BPC in a 3D HepG2 cell model (https://www.mdpi.com/1420-3049/28/7/3085). We investigated the degradation of BPA and BPS during cold atmospheric pressure plasma treatment and studied the toxic activity of the degradation products in collaboration with JSI; the results

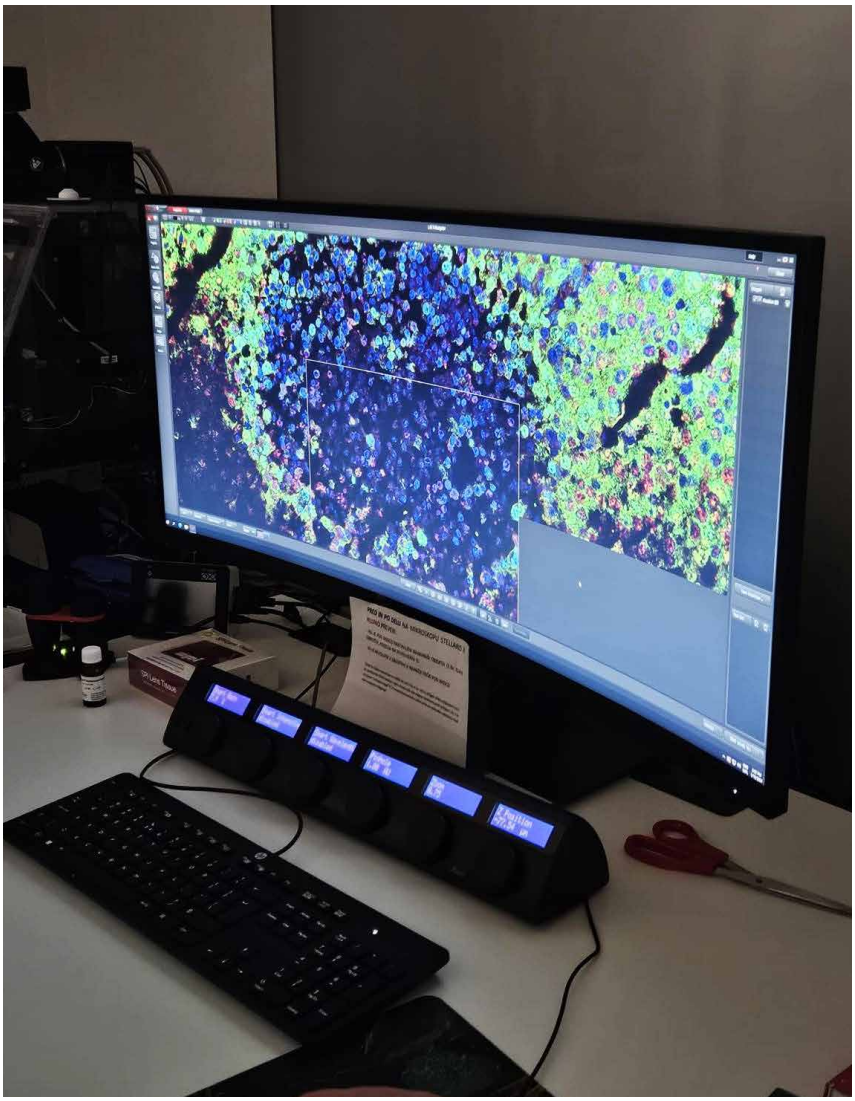
Gojenje sferoidov, pripravljenih iz HepG2 celic v dinamičnih bioreaktorjih CelVivo.
Foto: M. Štampar

Growing spheroids, prepared from HepG2 cells, in CelVivo dynamic bioreactors.
Photo: M. Štampar

Poleg tega v sklopu ARIS programa in HEU projekta PARC raziskujemo škodljivo delovanje mikotoksinov, ki jih proizvajajo plesni iz rodu Alternaria (https://link.springer.com/article/10.1007/s00204-023-03636-8). Kot novo raziskovalno področje na področju umetnih encimov so nanomateriali, ki imajo encimom podobne lastnosti, imenovani nanocimi, zaradi svojih edinstvenih lastnosti v primerjavi z naravnimi encimi in klasičnimi umetnimi encimi, v zadnjem času pritegnili veliko pozornosti, saj bi z njimi lahko premagali omejitve naravnih encimov, kot so nizka stabilnost in razmeroma visoki stroški priprave in čiščenja. Varnost nanocimov proučujemo v okviru H2020 MSCA-RISE projekta

were published in the prestigious (A") *Journal of Hazardous Materials* (https://doi.org/10.1016/j.jhazmat.2023.131478).

In the ARIS programme, we collaborated with colleagues from the Faculty of Pharmacy and Biochemistry in Zagreb to investigate whether the mycotoxins deoxynivalenol and zearalenone have adverse effects on cellular processes (https://doi.org/10.3390/ijms24044082). In addition, in the context of the ARIS programme and the HEU project PARC, we study the adverse effects of mycotoxins produced by fungi of the genus Alternaria (https://link.springer.com/article/10.1007/s00204-023-03636-8). As a new area of



Mikroskopiranje sferoidov na konfokalnem mikroskopu Leica Stellaris 8.
Foto: DE RAK

Microscopy of spheroids on a Leica Stellaris 8 confocal microscope.
Photo: DE RAK

NESTOR in ARIS projekta (J1-4395), kjer sodelujemo z Univerzo v Zaragozi in CSIC iz Španije ter CONICET in CNEA iz Argentine.

V okviru raziskav programa ARIS (P1-0245), projekta ARIS (J2-4428) in pogodbe z Ministrstvom za obrambo RS smo nadaljevali z ekološkimi raziskavami površinskih voda. Za ARSO smo v letu 2023 opravljali tudi biološki monitoring fitoplanktona v izbranih zadrževalnikih.

Na temo zaznavanja ekotoksikoloških učinkov psihoaktivnih snovi v vodah smo v soavtorstvu objavili A'' članek v reviji Science of the total environment (DOI: 10.1016/j.scitotenv.2022.161257). Nadaljevali smo tudi z aktivnostmi

research in the field of artificial enzymes, nanomaterials with enzyme-like characteristics, called nanozymes, have recently attracted a lot of attention due to their unique properties compared to natural enzymes and conventional artificial enzymes, as they could overcome the limitations of natural enzymes, such as low stability and relatively high production and purification costs. The safety of nanozymes is studied under the H2020 MSCA-RISE NESTOR project and ARIS project J1-4395, in collaboration with the University of Zaragoza and CSIC from Spain and CONICET and CNEA from Argentina.

Priprava sferoidov s pomočjo aggrewell ploščic.
Foto: M. Štampar

Preparation of spheroids using AggreWell™ plates.
Photo: M. Štampar

vključevanja državljanov v znanost v okviru spletne platforme Ciano SLO in na to temo objavili kar pet poljudnih in strokovnih člankov. Pojav cianobakterij v celinskih vodah in z njimi povezano sproščanje 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.

Within the framework of the ARIS programme P1-0245, ARIS projects P1-0245 and J2-4428 and a contract with the Ministry of Defence of the Republic of Slovenia, we continued our ecological research regarding freshwaters. We carried out the biological monitoring of phytoplankton in selected reservoirs for ARSO in 2023.

We co-authored an article about the detection of ecotoxicological effects of psychoactive substances in waters which was published in the journal *Science of the Total Environment* (DOI: 10.1016/j.scitotenv.2022.161257). We also continued our citizen engagement activities in science through the Ciano SLO online platform, publishing five popular and

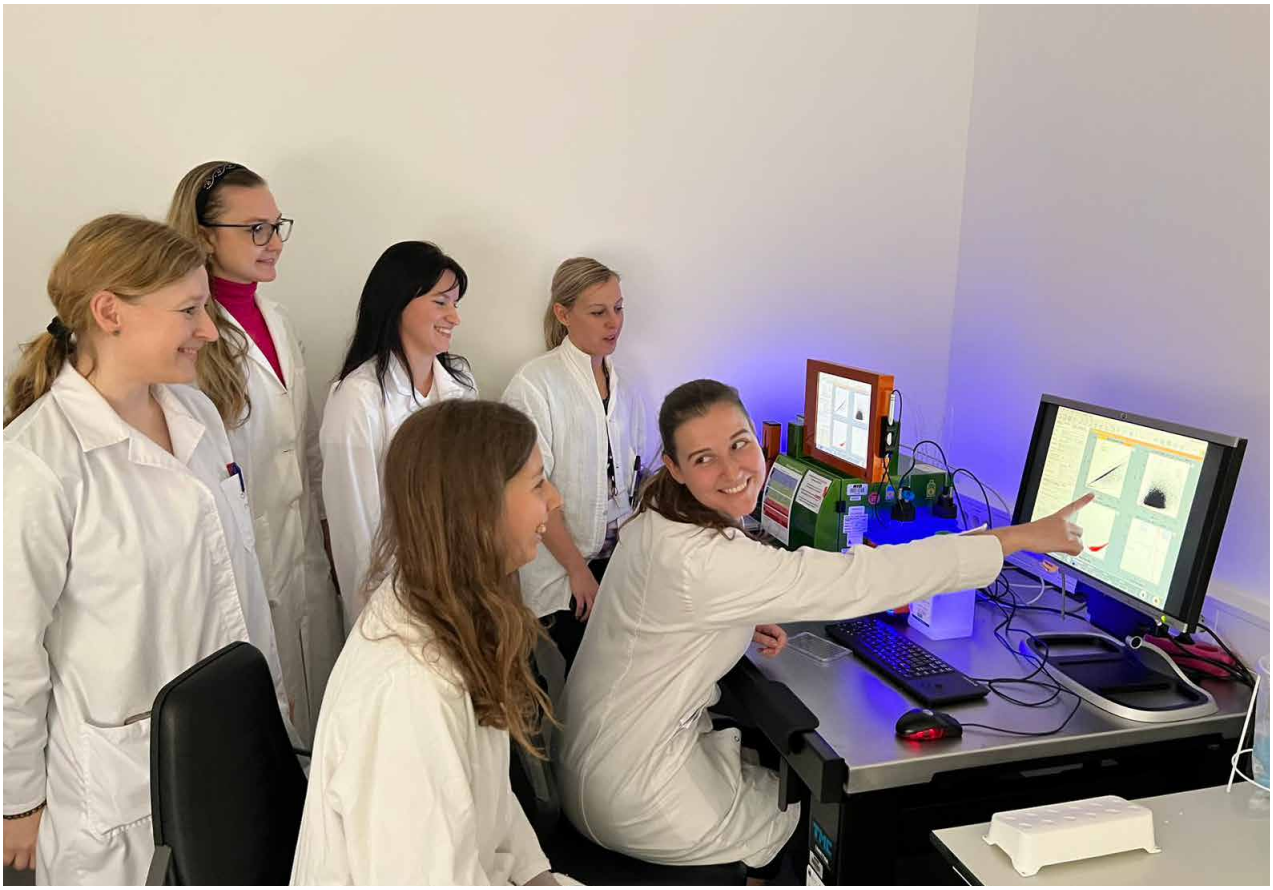
Vzorčenje vodnih teles za biomonitoring včasih poteka kar z obale.
Foto: T. Eleršek

The sampling of water bodies for biomonitoring is sometimes carried out from the shore.
Photo: T. Eleršek

Raziskave iniciacije in razvoja raka

V okviru programa in projektov ARIS 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 znanstveni reviji Cancers (https://www.mdpi.com/2072-6694/15/3/573), kjer smo pokazali, da je biološka tarča TRIM28 pomemben protein, ki je odgovoren

expert articles on the subject. The growth of cyanobacteria in inland waters and the associated release of cyanotoxins into the environment threaten human and animal health, destroy aquatic environments and cause economic damage. Only by detecting this toxic threat early and specifically are the competent institutions able to act quickly enough to reduce the magnitude and negative consequences of this phenomenon and thus improve water management.



Analiza imunskih celic bolnika z glioblastomom na pretočnem citometru.
Foto: DE RAK

Flow cytometer analysis of immune cells from a glioblastoma patient.
Photo: DE RAK

za invazijo glioblastomskih matičnih celic. Z inhibicijo proteina TRIM28 z vezavo specifičnega nanotelesa proti TRIM28 smo uspešno pokazali inhibicijo invazije glioblastomskih celic tako *in vitro* kot tudi v *in vivo* modelu rib cebric. Uspešno smo nadaljevali delo na EU projektu CutCancer, kjer smo znanstveno delo, ki obsega razumevanje celotnega tumorskega mikrookolja glioblastoma z uporabo novih metodologij s prostorsko ločljivostjo, predstavili tudi kot vabljeno predavanje na Karolinskem inštitutu na Švedskem ter na medicinskem centru VUmc v Amsterdamu na Nizozemskem.

Imunologija in celična imunoterapija

V okviru potekajočih projektov smo naše raziskovalne dosežke v obliki vabljenih predavanj in kratkih prispevkov predstavili na več konferencah (Spomladanskem sestanku Alergosekcije, 8. simpoziju Slovenskega imunološkega društva z mednarodno udeležbo, 11. Likarjevem simpoziju, Novartisovem BioCampu 2023 in IV. Doktorskem dnevu Bi(o)znanosti). Predstavljali smo delo, povezano z urejanjem genoma in nadgradnjo genske platforme za modifikacijo primarnih T limfocitov, kot tudi delo na področju preučevanja imunosupresivnih mehanizmov regulatornih T limfocitov, njihovega razmnoževanja in gojenja v *ex vivo* pogojih.

Research of the Initiation and Development of Cancer

within the framework of the ARIS 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. Our latest findings on the biology and treatment of glioblastoma (GBM) have been published in the scientific journal *Cancers* (https://www.mdpi.com/2072-6694/15/3/573), where we have shown that the biological target Vimentin is an important protein responsible for glioblastoma stem cell invasion. With the inhibition of the vimentin (VIM) protein by binding a specific nanobody, we successfully demonstrated an inhibition of glioblastoma cell invasion *in vitro* as well as in *in vivo* on a zebrafish model. We successfully continued our work on the HEU CutCancer project, where we presented our scientific work on understanding the whole tumour microenvironment of glioblastoma using novel spatial-resolution methodologies as an invited lecture at the Karolinska Institute in Sweden and at the VU Medical Centre in Amsterdam, the Netherlands.

Immunology and Cellular Immunotherapy

In the framework of ongoing projects, we presented our research achievements as invited lectures and short written contributions at several conferences (Allergosection Spring Meeting, 8th Symposium of the Immunology Society of Slovenia with international attendance, 11th Likar Symposium, Novartis BioCamp 2023 and 4th Doctoral Day of Bi(o)sciences). We presented work related to genome editing and genetic platforms to upgrade primary T cells, as well as work on immunosuppressive mechanisms of regulatory T cells, their proliferation and cultivation in *ex vivo* conditions.

Spektralni pretočni citometer. Pretočni citometer je v raziskavah na področju imunologije nepogrešljivi del opreme. S pretočno citometrijo lahko natančno določimo identiteto imunskih celic in kaj se z njimi v trenutku analize dogaja. Spektralna tehnologija omogoča spremljanje velikega števila proteinov oz. označevalcev v eni sami celici in hkrati na vseh celicah v vzorcu.
Foto: K. Skrbinšek

Spectral flow cytometer. The flow cytometer is an indispensable piece of equipment in immunology research. Flow cytometry can be used to precisely determine the identity of immune cells and obtain information about what is happening to them at the time of analysis. Spectral technology allows the monitoring of large numbers of proteins or markers in a single cell and simultaneously on all cells in a sample.
Photo: K. Skrbinšek

Nove alternative za poskuse na živalih

V okviru HEU CutCancer, kjer razvijamo nove alternativne *in vitro* sisteme, ki bi v prihodnosti lahko nadomestili ali zmanjšali število poskusov na laboratorijskih živalih, smo uspešno razvili in vpeljali tridimenzionalni *in vitro* celični sistem na jetrnih celicah in ALI (air-liquid interface) sistem na pljučnih celicah. 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, kar izvajamo v sklopu ARIS programa P1-0245 in HEU projekta PARC.

New Alternatives for Animal Testing

Within the framework of HEU CutCancer, where we are developing novel alternative *in vitro* systems that could replace or reduce the number of lab animal experiments in the future, we successfully developed and introduced a three-dimensional *in vitro* cell system on liver cells and ALI (air-liquid interface) system on lung cells. We are also developing new *in vitro* 3D cell models from zebrafish (*Danio rerio*) liver (ZFL) cells and are studying the adverse effects of bisphenol A and its numerous analogues in zebrafish embryos; this is implemented in the context of the ARIS programme P1-0245 and the HEU project PARC.

Predstavitev novega sistema za gojenje tropskih rib cebric – *Danio rerio.*
Foto: M. Štampar

Presentation of a new system for zebrafish breeding – *Danio rerio.*
Photo: M. Štampar

GLAVNI PROJEKTI V LETU 2023

V ARIS projektu (J2-4428) »Zelene rešitve za trajnostno večnamensko upravljanje voda« smo z znanstvenimi podatki, analizami in razvojem novih molekularnih orodij prispevali k izboljšanju upravljanja voda v smeri večje odpornosti jezer in zadrževalnikov. Sinergistično multidisciplinarno sodelovanje partnerjev zmanjšuje vrzel med akademskimi krogi, podjetji in vladnimi organi ter izboljšuje usklajenost med teoretičnim znanjem o delovanju evtrofnih ekosistemov in zagotavljanjem konkretnih smernic za njihovo ohranjanje ter upravljanje.

MAIN PROJECTS IN 2023

In the ARIS project "Green solutions for sustainable multi-purpose water management" (J2-4428), we contributed to improving water management towards more resilient lakes and reservoirs with scientific data, analysis and the development of new molecular tools. Synergistic multidisciplinary collaboration between partners reduces the gap between academia, business and government bodies, and improves the co-ordination between theoretical knowledge on the functioning of eutrophic ecosystems and the provision of specific guidance for their conservation and management.

ARIS projekt (J1-4395) »Razvoj novih večfunkcionalnih nanocimov na osnovi kovinskih oksidov in njihova toksikološka karakterizacija (NaNoZymSafe)« se osredotoča na proučevanje varnosti nanodelcev z encimskimi lastnostmi, ki se lahko uporabljajo v biomedicini, okoljskih tehnologijah, prehrambni industriji itd. Raziskujemo 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.

Nadaljujemo z raziskavami ARIS aplikativnega projekta (L3-3177), kjer proučujemo varnost kanabinoidov in pomen leteh za javno zdravje in vedenje potrošnikov.

Poleg naštetih ARIS projektov, kjer delujemo v vlogi vodje, smo v letu 2023 sodelovali še v številnih projektih kot partnerji, in sicer v velikem ARIS projektu (J7-4635) »MitoCan – Predklinični razvoj novih zaviralcev mitohondrijskih ionskih kanalov za zdravljenje raka«, kjer je vodilni partner Fakulteta za farmacijo, UL, v ARIS projektu (J1-4402) »Dinamični model molekulskega stroja DNA topoizomeraze tipa II in razvoj katalitičnih inhibitorjev« ter v ARIS projektu (J1-3019) »Računalniško in eksperimentalno proučevanje modulacije senescentnih celic kot novo orodje za boj proti s starostjo povezanim boleznim«, pri katerih je vodilni partner Kemijski inštitut. Kot partnerji smo v letu 2023 pridobili dva projekta, in sicer ARIS projekt J2-50047 z naslovom »Plazemska razgradnja genotoksičnih kontaminantov v odpadnih vodah«, kjer sodelujemo z IJS, ter ARIS projekt J4-50147 (»Raziskave teranostičnega potenciala egerolizinskih proteinov v boju proti raku sečnega mehurja«), kjer sodelujemo z Biotehniško fakulteto UL.

V letu 2023 smo nadaljevali z ARIS projektom (J3-4504) »Z vizualizacijo mikrookolja glioblastoma do boljše terapije«, z glavnim namenom razumeti izredno heterogeno in imuno sovražno mikrookolje glioblastoma ter njegove podporne vloge tumorju. Poleg tega smo v letu 2023 nadaljevali ARIS CEA projekt (NC-0023) »Inovativne sonde in inhibicija metaloproteaz za ciljanje glioblastomskih matičnih celic v tumorskem mikrookolju«. Projekt omogoča preučevanje vloge

The ARIS project "Development of novel multifunctional metal-oxide-based nanozymes and their toxicological characterisation (NaNoZymSafe)" (J1-4395) focuses on the assessment of the safety of nanoparticles with enzymatic properties, which can be used in biomedicine, environmental technologies, the food industry, etc. We 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 (co-ordinator), Italy and Argentina.

We are continuing our research on an ARIS applied project L3-3177, which studies the safety of cannabinoids and their relevance to public health and consumer behaviour.

In addition to the above ARIS projects where we act as the lead partner, we participated as partners in numerous other projects in 2023, namely the large ARIS project "MitoCan – Preclinical development of new mitochondrial ion channel inhibitors for cancer treatment" (J7-4635), where the Faculty of Pharmacy, UL, is the lead partner, the ARIS project "Dynamic model of a type II DNA topoisomerase biological nanomachine and design of catalytic inhibitors" (J1-4402), and the ARIS project "Computer and experimental investigation of senescent cell modulation as a new tool to combat age-related diseases" (J3-4516), in which the lead partner is the National Institute of Chemistry. We acquired two projects as partners in 2023, namely the ARIS project "Plasma-assisted removal of emerging genotoxic contaminants in wastewater"(J2-50047), where we work together with IJS, and the ARIS project J4-50147 (" Exploring the theranostic potential of aegerolysin-based protein complexes in combating bladder cancer"), where we work together with the Biotechnical Faculty of UL.

In 2023, we continued the ARIS project "Uncovering the glioblastoma microenvironment to enhance the therapy" (J3-4504) with the main aim to understand the highly heterogeneous and immune-hostile glioblastoma microenvironment and its supportive role for the tumour. In 2023, we also continued the ARIS CEA project "Innovative probes and inhibition of metalloproteases for targeting glioblastoma stem

različnih proteaz pri invaziji možganskega tumorja glioblastoma, kjer bi učinkovito ciljali invazivne in na terapijo odporne rakave matične celice.

V letu 2023 smo nadaljevali z delom na ARIS 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 ARIS 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

cells in the tumour microenvironment" (NC-0023). 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 2023, we continued our work on the ARIS 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 faster development of new testing methods for the safety of chemicals to ensure a safer environment.

As part of the ARIS project J3-2526, we have been studying glioblastoma stem cell niches as potential targets for the treatment of glioblastoma. Further research on the

Mikroskopiranje na novem konfokalnem mikroskopu Leica Stellaris 8.
Foto: DE RAK

Microscopy on the new Leica Stellaris 8 confocal microscope.
Photo: DE RAK

mikrookolju, smo dopolnili v okviru ARIS 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.

V letu 2023 smo nadaljevali z ARIS 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. Nadaljevali smo s preučevanjem in načrtovanjem testiranja imunomodulatorne sposobnosti neoantigenov, ki izvirajo iz pacientov z nedrobnoceličnim pljučnim rakom. Neoantigeni namreč predstavljajo obetavne tarče za zdravljenje raka (J3-4516). Poleg tega smo pridobili projekt, ki je posvečen študiju redke, a pomembne populacije T limfocitov – gama delta celic T (ARIS projekt J3-50109). Pridobili smo tudi tri projekte, ki nam pomagajo pri preučevanju imunosupresivnih lastnosti podskupine limfocitov T, znanih kot regulatorne celice T (Treg), ki so ključne za vzdrževanje imunske homeostaze in zanimive za razvoj terapij za zdravljenje avtoimunskih bolezni. V okviru natečaja 10X Grant Challenge (Labena, d. o. o.) in sredstev razvojnega stebra stabilnega financiranja NIB (InTREGing) smo preučevali transkriptom celic Treg na nivoju posameznih celic z metodo 10x Genomics RNA sekvenciranja. Projekt, financiran iz Načrta za odpornost in okrevanje (TREXCell, MN-0013-105), pa nam omogoča raziskovanje pristopov za nadgradnjo celic Treg.

Poleg nacionalnih projektov smo v letu 2023 nadaljevali z raziskavami na treh evropskih projektih 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 (https://doi.org/10.3389/ftox.2023.1220998). V okviru HEU projekta »Evidence driven indoor air quality improvement (EDIAQI; 101057497)«, kjer sodeluje 17 partnerjev, raziskujemo nove grožnje onesnaženosti zraka v zaprtih prostorih.

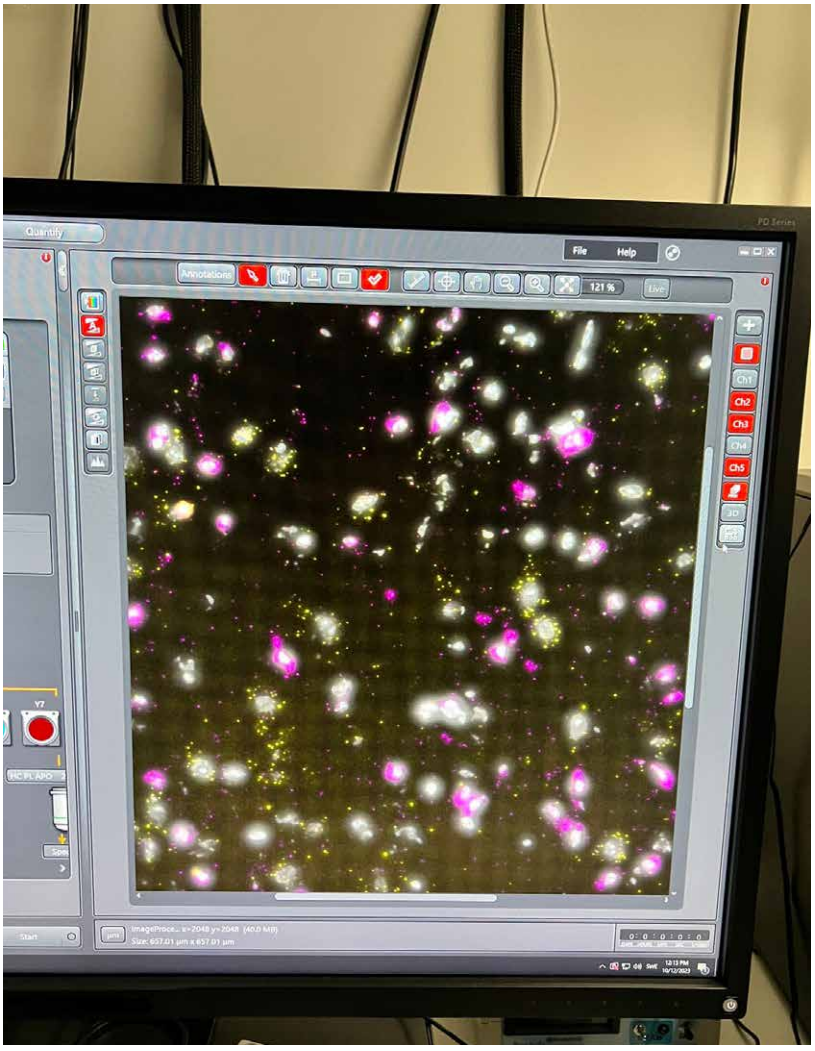
protease inhibitor cystatin F, which reduces the cytotoxicity of effector cells such as NK cells and cytotoxic T lymphocytes in the tumour microenvironment, was completed in the context of the ARIS project J3-2516. We have continued our research in the applied project L3-3176, where we are studying the possibility of using mesenchymal stem cells to treat COVID-19 disease.

In 2023, we continued the ARIS 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. We continued to study and plan the testing of the immunostimulatory capacity of neoantigens derived from non-small-cell lung cancer patients. Neoantigens are promising targets for cancer treatment (J3-4516). Furthermore, we have acquired a project dedicated to the study of a rare but important population of T lymphocytes – gamma delta T cells (J3-50109). We have also acquired three projects that help us study the immunosuppressive properties of a subset of T lymphocytes known as regulatory T cells (Treg), which are crucial for maintaining immune homeostasis and are of interest for developing therapies to treat autoimmune diseases. In the framework of the 10X Grant Challenge (Labena, d.o.o.) and funding from the NIB Stable Funding Development Pillar (InTREGing), we have been studying the Treg cell transcriptome at the single-cell level using the 10X Genomics RNA sequencing approach. A project funded by the Recovery and Resilience Plan (TREXCell, MN-0013-105) allows us to explore approaches to upgrade Treg cells.

In addition to national projects, we continued the research within three European projects under the Horizon Europe scheme in 2023. 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 activity of mycotoxins produced by *Alternaria* fungi. In addition, we are developing new approaches to identify non-genotoxic carcinogens (https://doi.org/10.3389/ftox.2023.1220998). In the framework of the HEU project "Evidence-driven indoor air quality improvement (EDIAQI; 101057497)", involving 17 partners, we are researching new indoor air pollution threats.

Kot koordinatorji projekta Horizon-Widera Twinning »Twinning for excellence to strategically advance research in carcinogenesis and cancer (CutCancer; 101079113)« želimo 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 Stockholm na Švedskem in VU Medical Centrom 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 co-ordinators of the project Horizon-Widera Twinning "Twinning for excellence to strategically advance research in carcinogenesis and cancer (CutCancer; 101079113)" we aim to strengthen and increase the research and innovation capacity and excellence of the NIB through targeted twinning activities with three internationally recognised institutions – Swansea University in the United Kingdom, Stockholm University in Sweden and the VU Medical Centre Amsterdam in the Netherlands. The CutCancer project allows advanced research on carcinogenesis and cancer therapeutic resistance using in vitro 3D cell models, high-throughput approaches for genomic instability evaluation, spatial analysis and single-cell analysis of tumour microenvironment.



Transkriptomika s prostorsko ločljivostjo na rezinah tumorja glioblastoma.
Foto: DE RAK

Spatial-resolution transcriptomics on glioblastoma tumour slices.
Photo: DE RAK

Upravljanje sistema akvarijev ribjih zarodkov.
Foto: M. Kambič

Management of fish embryo aquarium system.
Photo: M. Kambič

Metafer.
Foto: M. Kambič

Metafer.
Photo: M. Kambič

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13 Izvirni znanstveni članek (1.01)

1 Pregledni znanstveni članek (1.02)

1 Drugi znanstveni prispevek (1.03)

3 Strokovni članek (1.04)

5 Poljudni članek (1.05)

2 Objavljeni znanstveni prispevek na konferenci (vabljeno predavanje) (1.06)

2 Objavljeni znanstveni prispevek na konferenci (1.08)

5 Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje)(1.10)

31 Objavljeni povzetek znanstvenega prispevka na konferenci (1.12)

3 Samostojni znanstveni sestavek ali poglavje v monografski publikaciji (1.16)

1 Intervju (1.22)

1 Končno poročilo o rezultatih raziskav (2.12)

7 Radijska ali televizijska oddaja (2.19)

1 Radijski ali TV dogodek (3.11)

6 Prispevek na konferenci brez natisa (3.15)

5 Vabljeno predavanje na konferenci brez natisa (3.16)

5 Uredništvo

BIBLIOGRAPHY

13 original scientific articles (1.01)

1 scientific review article (1.02)

1 other scientific contribution (1.03)

3 expert articles (1.04)

5 popular articles (1.05)

2 published scientific papers at a conference (lecture by invitation) (1.06)

2 published scientific papers at a conference (1.08)

5 published summaries of a scientific paper at a conference (lecture by invitation) (1.10)

31 published summaries of a scientific paper at a conference (1.12)

3 stand-alone expert papers or chapters in a monographic publication (1.16)

1 interview (1.22)

1 final report on research results (2.12)

7 radio or TV broadcasts (2.19)

1 radio or TV event (3.11)

6 papers at a conference without printing (3.15)

5 lectures at a conference upon invitation without printing (3.16)

5 editorial boards

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Photo: GEN archive

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Oddelek za raziskave organizmov in ekosistemov
Department of Organisms and Ecosystems Research

VODJA DO OKTOBRA 2023:
IZR. PROF. DR. **META VIRANT-DOBERLET**

HEAD UNTIL OCTOBER 2023:
ASSOC. PROF. DR **META VIRANT-DOBERLET**

Izr. prof. dr. Meta Virant-Doberlet, znanstvena svetnica, je bila vodja Oddelka za raziskave organizmov in ekosistemov od leta 2016 do vključno oktobra 2023. 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, was the Head of the Department of Organisms and Ecosystems Research from 2016 until the end of October 2023. She is a leading authority on arthropod vibrational communication. Her research is focused on processes which not only shape the evolution of vibrational communication, but are also central to understanding 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 groundbreaking studies, she has been awarded the international Insect Drummer Lifetime Achievement Award and the Miroslav Zei Award for Exceptional Scientific Achievements within the fields of Research at the NIB.

VODJA OD NOVEMBRA 2023: DR. **NATAŠA MORI**
HEAD SINCE NOVEMBER 2023: DR **NATAŠA MORI**

Dr. Nataša Mori je znanstvena svetnica od leta 2022 in vodja Oddelka za raziskave organizmov in ekosistemov od novembra 2023. Njeno področje dela so raziskave ekosistemov celinskih voda, kjer se posveča aktualnim vprašanjem o vplivu antropogenih pritiskov na vzorce razširjenosti biodiverzitete in odzive ekosistemskih procesov v površinskih in podzemnih vodah. Njene raziskave se osredotočajo na probleme onesnaženja z mikroplastiko, vpliv rabe prostora in podnebnih sprememb na vodne ekosisteme ter tudi na ekološko dinamiko in pomen prehodnih območij med površinskimi in podzemnimi ekosistemi, kot so prodišča, poplavne ravnice in izviri.

Dr Nataša Mori has been a scientific councillor since 2022 and Head of the Department for Organisms and Ecosystems Research since November 2023. Her field of work is research into inland water ecosystems, where she addresses current research questions about the impact of anthropogenic pressures on the distribution patterns of biodiversity and the responses of ecosystem processes in surface and ground waters. Her research focuses on the problems of microplastic pollution and the impact of land use and climate change on aquatic ecosystems, as well as on the ecological dynamics and importance of transition zones between surface and underground ecosystems, such as gravel bars, floodplains and springs.

STRATEGIJA EU ZA BIOTSKO RAZNOVRSTNOST DO LETA 2030

»Vrnimo naravo v naša življenja.«

EU 2030 BIODIVERSITY STRATEGY

"Bringing nature back into our lives."

Laboratoriji Oddelka za raziskave organizmov in ekosistemov. Foto: M. Kambič.

Department for Organisms and Ecosystems research. Photo: M. Kambič.

KLJUČNE DEJAVNOSTI ODDELKA

Na Oddelku za raziskave organizmov in ekosistemov 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. Svoje interdisciplinarno znanje in izkušnje, pridobljene v temeljnih raziskavah, uporabljamo za predloge učinkovitejših in bolj trajnostnih posegov v naravo in okolje.

KEY ACTIVITIES OF THE DEPARTMENT

Through basic and applied research, the Department of Organisms and Ecosystems Research creates top-level knowledge necessary for the 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.

Škrlatni kukuj (*Cucujus cinnaberinus)* je vrsta evropskega varstvenega pomena, ki jo je iz Slovenije kot prvi opisal Joannes A. Scopoli (1723–1788), čigar 300. obletnico rojstva smo slavili v letu 2023. V mednarodnem konzorciju smo v letu 2023 v reviji *Journal of Biogeography* objavili filogeografijo vrste, ki je pokazala več filogenetskih linij v Evropi, nekatere morda celo kot nove kriptične vrste, pri čemer se pri nas pojavljata t. i. balkanska in panonska linija. Foto: A. Vrezec

The scarlet beetle (*Cucujus cinnaberinus*) is a species of European conservation importance, first described from Slovenia by Joannes A. Scopoli (1723-1788), whose 300th birthday we celebrated in 2023. In an international consortium, we published the phylogeography of the species in 2023 in the *Journal of Biogeography*, which revealed multiple phylogenetic lineages in Europe, some possibly even new cryptic species, with the Balkan and Pannonian lineages present in Slovenia. Photo: A. Vrezec

Specifična področja raziskav so naslednja:

- filogenija, taksonomija in biogeografija izbranih skupin pajkov, rakov in vretenčarjev;
- evolucija ekstremnih fenotipov;
- primerjalna genomika in izražanje genov funkcionalnih lastnosti pri modelnih vrstah;
- 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;

Our specific areas of research include:

- phylogeny, taxonomy and biogeography of selected groups of spiders, crustaceans and vertebrates
- evolution of extreme phenotypes
- comparative genomics and gene expression of functional traits in different model species
- 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

Postavitev novih gnezdilnic za kozačo (*Strix uralensis*) na Jelovici v projektu JeloviZA, kar bo razširilo integrirani monitoring vrste v Sloveniji, ki ga koordinira NIB že več kot 20 let.
Foto: A. Mulej

Installation of new nesting boxes for the Ural owl (*Strix uralensis*) in Jelovica under the JeloviZA project, expanding the integrated monitoring of this species in Slovenia, co-ordinated by the NIB for over 20 years.
Photo: A. Mulej

- kemična ekologija;
- biodiverziteta kopenskih in ekosistemov celinskih voda, vključno s podzemnimi ekosistemi;
- vpliv podnebnih sprememb na biodiverziteto in ekosistemske funkcije;
- prilagojenost izbranih vrst na spremembe dejavnikov v okolju pod vplivom človeka 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;
- 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 in bioakustiko;
- varstvena genomika dvoživk, plazilcev in rib;
- podpora ohranjanju 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.

GLAVNI DOSEŽKI V LETU 2023

Znanstvena odličnost

Za zaščito opraševalcev je ključno razumeti, kaj povzroča spremembe v njihovih združbah na različnih geografskih območjih. Sodelovali smo v raziskavi, v kateri smo preučili

- chemical ecology
- biodiversity of terrestrial and freshwater ecosystems, including underground ecosystems
- impacts of climate change on biodiversity and ecosystem functions
- 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
- 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 and bioacoustics
- conservation genomics of amphibians, reptiles and fish
- protection of endangered species and their habitats (nationally and globally) and assessment of their conservation status, and proposals of the status improvement, as well as education about the importance of biodiversity

MAIN ACHIEVEMENTS IN 2023

Scientific excellence

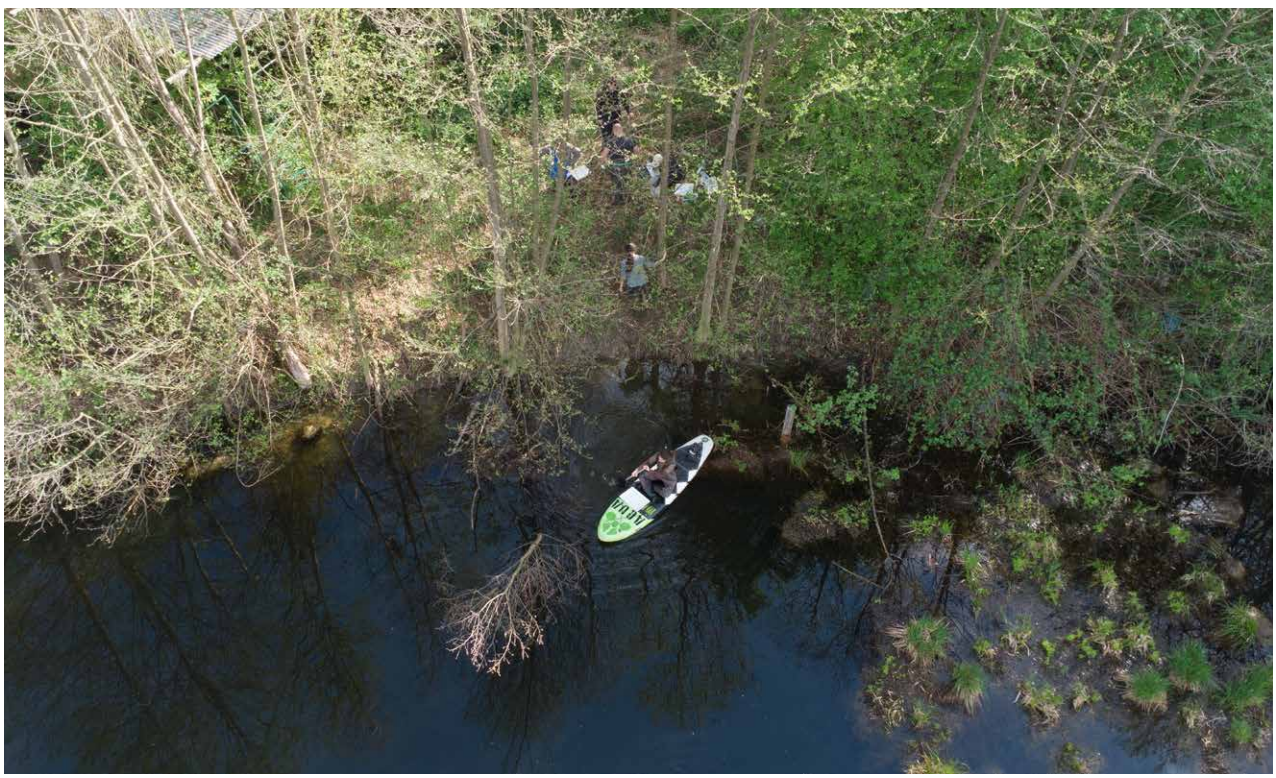
To protect pollinator species, it is crucial to understand what drives changes in their communities across different regions. We participated in a study in which we examined

dejavnike, ki vplivajo na raznolikost 644 čebeljih vrst v 177 komercialnih sadovnjakih jabolk v 33 državah in štirih globalnih biomih. Ugotovitve so pokazale, da so neobdelana območja in ekološko kmetovanje povezani z večjo raznolikostjo divjih čebel. Raziskava poudarja pomen velikih analiz pri razumevanju funkcionalne in filogenetske raznolikosti, kar je bistveno za spodbujanje biotske raznovrstnosti v agroekosistemih v času globalnih sprememb. Objavljena je bila v reviji *Science of the Total Environment*. DOI: 10.1016/j.scitotenv.2023.165933

Sodelovali smo v raziskavi, v kateri smo ocenili vpliv rabe zemljišč na številčnost opraševalcev. Čeprav divji opraševalci igrajo ključno vlogo pri pridelavi hrane, njihova ocena trenutno manjka v najpogosteje uporabljani metodi za oceno okoljskih vplivov, oceni življenjskega cikla (LCA),

the factors influencing the diversity of 644 bee species in 177 commercial apple orchards across 33 countries and four global biomes. The findings showed that herbaceous, uncultivated areas and organic farming were linked to higher wild bee diversity. The study highlights the value of large-scale analyses in understanding functional and phylogenetic diversity, which is vital for promoting biodiversity in agroecosystems amidst global change. The study was published in *Science of The Total Environment*. DOI: 10.1016/j.scitotenv.2023.165933

We participated in a study in which we assessed the impact of land use on pollinator abundance. While wild pollinators play a key role in food production, their assessment is currently missing from the most used environmental impact assessment method, Life Cycle Assessment (LCA). This is



Interdisciplinarne raziskave biodiverzitete vodnih habitatov z naprednimi metodami, okoljsko DNA in bioakustiko včasih zahtevajo nekaj improvizacije.
Foto: J. Polajnar

Interdisciplinary biodiversity research of aquatic habitats with advanced methods, environmental DNA, and bioacoustics, sometimes requires a bit of improvisation.
Photo: J. Polajnar

predvsem zaradi omejitev pri dostopnosti podatkov in združljivosti z inventarji LCA. Da bi zapolnili to vrzel, smo s pomočjo Delphi ocenjevanja pridobili oceno o relativni številčnosti. V raziskavi je sodelovalo 25 strokovnjakov, ki so podali ocene številčnosti za 24 kategorij rabe zemljišč. Objavljena je bila v *Environmental Science & Technology.* DOI: 10.1021/acs.est.2c05311

V reviji *Annual Reviews of Entomology* smo objavili pregledni članek, ki prvič po skoraj dveh desetletjih sistematično obravnava prisotnost in vlogo vibracijskih signalov pri žuželkah. Članek je bil kot najboljša objava na

mainly due to constraints in data availability and compatibility with LCA inventories. To target this gap, relative pollinator abundance estimates were obtained with the use of a Delphi assessment, during which 25 experts provided scores abundance associated with 24 land use categories. The study was published in *Environmental Science & Technology.* DOI: 10.1021/acs.est.2c05311

In the journal *Annual Review of Entomology,* we published a review article that systematically addresses the presence and role of vibrational signals in insects for the first time in almost two decades. As the best publication in the field of

Terenske meritve kuščaric (*Gallotia galloti*) na Tenerifih. Foto: M. Krofel

Field measurements of the lizard species *Gallotia galloti* in Tenerife. Photo: M. Krofel

področju biologije izbran tudi za javno predstavitev na dogodku ARIS »Odlični v znanosti« novembra 2023. Izjemnost dosežka je, da poglobljeno razumevanje tematike podaja v obliki jedrnate sinteze, ki obravnava tako taksonomsko razširjenost kot mehanizme takega načina sporazumevanja med žuželkami, predstavlja njegove temeljne značilnosti in specifike, povzema glavne ugotovitve, ideje in koncepte kot tudi nove smeri raziskav in njihovega pomena ter izpostavlja tekoče raziskovalne izzive na področju biotremologije žuželk. DOI: 10.1146/annurev-ento-120220-095459

V reviji *Systematic Biology* smo objavili pomemben članek na tematiko biološke klasifikacije organizmov. Mnenja znanstvenikov so pri definicijah taksonomskih rangov, višjih od vrste, lahko zelo različna. V prispevku smo se osredotočili na

biology, the article was also selected for a public presentation at the ARIS event 'Excellent in Science' in November 2023. The review provides an in-depth understanding of the topic in the form of a concise synthesis, which deals with both the taxonomic distribution and the mechanisms of this type of communication among insects, presents its fundamental characteristics and specifics, summarises the main findings, ideas and concepts as well as new research directions and their importance, and highlights ongoing research challenges in the field of insect biotremology. DOI: 10.1146/annurev-ento-120220-095459

We published an important paper on the biological classification of organisms in *Systematic Biology.* Scientists' opinions can differ widely on the definition of higher taxonomic

Uporaba prenosnega laserskega vibrometra VibroGo pri terenskem snemanju vibracijske krajine na mokrišču na Blokah.
Foto: R. Šturm

Field recording of vibroscape on Bloke using portable laser vibrometer VibroGo.
Photo: R. Šturm

sistematski problem pajkov iz nerangiranega klada Orbipurae. Argumentirali smo, zakaj je shema, kjer omenjeni klad razdelimo na več družin, ki izboljšajo diagnostično zanesljivost, zvišajo informacijsko vrednost, so uporabnejše za namene varovanja narave in bolj praktične za taksonomske primerjave, boljša od nedavno predlagane alternative, ki združuje te družine v Araneidae sensu lato. V članku smo predlagali redefinicijo Araneidae in priznanje monogenerične družine pajkov Paraplectanoididae fam. nov. Z vključitvijo novih subgenomskih podatkov smo prispevali k poznavanju sorodstvenih odnosov znotraj Orbipurae, s teoretično argumentacijo predlagane klasifikacije pa smo pomembno prispevali tudi v širše področje sistematske in evolucijske biologije. DOI: 10.1093/sysbio/syad021

ranks. In this paper, we focus on the systematic problem of spiders from the unranked clade Orbipurae. We argue why a scheme where the clade is divided into several families that improve diagnostic reliability and increase information content and are more useful for conservation purposes and more practical for taxonomic comparisons is preferable to the recently proposed alternative that groups these families into Araneidae sensu lato. In this paper we therefore propose a redefinition of Araneidae and the recognition of the monogeneric spider family Paraplectanoididae fam. nov. By incorporating new sub-genomic data, we have contributed to the knowledge of the phylogenetic relationships within the Orbipurae, and made an important contribution to the broader field of systematics and evolutionary biology through the theoretical argumentation of the proposed classification. DOI: 10.1093/sysbio/syad021

Sledenje pepelastega lunja s pomočjo oddajnika v okviru projekta LIFE IP Natura.si.
Foto: M. Bedjanič

Tracking of the hen harrier using a transmitter as part of the LIFE IP Natura.si project.
Photo: M. Bedjanič

Celostno preučevanje funkcionalnih lastnosti organizmov zahteva dolgotrajno in kompleksno raziskovanje. Začne se z dobro zasnovano raziskavo in vključuje več ravni raziskovanja – od molekularne genetike, morfologije in fiziologije do ekologije in vedenja. Takšne kompleksne raziskave nam lahko pomagajo pridobiti nova spoznanja o prilagajanju vrst na razmere v okolju. Pri vrsti kuščarja *Gallotia galloti*, ki živi na nadmorski višini 3700 metrov, smo preučevali fiziologijo in vedenje ter tako pridobili in združili podatke o njihovi starostni strukturi, termo- in hidroregulacijskem vedenju ter štirih presnovnih in s stresom povezanih biomarkerjih, da bi razumeli, kako na funkcionalne lastnosti teh organizmov vplivajo ekstremne razmere v okolju. Uspelo nam je pokazati, da je prilagoditev na zelo različne okoljske razmere pri tej kuščarici posledica medsebojnega vpliva dveh proce-

The integrative study of multiple functional traits is a complex research effort that requires a well-conceived study design and multiple levels of investigation—from molecular genetics, morphology and physiology to ecology and behaviour. Such complex studies can help us to gain new insights into adaptation. We studied the physiological and metabolic performance of a model species of the lizard *Gallotia galloti* living at an altitude range of 3,700 metres. We integrated data on age structure, thermal and hydric regulatory behaviour, and four metabolic and stress-related biomarkers to understand how the functional properties of an ectotherm may be affected by extreme conditions ectotherms can be influenced by extreme environmental changes. We were able to show that adaptation to very different environmental conditions in this lizard may be related to an interplay between

Ob selitvi v BTS-NIB novembra 2023
smo vzpostavili nov laboratorij za okoljsko DNA.
Foto: D. Tome

Upon moving to BTS-NIB in November 2023,
we established a new environmental DNA laboratory.
Photo: D. Tome

sov: plastičnost in lokalno prilagajanje. Nove ugotovitve so bile objavljene v reviji *Journal of Biogeography*. DOI: 10.1111/jbi.14711

V Evropskem konceptu *One Health* smo v okviru mednarodnega konzorcija v okviru COST *ERBFacility* z vodilnimi slovenskimi avtorji pripravili analizo in koncept evropskega biomonitoringa okoljskih onesnažil z uporabo končnih plenilcev kot indikatorskih vrst, pri čemer gre za doslej najobširnejšo sintezo obstoječih podatkov. Objavljena je bila v reviji *Science of the Total Environment*. Končni plenilci so pogoste indikatorske vrste za monitoring okoljskih onesnažil zaradi njihove izpostavljenosti bioakumulativnim in biomagnifikacijskim kemikalijam, zato so dobra ocena za vrednotenje izpostavljenosti ljudi okoljskim onesnažilom. Izjemnost dela je, da uvaja nov pristop vrednotenja okoljskih vplivov, ki se regionalno spreminjajo glede na ekološke značilnosti tarčnih vrst. Delo uvaja pojem kontekstualnih populacijskih podatkov, ki so ključni za pravilno interpretacijo širokoprostorskih vzorcev onesnaženosti. Ekološke lastnosti lahko pojasnijo prostorsko-časovne variacije v izpostavljenosti in vplivu onesnažil. V delu smo analizirali prostorsko variabilnost izbranih kontekstualnih parametrov pri lesni sovi, plenilski vrsti, ki jo je akcija COST *European Raptor Biomonitoring Facility* opredelila kot eno najprimernejših vrst za vseevropski biomonitoring. Na podlagi naših ugotovitev smo predlagali minimalno priporočeno shemo za monitoring populacijskih kontekstualnih podatkov kot prvi korak k vseevropski shemi biomonitoringa okoljskih onesnažil s plenilci kot indikatorskimi vrstami. DOI: 10.1016/j.scitotenv.2022.160530

Celinske vode so globalno onesnažene z mikroplastiko (delci < 5 mm). Razumevanje vzorcev onesnaženja z mikroplastiko v različnih porečjih je ključno za izboljšanje upravljanja voda. V reviji *Science of the Total Environment* smo objavili eno prvih raziskav, ki preučuje koncentracije mikroplastike v manjših rekah, vključno z vrsto polimera, obliko, velikostjo in barvo delcev v vodi in sedimentih. Cilj raziskave je bil razumeti, kako iztoki čistilnih naprav in urbanizacija, skupaj s hidrogeomorfološkimi lastnostmi raziskovanih rek, vplivajo na onesnaženje z mikroplastiko. V obeh raziskovanih porečjih je bil opažen gradient naraščajoče koncentracije delcev v vzorcih vode in sedimentov po toku navzdol. Delci polietilena (PE) in polipropilena (PP) so bili najpogostejši. Vlakna so prevladovala v vzorcih vode, medtem ko so bili

plasticity and local adaptation. The new findings were published in the *Journal of Biogeography*. DOI: 10.1111/jbi.14711

In the European concept of *One Health*, within the framework of the international consortium of the COST *ERBFacility,* together with leading Slovenian authors, we have prepared an analysis and concept of European biomonitoring of environmental pollutants using apex predators as indicator species with the most comprehensive synthesis of existing data so far. The study was published in *Science of The Total Environment.* Apex predators are often used as sentinel species in contaminant monitoring due to their exposure and vulnerability to persistent, bioaccumulative and biomagnificable contaminants. Therefore, they are good assessment tool for evaluating exposure of human population to environmental contaminants. The work is exceptional since it introduces novel approach for the assessment of environmental impacts, which can vary in space and time according to ecological traits of target species. The work introduces the novel term of population contextual data, which are crucial for correct interpretation of large-scale contaminant spatial patterns. These traits can explain spatiotemporal variation in contaminant exposure and contaminant impacts. We reviewed the spatial variation in selected contextual parameters in the tawny owl, a species identified by the *COST Action European Raptor Biomonitoring Facility* as one of the most suitable candidates for pan-European biomonitoring. Based on our findings, we proposed a minimal recommended scheme for monitoring of population contextual data as one of the first steps towards a pan-European environmental pollutant monitoring scheme using predators as indicator species. DOI: 10.1016/j.scitotenv.2022.160530

Aquatic ecosystems globally are heavily impacted by microplastics (MPs; particles <5 mm). Understanding MP pollution patterns across various river catchments is crucial for improved water management. This study, published in *Science of the Total Environment,* is one of the first to examine MP concentrations in smaller rivers, including polymer type, shape, size, and colour, in water and sediments. The aim of the research was to understand how wastewater treatment plant effluents and urbanisation, along with natural hydrogeomorphology, influence MP pollution in smaller river catchments. A gradient of increasing particle concentration was noted in both water and sediment samples and in both catchments. Polyethylene (PE) and polypropylene (PP) particles were most common. Fibres were

fragmenti pogostejši v sedimentih. Ugotovili smo, da so ključni dejavniki, ki vplivajo na koncentracije mikroplastike, značilnosti porečja, hidrogeomorfološke značilnosti reke, lokacija in metoda vzorčenja ter hidrometeorološke razmere med vzorčenjem. DOI: 10.1016/j.scitotenv.2022.160043

Projekti v letu 2023 in organizacija dogodkov

Pridobili smo dva Interreg projekta, ki se ukvarjata s problematiko opraševalcev, in sicer Interreg Alpine Space **FRACTAL: Fostering gReen infrAstruCture in the Alps** (2023–2024) in Interreg **BEE2GETHER: Strengthening the cross-border innovative system for improving biodiversity through monitoring bees** (2023–2025).

Postali smo partnerji v evropskem **Biodiversa+ projektu DarCo** s področja raziskav podzemne biodiverzitete. Konzorcij projekta, ki ga sestavlja 13 partnerjev, vodi italijanski CNDR-IRSA. Projekt naslavlja vertikalno razsežnost ohranjanja biodiverzitete in bo razvil stroškovno učinkovit načrt za vključitev podzemnih ekosistemov v načrte za ohranjanje biodiverzitete in blaženja učinkov podnebnih sprememb po letu 2020.

Pridobili smo raziskovalni projekt **»ECTO-HIGH-EXPAND - Ectotherm adaptation in metabolism to high altitude«**, prijavljen na tretji razpis eLTER PLUS za Transnational Access (TA). Projekt zajema enotedensko terensko ekspedicijo v švicarske Alpe za vzorčenje ekofizioloških vzorcev različnih vrst ektotermnih organizmov.

Vključeni smo bili v raziskovalni projekt AGROLIZARDS+, financiran s strani Portugalske raziskovalne agencije (FCT). Projekt vodi Miguel A. Carretero z inštituta CIBIO/InBIO Univerze v Portu (Portugalska), vključuje pa mednarodno ekipo raziskovalcev iz petih držav (Portugalska, Grčija, Španija, Slovenija in Italija) ter traja tri leta (januar 2023 – december 2025). Naslov projekta je **»AGROLIZARDS+ Role of lizards in agroenvironments: from trophic networks to ecosystem services«**. V projektu bomo raziskovali, kakšna je ekosistemska vloga kuščarjev v kmetijski krajini in kako vpliva na njihovo vlogo različna raba pesticidov.

Uspešni smo bili tudi pri pridobivanju tržnih projektov. Pridobili smo projekt **»Vzpostavitev monitoringa divjih čebel v Sloveniji (čmrljev in čebel samotark) po skupni**

predominant in water samples, while fragments were more frequent in sediments. We found that key factors influencing MP concentrations include catchment characteristics, river hydrogeomorphology, sampling location and method, and hydrometeorological conditions during sampling. DOI: 10.1016/j.scitotenv.2022.160043

Projects and Events in 2023

We obtained two Interreg projects addressing pollinator issues: Interreg Alpine Space **FRACTAL: Fostering gReen infrAstruCture in The Alps** (2023–2024) and Interreg **BEE-2GETHER: Strengthening the cross-border innovative system for improving biodiversity through monitoring bees** (2023–2025).

We became partners in the European **Biodiversa+ project DarCo**, focused on research into subterranean biodiversity. The project consortium, comprising 13 partners, is led by the Italian CNDR-IRSA. The project addresses the vertical dimension of biodiversity conservation and will develop a cost-effective plan to integrate subterranean ecosystems into post-2020 biodiversity conservation and climate change mitigation plans.

We also obtained the research project **"ECTO-HIGH-EXPAND – Ectotherm adaptation in metabolism to high altitude"**, submitted under the third eLTER PLUS call for Trans-national Access (TA). The project includes a one-week field expedition in the Swiss Alps to sample ecophysiological specimens from various ectothermic organisms.

We were involved in the AGROLIZARDS+ research project, funded by the Portuguese Research Agency (FCT). The project is led by Miguel A. Carretero from the CIBIO/InBIO Institute of the University of Porto (Portugal) and includes an international team of researchers from five countries (Portugal, Greece, Spain, Slovenia and Italy). The project runs for three years (January 2023 – December 2025). The project's title is **"AGROLIZARDS+: The Role of Lizards in Agro-environments: from Trophic Networks to Ecosystem Services"**. In this project, we will investigate the ecosystem role of lizards in agricultural landscapes and how different pesticide uses affect their role.

We were also successful in acquiring applied projects. We were granted approval for the project **"Establishment of**

metodologiji EU v letu 2023«. Projekt se financira v okviru Sklada za podnebne spremembe. Odobrena sta bila tudi dva projekta, ki jih financira Triglavski narodni park (TNP). En projekt se ukvarja z **monitoringom ekološkega stanja Triglavskih jezer**, drugi pa vzpostavlja **monitoring invazivnih vrst školjk v TNP**. V letu 2023 smo po naročilu Zavoda RS za varstvo narave izvedli postavitev novih gnezdilnic za kozačo (*Strix uralensis*) na Jelovici v projektu **JeloviZA**, kar bo razširilo integrirani monitoring vrste v Sloveniji, ki ga koordinira NIB že več kot 20 let. V okviru projekta smo izvedli tudi uspešno izobraževalno delavnico za gozdarje in lastnike gozdov.

Ob svetovnem dnevu čebel smo pripravili javno predstavitev rezultatov **pilotnega monitoringa divjih čebel v Sloveniji**. V triletni raziskavi smo našli 239 od 575 vrst divjih čebel (čmrljev in čebel samotark), ki so bile kadarkoli najdene v Sloveniji. Predstavitve sta se udeležila tudi ministrica za kmetijstvo, gozdarstvo in prehrano ter vodja Sektorja za biotsko raznovrstnost Ministrstva za naravne vire in prostor.

monitoring of wild bees in Slovenia (bumblebees and solitary bees) according to the EU common methodology in 2023." The project is financed under the Climate Change Fund. We also received approval for two projects funded by Triglav National Park (TNP). One project addresses the **monitoring of the ecological status of Triglav Lakes**, while the other establishes **monitoring of invasive mussel species in TNP.** In 2023, we set up new nesting boxes for the Ural owl (*Strix uralensis*) in Jelovica under the JeloviZA project, expanding the integrated monitoring of this species in Slovenia, which has been co-ordinated by the National Institute of Biology (NIB) for over 20 years. We also conducted a successful educational workshop for foresters and forest owners as part of the project.

On World Bee Day, we held a public presentation of the results from the **pilot monitoring of wild bees in Slovenia**. In our three-year study, we identified 239 out of 575 wild bee species (bumblebees and solitary bees) that have ever been found in Slovenia. The presentation was also attended by the Minister of Agriculture, Forestry, and Food, and the Head of the Biodiversity Sector at the Ministry of Natural Resources and Spatial Planning.

Postavitev talnih gnezdilnic v okviru projekta EIP POMOP.
Foto: D. Bevk

Installation of ground nesting boxes as part of the EIP POMOP project.
Photo: D. Bevk

Sotočje treh rek, Kamniške Bistrice, Save in Ljubljanice. Delci mikroplastike so bili najdeni tudi v zgornjem toku Kamniške Bistrice.
Foto: D. Tome

Confluence of three rivers, the Kamniška Bistrica, Sava, and Ljubljanica. Microplastic particles were also found in the upper course of the Kamniška Bistrica.
Photo: D. Tome

Laboratorij za raziskave vodnih biofilmov.
Foto: M. Kambič

Laboratory for the aquatic biofilms research.
Photo: M. Kambič

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2 published summaries of a scientific paper at a conference (lecture by invitation) (1.10)
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1 expert monograph (2.02)
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Skupinska fotografija oddelka EKOS
po selitvi v BTS-NIB v novembru 2023.
Foto: D. Tome

Group photo of the EKOS department
after moving to BTS-NIB in November 2023.
Photo: D. Tome

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EXPERT AND TECHNICAL STAFF AND ADMINISTRATIVE SUPPORT

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Infrastrukturni center NIB
NIB Infrastructural Centre

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

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 MBS (IC MBS) as part of Marine Biology Station Piran (MBS).

Laboratorij za molekularno biologijo
Oddelka za biotehnologijo
in sistemsko biologijo NIB.
Foto: M. Pompe Novak

Molecular Biology Laboratory
of the Department of Biotechnology
and Systems Biology, NIB.
Photo: M. Pompe Novak

IC NIB je tudi v letu 2023 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 2023 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.

In 2023, the IC NIB continued to ensure co-operation 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 co-operation in European and other international projects in 2023. The IC NIB's modern and well-maintained (pursuant to ISO 17025) large infrastructural 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.

Laboratorij za molekularno biologijo
Oddelka za biotehnologijo
in sistemsko biologijo NIB.
Foto: M. Pompe Novak

Molecular Biology Laboratory
of the Department of Biotechnology
and Systems Biology, NIB.
Foto: M. Pompe Novak

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 izreden pomen vsebine IC NIB za slovenski prostor, in sicer na zelo raznolikih področjih raziskovalnega dela ter aplikacij pri delu tako za podjetja, državne in vladne organe ter resorje kot 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 IC MBP uvršča 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 ter 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.

IC NIB svojo veliko infrastrukturno opremo redno dopolnjuje in posodablja.

Veliko infrastrukturno opremo IC MBP so v letu 2023 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,
- aparatura za pomnoževanje DNA v realnem času (Thermo Fisher QuantiStudio 3),

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 MBS supports research and applied activities for ministries and other state bodies as well as educational activities carried out at the MBS. The technologically advanced equipment enables state-of-the-art research at sea and places IC MBS among the leading centres in the Mediterranean. The MBS serves as the National Oceanographic Data Centre (NODC). The IC MBS'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 of 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.

The IC NIB regularly supplements and updates its large infrastructural equipment.

In 2023, the large infrastructural equipment of the IC MBS 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

- večmodularni čitalec mikrotitrskih plošč SPARK (Tecan),
- visokozmogljivi visokotlačni tekočinski kromatograf (Agilent Technologies 1260 Infinity),
- analizator za segmentno-pretočno analizo (SFA) vzorcev morske vode (Seal Analytical QuAAtro 39),
- FTIR mikroskop (PerkinElmer Spotlight 200i).

Veliko infrastrukturno opremo IC Planta so v letu 2023 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, in Fluidigm BioMark HD),
- robot za pipetiranje (Hamilton Microlab STARlet),
- aparatura za izolacijo nukleinskih kislin (KingFisher Apex),
- sistem za hitro pripravo in koncentriranje bioloških vzorcev z možnostjo bioloških analiz na gojiščih ter
- komore za ločeno gojenje rastlin (Kambič).

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

Aparatura za kapljični digitalni PCR (Biorad QX100) se je v letu 2023 trajno okvarila in bila odpisana.

- Real-time PCR instrument (Thermo Fisher QuantStudio3);
- Multimode microplate reader (Spark, Tecan)
- High-performance high-pressure liquid chromatograph (Agilent Technologies 1260 Infinity)
- Segment-flow analyser (SFA) for seawater samples (Seal Analytical QuAAtro 39);
- FTIR microscope (PerkinElmer Spotlight 200i)

In 2023, 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)
- Newton 7.0 BIO whole plant imaging system (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, and Fluidigm BioMark HD)
- Robot for pipetting (Hamilton Microlab STARlet)
- Instrument for the isolation of nucleic acids (KingFisher Apex)
- System for rapid preparation and concentration of biological samples with the possibility of biological analysis on the media
- Plant growth chambers for separate breeding (Kambič)

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).

The droplet digital PCR instrument (Biorad QX100) was permanently damaged and written off in 2023.

Konec leta 2022 je bila zaključena 1. faza gradnje novega objekta Biotehnološkega stičišča Nacionalnega inštituta za biologijo (BTS-NIB) ter s tem omogočena selitev Oddelka za biotehnologijo in sistemsko biologijo NIB in z njim IC Planta v novo stavbo. V letu 2023 je tako IC Planta deloval v novem objektu BTS-NIB. Skupaj s staro stavbo NIB so bili konec leta 2022 porušeni in odpisani:

- komore za gojenje rastlin in tkivnih kultur (Kambič),
- karantenski rastlinjak in
- karantenski rastlinjak s podtlakom,

zato v letu 2023 niso bili več del velike infrastrukturne opreme IC Planta.

At the end of 2022, phase 1 of the construction of the new Biotechnology Hub of the National Institute of Biology (BTS-NIB) was completed, allowing the relocation of the NIB's Department of Biotechnology and Systems Biology together with IC Planta to the new building. In 2023, IC Planta thus operated in the new Biotechnology Hub of the National Institute of Biology (BTS-NIB). Together with the old NIB building, they were demolished and written off at the end of 2022:

- Growth chambers for plant and tissue culture breeding (Kambič)
- Quarantine greenhouse
- Quarantine greenhouse with negative pressure.

Therefore, they were no longer part of the large infrastructure equipment of the IC Plant in 2023.

Laboratorij za transformacije
Oddelka za biotehnologijo
in sistemsko biologijo NIB.
Foto: M. Pompe Novak

Plant Transformation Laboratory
of the Department of Biotechnology
and Systems Biology, NIB.
Photo: M. Pompe Novak

V letu 2023 je Oddelek za biotehnologijo in sistemsko biologijo NIB v novi stavbi pridobil nove:

- komore za gojenje rastlin in tkivnih kultur (PSI),
- komore za ločeno gojenje rastlin (PSI) in
- karantenski rastlinjak (Rastlinjaki Gajšek in CMF),

ki so bili nabavljeni iz kohezijskih sredstev v okviru gradnje novega objekta BTS-NIB. Za vzdrževanje te velike infrastrukturne opreme je NIB za leto 2023 pridobil ločena sredstva od Ministrstva za visoko šolstvo, znanost in inovacije, zato ta velika infrastrukturna oprema v letu 2023 ni bila vključena v IC Planta.

In 2023, the Department of Biotechnology and Systems Biology of the NIB acquired in the new building new:

- Growth chambers for plant and tissue culture breeding (PSI)
- Plant growth chambers for separate breeding (PSI)
- Quarantine greenhouse (Rastlinjaki Gajšek in CMF)

which were purchased with cohesion funding as part of the construction of the new Biotechnology Hub of the National Institute of Biology (BTS-NIB). The NIB has obtained separate funding from the Ministry of Higher Education, Science and Innovation for the maintenance of this large infrastructure equipment for 2023, therefore this large infrastructure equipment was not included in IC Planta in 2023.

Laboratorij za virologijo Oddelka za biotehnologijo in sistemsko biologijo NIB.
Foto: M. Pompe Novak

Virology Laboratory of the Department of Biotechnology and Systems Biology, NIB.
Photo: M. Pompe Novak

Prav tako v letu 2023 ni bila vključena v IC NIB velika infrastrukturna oprema, ki je bila v letih 2022 in 2023 nabavljena iz dodatnih sredstev za investicijsko operacijo »Nakup raziskovalne opreme« od Ministrstva za visoko šolstvo, znanost in inovacije v okviru gradnje novega objekta BTS-NIB:

- namizni masni spektrometer za avtomatsko identifikacijo mikroorganizmov (Bruker MALTI TOF Biotyper),
- ultracentrifuga (Beckman Coulter Optima XPN-90),
- sistem za pripravo vzorcev za presevno elektronsko mikroskopijo,
- aparatura za digitalno PCR (Stilla naica),
- aparatura za PCR v realnem času (QuantStudio7 Pro),
- mikro-analitska in analitska tehtnica za tehtanje in sistemom za preverjanje pipet,
- sistem za fenotipizacijo rastlin (PSI),
- motoriziran pokončni epifluorescentni mikroskop (Zeiss) ter
- avtomatiziran stereomikroskop z digitalno kamero in nastavkom za fluorescenco (Leica),

saj je tudi za vzdrževanje te velike infrastrukturne opreme za leto 2023 NIB pridobil ločena sredstva od Ministrstva za visoko šolstvo, znanost in inovacije.

Izgradnja novega objekta BTS-NIB je omogočila, da se je velika raziskovalna infrastrukturna oprema IC Planta preselila v nove moderne laboratorije, kar je uporabnikom omogočilo še boljšo uporabniško izkušnjo.

Similarly, the large infrastructure equipment procured in 2022 and 2023 from the additional funds 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) was not included in the IC NIB in 2023:

- Benchtop mass spectrometer for the automated microbial identification system (Bruker MALTI TOF Biotyper)
- Ultracentrifuge (Beckman Coulter Optima XPN-90)
- Sample preparation system for transmission electron microscopy
- Digital PCR instrument (Stilla Technologies Naica)
- Real-time PCR instrument (ABI QuantStudio7 Pro)
- Micro-analytical and analytical weighing balance and pipette checking system
- Plant Phenotyping System (PSI)
- Motorised upright epifluorescence microscope (Zeiss)
- Automated stereomicroscope with digital camera and fluorescence adapter (Leica),

as the NIB has also obtained separate funding from the Ministry of Higher Education, Science and Innovation for the maintenance of this large infrastructure equipment for 2023.

The construction of the new Biotechnology Hub of the National Institute of Biology (BTS-NIB) has allowed IC Planta's large research infrastructure equipment to be relocated to new state-of-the-art laboratories, providing an even better user experience.

Karantenski rastlinjak.
Foto: M. Kambič

Quarantine greenhouse.
Photo: M. Kambič

Knjižnica NIB
The NIB Library

Vir: Primerjalne biološke študije pri izopodih : letno poročilo 1980 : T - 32. 1980. Ljubljana : University, Institute of Biology.

Source: Primerjalne biološke študije pri izopodih : letno poročilo 1980 : T - 32. 1980. Ljubljana : University, Institute of Biology.

VODJA HEAD

Barbara Černač (do 15. 2. 2023 until 15 February 2023)
Dr. Vesna Mia Ipavec

SODELAVKA STAFF

Lučka Glavač

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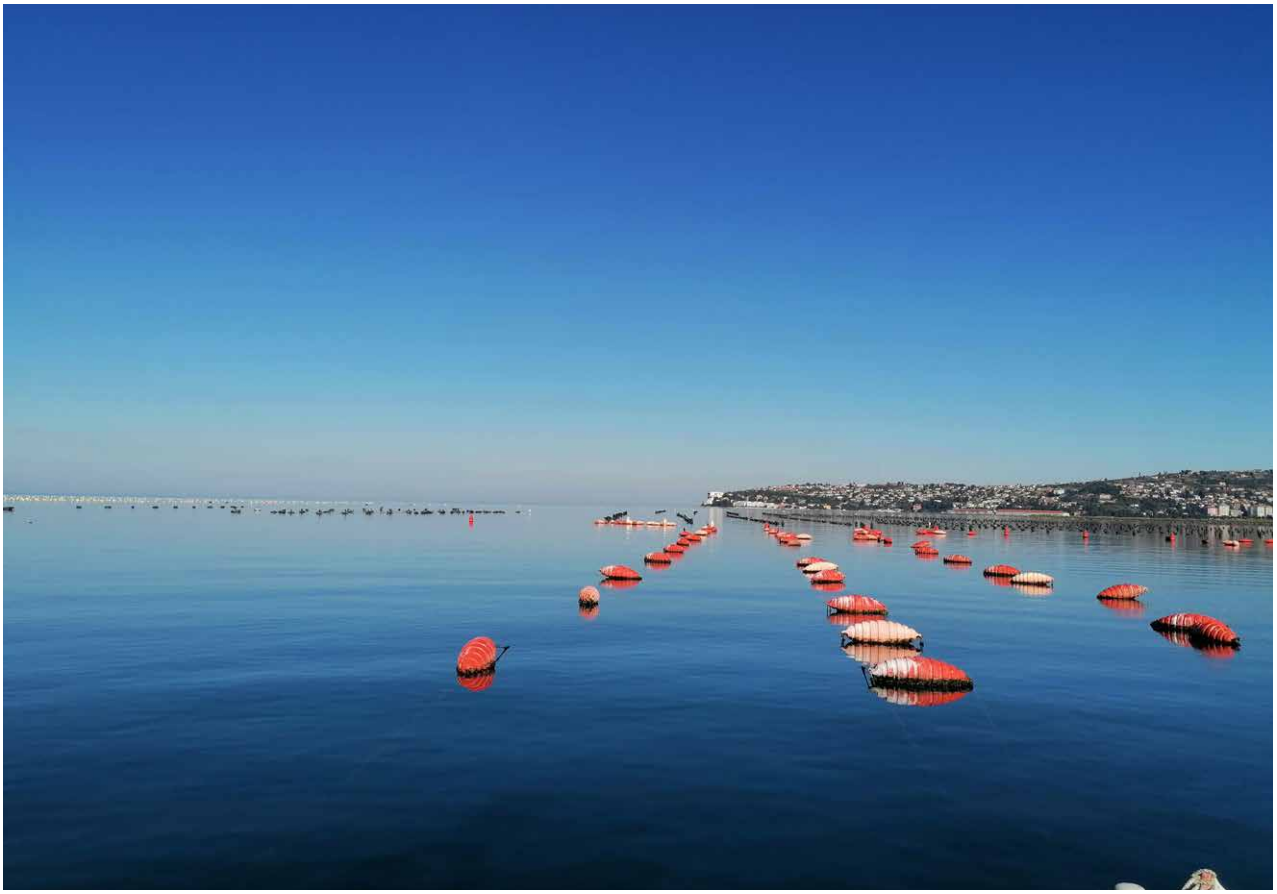

Morje je pomembno območje za izvajanje številnih človeških dejavnosti, med njimi je tudi marikultura, ki je pri nas osredotočena predvsem na gojenje dagenj.
Foto: B. Mavrič

The sea is an important area for the implementation of numerous human activities, including mariculture, which in Slovenia is focused primarily on the cultivation of mussels.
Photo: B. Mavrič

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

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Pri proučevanju odziva krompirja na napad mikroorganizmov ali na vremenske ekstreme, tkivne kulture krompirja predstavljajo eksperimentalni sistem, v katerem z vnosom genskih sprememb proučujemo vlogo posameznih molekul, ki pri tem odzivu sodelujejo.
Foto: M. Kambič

In studying the response of potatoes to microbial attacks or extreme weather conditions, potato tissue cultures serve as an experimental system in which, by introducing genetic modifications, we investigate the role of individual molecules involved in these responses.
Poto: M. Kambič

ODDELEK ZA GENETSKO TOKSIKOLOGIJO IN BIOLOGIJA RAKA

DEPARTMENT OF GENETIC TOXICOLOGY AND CANCER BIOLOGY

IZVIRNI ZNANSTVENI ČLANEK
ORIGINAL SCIENTIFIC ARTICLE

1. COLLINS, Andrew, MØLLER, Peter, GAJSKI, Goran, VODENKOVÁ, Soňa, ABDULWAHED, Abdulhadi, ANDERSON, Diana, BANKOGLU, Ezgi Eyluel, BONASSI, Stefano, BOUTET-ROBINET, Elisa, BRUNBORG, Gunnar, NOVAK, Matjaž, ŽEGURA, Bojana, et al. Measuring DNA modifications with the comet assay: a compendium of protocols. Nature protocols. [Online ed.]. 2023, vol. 18, str. 929-989, ilustr. ISSN 1750-2799. https://doi.org/10.1038/s41596-022-00754-y, DOI: 10.1038/s41596-022-00754-y. [COBISS.SI-ID 140001027]
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3. FILIPIĆ, Arijana, DOBNIK, David, GUTIÉRREZ-AGUIRRE, Ion, RAVNIKAR, Maja, KOŠIR, Tamara, BAEBLER, Špela, ŠTERN, Alja, ŽEGURA, Bojana, PETKOVŠEK, Martin, DULAR, Matevž, MOZETIČ, Miran, ZAPLOTNIK, Rok, PRIMC, Gregor. Cold plasma within a stable supercavitation bubble - a breakthrough technology for efficient inactivation of viruses in water. Environment international. [Print ed.]. 2023, vol. 182, str. 108285-1-108285-10. ISSN 0160-4120. DOI: 10.1016/j.envint.2023.108285. [COBISS.SI-ID 170521347]
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SAMOSTOJNI ZNANSTVENI SESTAVEK ALI POGLAVJE V MONOGRAFSKI PUBLIKACIJI
INDEPENDENT SCIENTIFIC COMPONENT PART OR A CHAPTER IN A MONOGRAPH

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ODDELEK ZA RAZISKAVE ORGANIZMOV IN EKOSISTEMOV

DEPARTMENT OF ORGANISMS AND ECOSYSTEMS RESEARCH

IZVIRNI ZNANSTVENI ČLANEK
ORIGINAL SCIENTIFIC ARTICLE

1. AGNARSSON, Ingi, STARRETT, James, BABBITZ, Zachary, BOND, Jason E., GREGORIČ, Matjaž, RABERAHONA, Onjaherizo Christian, WILLIAMS, Steven, KUNTNER, Matjaž. Discovery and genetic characterization of single cohort adult colonies with male aggregations, and preliminary evidence for lekking in a Malagasy kite spider (Isoxya, Gasteracanthinae). Insect systematics and diversity. Jan. 2023, vol. 7, iss. 1, str. 1-15, ilustr. ISSN 2399-3421. https://doi.org/10.1093/isd/ixac029, DOI: 10.1093/isd/ixac029. [COBISS.SI-ID 143761411]

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Offspring of the Ural owl.
Photo: J. Polajnar

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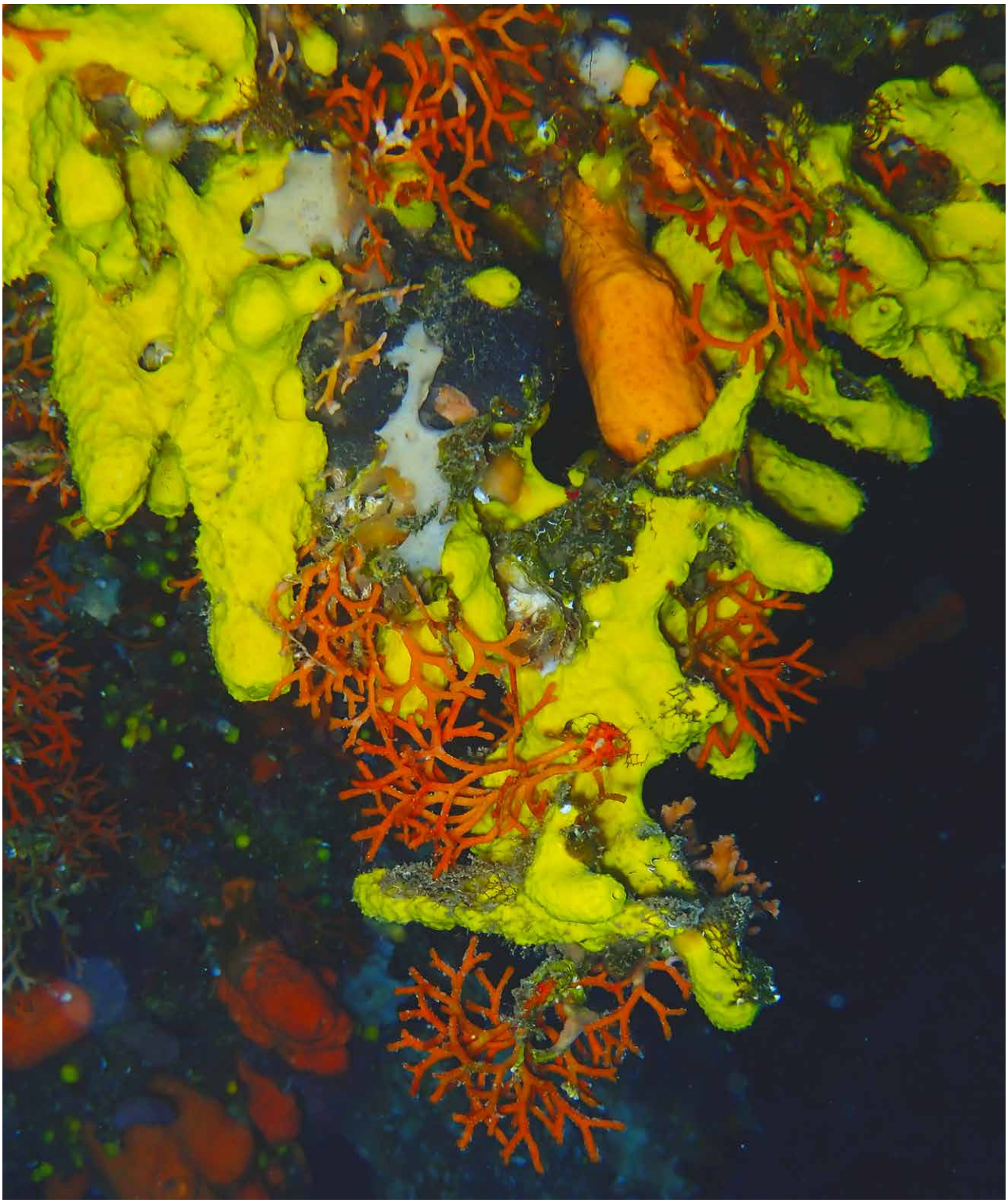

Morje ni samo veliko in modro,
je predvsem zelo barvito
in skriva številne mikrosvetove.
Foto: A. Fortič

The sea is not only big and blue,
it is also very colorful and hides
numerous microworlds.
Photo: A. Fortič.