2021

POROČILO O DELU
ANNUAL REPORT

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

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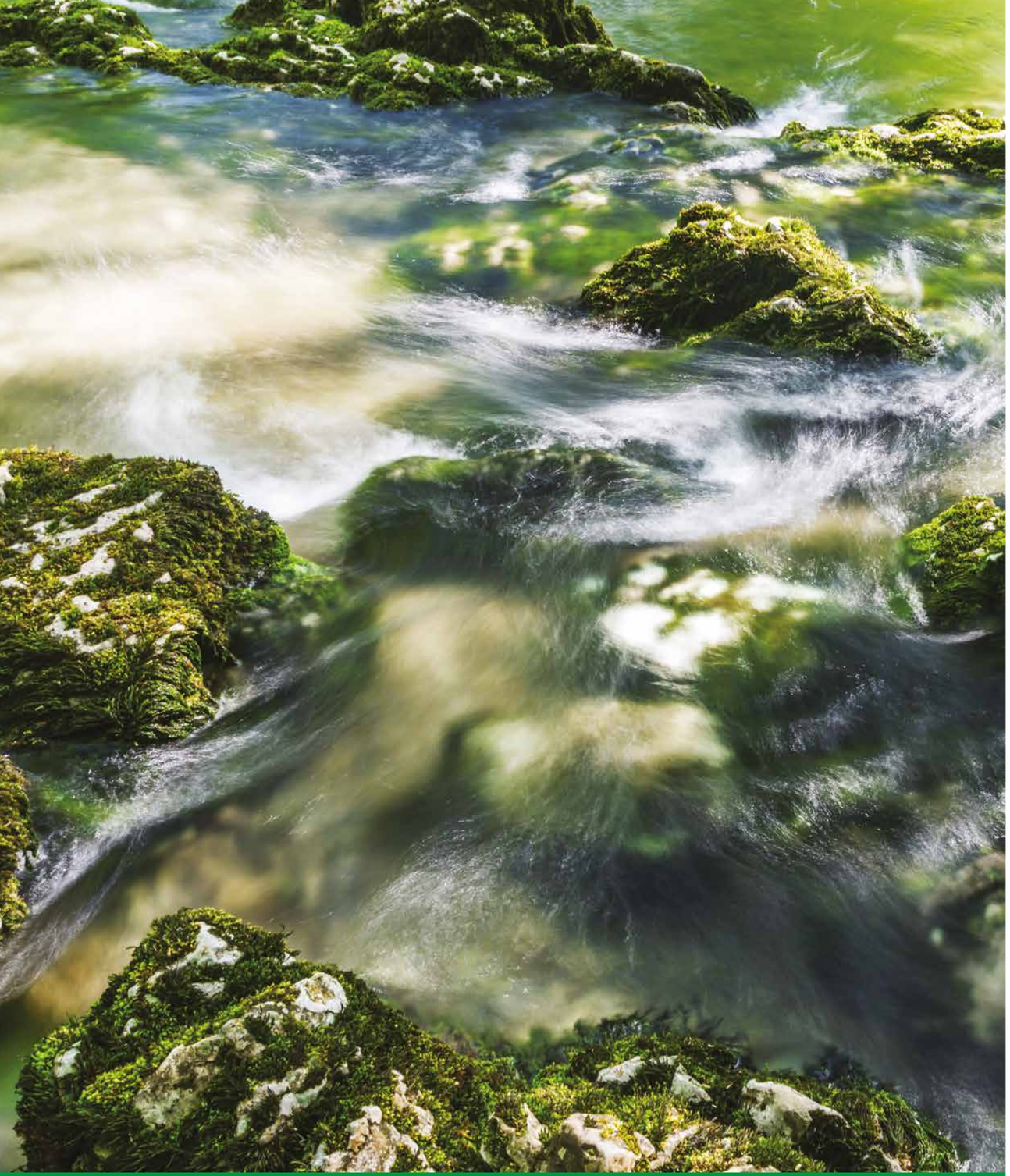
NATIONAL INSTITUTE OF **BIOLOGY**

Uredili: Barbara Černač, Katja Sinur
Ljubljana, 2022



Nekje na sredini Rakovega Škocjana (foto: David Dobnik).
Somewhere in the middle of Rakov Škocjan (Photo: David Dobnik).

POSLANSTVO

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

Poslanstvo izvršujemo:

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

VIZIJA

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

MISSION

NIB's mission is to create new knowledge in the field of biological sciences to understand life processes, preserve biodiversity and a healthy environment to achieve greater quality of life and support sustainable development. We interconnect interdisciplinary in the fields of nature and environmental protection, biotechnology, informatics, pharmacy and medicine, agriculture, forestry, fisheries and food, tourism and maritime transport, and spatial planning.

We carry out our mission

- By breakthrough core research in the field of biological and related natural sciences and publication of research results in scientific publications;
- By applied research and transfer of results into practice for international, European, national and local authorities and organisations as well as economic entities in order to improve the quality of life and ensure sustainable development of society;
- By participating in education at undergraduate, postgraduate and post doctoral level;
- By communication of science to various target groups and the public.

VISION

NIB as an internationally established independent scientific research and development institution strives to create top-level knowledge and develop technologies and products in the fields of biological and related natural sciences, to maintain the satisfaction and high motivation of its employees with good organisation and top-quality equipment, and to enable the development of top-quality human resources for high value-added jobs in the economy and public sector. We will provide our long-term development in close cooperation with the society and the business sector.

VSEBINA

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Krona valujočih tentaklov pahljačastega cevkarja *(Sabella spallanzani)* (foto: Tihomir Makovec).
A crown of billowing tentacles of the marine polychaete worms (*Sabella spallanzani*) (Photo: Tihomir Makovec).

DIREKTORICA: prof. dr. Maja Ravnikar
DIRECTOR: Prof. Dr. Maja Ravnikar

UVODNA BESEDA DIREKTORICE

V časih premika vrednot in družbene zavesti v individualizacijo smo se soočili z vse večjo medosebno odtujenostjo in odtujenostjo od narave, ki sta privedli do konflikta tistega, kar mora v svojem bistvu bivati v sožitju. Ta uničujoči konflikt je človeštvo prisilil v razmislek o prihodnosti obstoja, vse glasnejši so klici in prizadevanja za vzpostavitev tiste ključne »tajne vezi«, ki zagotavlja naše sobivanje. Vključujoče in pravično.

Temeljna naloga znanosti je ustvarjanje boljše prihodnosti. V zavedanju, da lahko boljšo prihodnost ustvarjamo le z neuničujočim napredkom, sem ponosna, da Nacionalni inštitut za biologijo vodimo v smeri sodelovanja, sodelovanja človeka z naravo, s sočlovekom, znanstvenika z znanstvenikom, sodelovanja ob prenašanju znanja ter z upoštevanjem vsega skupnega in različnega. Da težimo k doseganju ciljev, katerih skupna dodana vrednost je bistveno višja od vsote posamičnih.

DIRECTOR'S FOREWORD

In a time when values and social consciousness are shifting towards individualisation, we face increasing interpersonal alienation and alienation from nature, which have led to the conflict of what should essentially live in harmony. This destructive conflict has forced mankind to reflect on the future of existence, as stronger calls and efforts are made to establish the crucial "secret link" that ensures our coexistence. A coexistence that is inclusive and equitable.

The fundamental task of science is to create a better future. Being aware that a better future can only be created through non-destructive progress, I am proud that we are leading the National Institute of Biology towards collaboration – human collaboration with nature and with other people, scientist to scientist, collaboration with the transfer of knowledge and mindfulness of everything that is common or different. I am proud that we are striving to achieve goals with a total added value that is significantly higher than the sum of the individual goals.

S ciljem vključujočega napredka smo se v letu 2021 podali po poti, ki so jo zaznamovali mnogi pomembni začetki in premiki. Po poti, ki jo riše hitra rast Inštituta in njegove vloge v mednarodnem raziskovalnem prostoru.

Meseca julija smo začeli z gradnjo stavbe Biotehnološkega stičišča Nacionalnega inštituta za biologijo (BTS-NIB), ki predstavlja izjemno pomembno investicijo v znanstvenoraziskovalno infrastrukturo na področju biotehnologije in ved o življenju, ki bo omogočala nadaljnji preboj slovenskega znanja v temeljnih in uporabnih vidikih bioznanosti ter prenašanje znanja v industrijsko prakso. Zahteven in obsežen projekt je v višini 27,738 mio EUR financiran s strani evropskih kohezijskih sredstev (80 %) in slovenskega proračuna (20 %). Ob moderno zasnovani infrastrukturi Morske biološke postaje NIB z novim Biotehnološkim stičiščem, ki je primer visokotehnološke gradnje, upoštevajoč načela nizkoogljične, energetsko učinkovite, zelene in trajnostne gradnje, izboljšujemo infrastrukturno opremljenost raziskovalnega prostora v Sloveniji in onkraj njenih meja.

NIB je v letu 2021 uspel z umestitvijo nakupa novega električnega plovila za potrebe enote Morska biološka postaja (MBP) v Program porabe sredstev Sklada za podnebne spremembe v obdobju 2021–2023. Z zagotovitvijo sredstev v višini do 3.000.000 EUR za sofinanciranje električnega plovila bo omogočena nadomestitev sedanjega plovila SAGITA, ki je že precej dotrajano, hkrati pa narejen pomemben korak k zmanjšanju škodljivih emisij toplogrednih plinov.

Ob hitrem odzivu na aktualne razmere smo na Oddelku za biotehnologijo in sistemsko biologijo (FITO) začeli v letu 2021 izvajati državni monitoring SARS-CoV-2 v odpadni vodi. Rezultati monitoringa so vključeni v matematične modele napovedovanja poteka epidemije pri Sledilniku COVID-19, saj se s spremembo trenda okuženosti v odpadnih vodah pomembno dopolnjuje testiranje posameznikov in pridobi pregled nad prisotnostjo in dinamiko različic virusa. Aktivni smo v ožji skupini Evropske komisije v okviru pobude *EU4S Wastewater Sentinels* na področju monitoringa odpadne vode za sledenje epidemiji covida-19. V sodelovanju s Skupnim raziskovalnim

With the goal of inclusive progress, in 2021, we embarked on a path marked by many important beginnings and shifts. A path charted by the rapid growth of the Institute and its role in the international research sphere.

In July, we launched the construction of the Biotechnological Hub of the National Institute of Biology (BTH-NIB), which is an extremely important investment in research infrastructure in the fields of biotechnology and the life sciences. It will facilitate the continued breakthrough of Slovenian knowledge in basic and applied aspects of bioscience and the transfer of knowledge into industrial practice. This demanding and comprehensive project worth €27.738 million is financed by the EU Cohesion Fund (80%) and the Slovenian budget (20%). With the modern design of the NIB Marine Biology Station infrastructure and a new Biotechnology Hub, which is an example of high-technology construction incorporating the principles of a low-carbon, energy-efficient, green and sustainable building, we are improving the infrastructural equipment of the research sphere in Slovenia and beyond.

In 2021, the NIB managed to include the purchase of a new electric vessel for its Marine Biology Station (MBS) in the Climate Change Funding Programme for the 2021–2023 period. By ensuring funds of up to €3,000,000 for the co-financing of this vessel, we will be able to replace the current SAGITA vessel, which is fairly decrepit, while taking an important step towards reducing harmful greenhouse gas emissions.

In rapid response to the current situation, the Department of Biotechnology and Systems Biology (FITO) began to carry out the national monitoring of SARS-CoV-2 in wastewater in 2021. The monitoring results are included in the mathematical epidemic projection models of the COVID-19 Tracker project, given the fact that the detection of changes in wastewater contamination trends significantly complements the testing of individuals and provides an overview of the presence and dynamics of virus variants. We are active in the European Commission's core group of the EU4S *Wastewater Sentinel System*

središčem Evropske komisije (JRC, Ispra) je NIB sodeloval pri več študijah v povezavi s SARS-CoV-2, pogodbeno tudi pri določanju stabilnosti ugotavljanja SARS-CoV-2 v odpadni vodi.

NIB stalno sodeluje z gospodarstvom. V letu 2021 smo ustanovili podjetje Niba Labs ter z licenčno pogodbo prenesli znanje in tehnologije na področju analitskih postopkov v procesih proizvodnje in karakterizacije ter kvantifikacije virusov kot genskih vektorjev ali cepiv in nečistoč. NIB in Niba Labs načrtujeta sodelovanje pri nadaljnjem razvoju in trženju tehnologij na področju karakterizacije in kvantifikacije terapevtskih virusov, ki se uporabljajo za gensko zdravljenje.

Močno smo bili vpeti v različne dejavnosti, povezane s predsedovanjem Slovenije Svetu EU. Sodelavec Oddelka za raziskave organizmov in ekosistemov (EKOS) dr. Danilo Bevk je julija sodeloval na srečanju evropskih ministrov za okolje na Brdu pri Kranju, kjer je predstavil pomen in ogroženost opraševalcev ter pilotni monitoring čebel v Sloveniji. Novembra je na srečanju direktorjev direktoratov za naravo in biodiverziteto držav EU predstavil pestrost divjih čebel v Sloveniji ter dejavnosti NIB na področju opraševalcev. Oktobra smo na MBP gostili 35 znanstvenih atašejev in direktorjev direktoratov članic EU ter spremljevalno ekipo MIZŠ in jim predstavili znanstvenoraziskovalno delo Inštituta.

Kljub zaostrenim epidemiološkim razmeram smo organizirali vrsto odmevnih mednarodnih predavanj, srečanj, simpozijev in razstav, promocij strokovnih monografij ter rezultatov projektov, s katerimi NIB promovira svoje dosežke in popularizira znanost.

for the monitoring of wastewater to track the COVID-19 epidemic. In cooperation with the European Commission's Joint Research Centre (JRC, Ispra), the NIB took part in several studies related to SARS-CoV-2. Under contract, the NIB collaborated on determining the stability of SARS-CoV-2 detection in wastewater.

The NIB enjoys an ongoing collaboration with industry. In 2021, we founded Niba Labs and signed a license agreement to transfer our knowledge and technologies in the field of analytical procedures in the processes of the production, characterisation and quantification of viruses as genetic vectors or vaccines and impurities. The NIB and Niba Labs are planning to work together on the further development and marketing of technologies in the field of the characterisation and quantification of therapeutic viruses used in gene therapy.

We strongly engaged in various activities connected to the Slovenian Presidency of the EU Council. In July, Dr Danilo Bevk of the Department of Organisms and Ecosystems Research (EKOS) took part in a meeting of the European ministers of the environment at Brdo pri Kranju, where he talked about the importance and endangerment of pollinators and the pilot monitoring of bees in Slovenia. At the November meeting of the heads of directorates for nature and biodiversity in EU countries, he presented the diversity of wild bees in Slovenia and the NIB's pollinator-related activities. In October, the MBS hosted 35 scientific attachés and heads of EU-member directorates, as well as the accompanying team of the Ministry of Education, Science and Sport, and introduced them to the research work of the Institute.

Despite the harsh epidemiological circumstances, we held a series of high-profile international lectures, meetings, symposia and exhibitions, promotions of scientific monographs and project results through which the NIB promotes its achievements and popularises science.

22. maja, ob mednarodnem dnevu biotske raznovrstnosti, smo se kot prva slovenska institucija pridružili globalni zavezi *Združeni za biodiverziteto*, ki jo je leta 2020 ustanovila EU za ozaveščanje potrebe po zaščiti vseh oblik življenja. V počastitev mednarodnega dneva biotske raznovrstnosti smo v okviru projekta *LIFE Naturaviva* pripravili veliko zunanjo fotografsko razstavo z naslovom *Biodiverziteta Slovenije*. Dogodek je z nagovorom počastil podžupan mestne občine Ljubljana prof. dr. Janez Koželj. Na 80 panojih Jakopičevega sprehajališča v Tivoliju je bil predstavljen delček naše čudovite narave.

Na Oddelku za genetsko toksikologijo in biologijo raka (GEN) smo se dejavno vključevali v razširjanje rezultatov evropskega projekta *Eco-AlpsWater* med splošno javnost in deležnike, ki so kakor koli povezani z uporabo ali upravljanjem slovenskih voda.

Na MBP smo v sodelovanju z Institutom »Jožef Stefan« in Biotehniško fakulteto Univerze v Ljubljani pridobili nov raziskovalni program ARRS *Morska in mikrobna biotehnologija* (vodja Ana Rotter). Morska biotehnologija je prioritetno področje v vseh novejših evropskih pobudah (npr. *Strategija o bioekonomiji, Strategija o modri ekonomiji, Strategija za modro rast)*. Nov program bo omogočil razvoj tega pomembnega raziskovalnega področja, ki ima na MBP zametke že v kar nekaj projektih (H2020: *GoJelly*; Interreg Med: *B-Blue*; COST: *Ocean4Biotech*).

Izmed številnih projektov, ki smo jih v letu 2021 izvajali na MBP, velja omeniti trilateralni projekt s posebej velikim družbenim pomenom *Pirati plastike – dajmo, Evropa!*, ki je bil s strani Slovenije podprt kot projekt CRP (vodja Mateja Grego) in preučuje onesnaženost slovenskih rek s plastiko po principu ljubiteljske znanosti (sodelovanje več kot 100 osnovnih in srednjih šol). Projekt je bil večkrat predstavljen na različnih domačih in evropskih dogodkih, zlasti v času predsedovanja Slovenije Svetu EU (npr. konferenca *All-Atlantic 2021*, konferenca Predsedstva *Novi evropski raziskovalni prostor* v okviru *Meseca znanosti 2021)*.

On 22 May, on the occasion of the International Day for Biodiversity, we became the first Slovenian institution to join the global coalition *United for Biodiversity*, which was established in 2020 by the EU to raise awareness of the need to protect all forms of life. We celebrated the International Day for Biodiversity by preparing a large outdoor photographic exhibition entitled *Biodiversity of Slovenia* within the framework of *LIFE Naturaviva*. The event was addressed by the Vice Mayor of the City of Ljubljana Prof. Janez Koželj. The 80 exhibition panels on the Jakopič Promenade in Tivoli showcased various aspects of our beautiful nature.

Our Department of Genetic Toxicology and Cancer Biology (GEN) actively participated in the dissemination of the results of the European *Eco-AlpsWater* project to the general public and all stakeholders with an interest in the use or management of Slovenian water bodies.

In partnership with the Jožef Stefan Institute and the Biotechnical Faculty of the University of Ljubljana, our MBS acquired a new Slovenian Research Agency research programme for *Marine and microbial biotechnology* (led by Ana Rotter). Marine biotechnology is a priority area in all recent EU initiatives (e.g. the *Bioeconomy Strategy, Blue Economy Strategy and Blue Growth Strategy*). The new programme will help develop this important research area, which has budded at the MBS into quite a few projects (H2020: *GoJelly;* Interreg Med: *B-Blue;* COST: *Ocean4Biotech*).

One of the most noteworthy projects implemented at the MBS in 2021 was *Pirates of Plastics - Go Europe!*, a trilateral project of particularly great social significance supported by Slovenia as a CRP project (targeted research project), led by Mateja Grego, which examines the pollution of Slovenian rivers with plastic on the basis of amateur science (involving more than 100 primary and secondary schools). This project has been presented many times at various national and EU events, especially during the Slovenian Presidency of the EU Council (such as *All-Atlantic 2021* and the Presidency conference *New European Research Area* in the context of *Science* Month 2021).

Na mednarodnem simpoziju *V vrtincu sprememb* smo oktobra gostili kar 44 razpravljavk in razpravljavcev ter preko različnih omrežij dosegli več kot 20.000 ljudi. NIB je pripravil tudi *Okoljski manifest*, v katerem so organizatorji posveta strnili ključne predloge in rešitve, predstavljene v treh tematskih diskusijah simpozija: o biodiverziteti, o vodi in o energetskem prehodu. NIB s trajnostno naravnanim delovanjem podpira varovanje okolja in smernice zelene družbe, zato smo pripravili tudi priporočila o trajnostni organiziranosti dogodkov.

V novo sprejeti *Strategiji NIB* smo natančno opredelili usmeritve in prednostne naloge za izvajanje svojega poslanstva in doseganje ciljev ob upoštevanju globalnih trendov in družbenih izzivov ter posodobili vizijo in poslanstvo. Komisijo za etiko smo preimenovali v Komisijo za etiko in enake možnosti, ki je poleg reševanja etičnih vprašanj zadolžena za koordinacijo izvedbe in spremljanje *Načrta za enakost spolov NIB* ter za podajanje predlogov in priporočil vodstvu NIB in zaposlenim na področju enakosti spolov.

S ponosom lahko povem, da smo v letu 2021 na NIB okrepili stare ter postavili nekatere nove temelje, ki tlakujejo pot vrhunski, odprti in dostopni znanosti, napredku za boljši jutri. Z vključujočimi pristopi želimo znanosti povrniti zasluženo zaupanje. To moramo storiti, da bi lahko zaživeli v okolju zdravja, blaginje in varnosti, v katerem se v polni meri uresničujejo potenciali vsakega posameznika. To moramo storiti kot družba in posamezniki. Ustvariti moramo kolektivno zavest, da so spremembe na bolje mogoče. Da smo lahko raziskovalci ustvarjalci, glasniki in nosilci teh sprememb. Zase, za nas in za bodoče generacije.

Prof. dr. Maja Ravnikar
direktorica NIB

In October, at the international symposium *In the Swirl of Change*, we hosted 44 speakers and reached more than 20,000 people through various media. The NIB also drew up an *Environmental Manifesto* in which the debate organisers summed up the key proposals and solutions presented in three thematic discussions of the symposium: biodiversity, water and energy transition. The NIB's sustainably-oriented operation supports environmental protection and green society guidelines, which is why we have also prepared recommendations on sustainable event organisation.

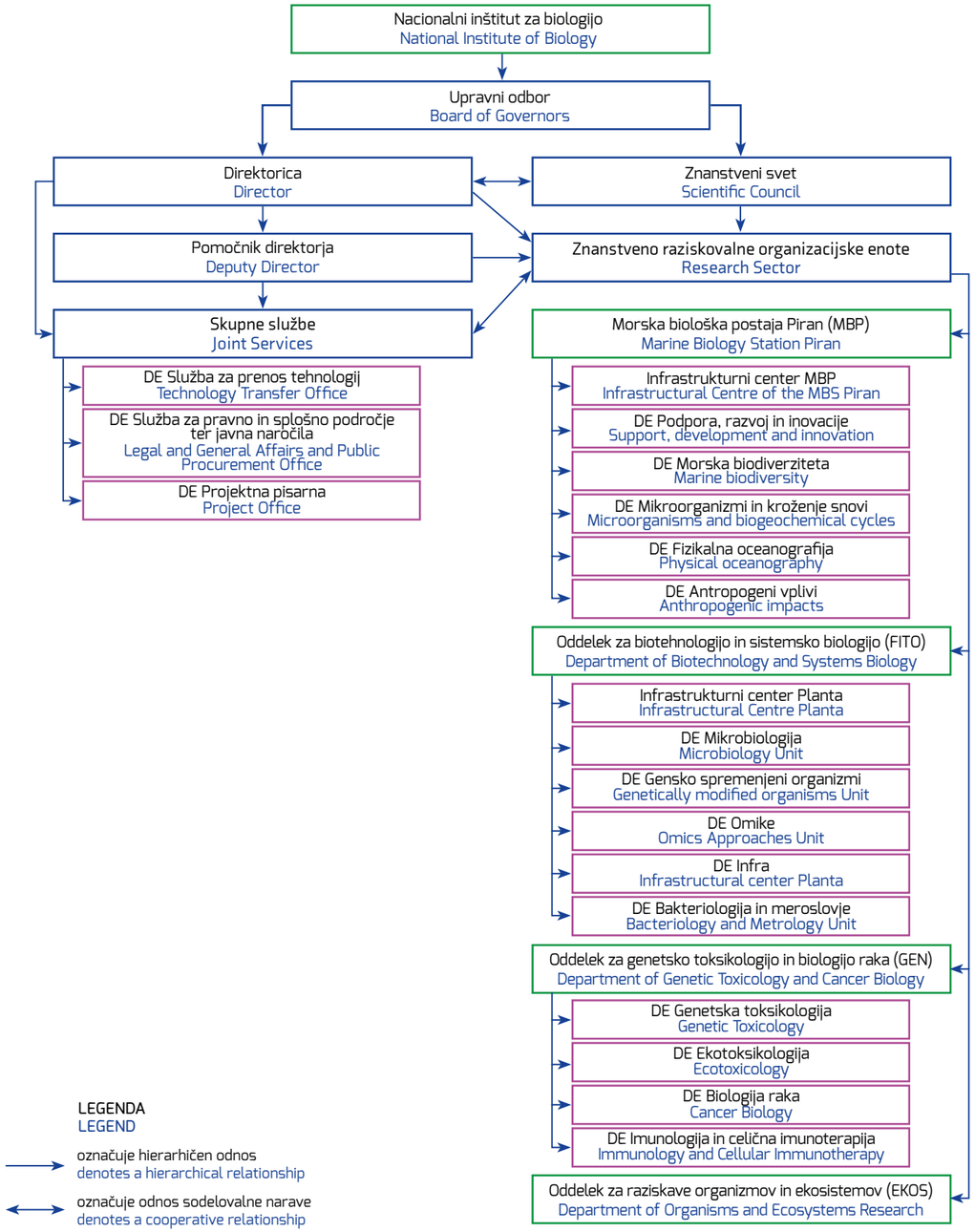
In our newly adopted *NIB Strategy*, we clearly defined the policies and priorities for the implementation of our mission and the achievement of our objectives, taking into account global trends and societal challenges, as well as updated our vision and mission. Our Ethics Committee was renamed the Ethics and Equal Opportunities Committee, and its responsibility, in addition to dealing with ethical issues, is to coordinate the implementation and monitor the *NIB Gender Equality Plan*, as well as to put forward proposals and recommendations to NIB's management and employees in the context of gender equality.

I am proud to say that in 2021, the NIB strengthened its old foundations and added new cornerstones that pave the way for outstanding, open and accessible science and progress for a better tomorrow. By using inclusive approaches, we wish to restore the well-deserved faith in science. We must do this to accomplish an existence in a world of health, prosperity and security, where the potentials of each individual are fully realised. We must do this as a society and as individuals. A collective awareness must be created that changes for the better are possible, and that we can all be the researchers, creators, voices and vehicles of those changes. For oneself, for all of us and for future generations.

Prof. Dr. Maja Ravnikar
Director of the NIB

Lišček (*Carduelis carduelis*) – ne le poleti, tudi pozimi si ptice rade urejajo perje v vodi (foto: Davorin Tome).
The goldfinch (*Carduelis carduelis*) - not only in summer, but also in winter the birds like to clean their plumage in the water (Photo: Davorin Tome).

ORGANIZACIJSKA SHEMA
ORGANIZATIONAL SCHEME



LEGENDA
LEGEND

označuje hierarhičen odnos
denotes a hierarchical relationship

označuje odnos sodelovalne narave
denotes a cooperative relationship

VODSTVO INŠTITUTA

MANAGEMENT OF THE INSTITUTE

DIREKTORICA DIRECTOR:

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

POMOČNIK DIREKTORICE ZA FINANČNO RAČUNOVODSKO PODROČJE DEPUTY DIRECTOR FOR FINANCE AND ACCOUNTING

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

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

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

UPRAVNI ODBOR BOARD OF GOVERNORS:

prof. dr. Franci Demšar, Nacionalna agencija Republike Slovenije za kakovost v visokem šolstvu – predsednik president;

mag. Gašper Polajnar (od from 3. 6. 2021);

dr. Tomaž Boh, Ministrstvo za izobraževanje, znanost in šport (od from 20. 1. 2020);

dr. Ruth Rupreht, Ministrstvo za okolje in prostor;

prof. dr. Uroš Urleb, Biofarmacevtika Mengeš, Novartis.

Mandat Mandate: 22. 6. 2018–21. 6. 2022

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, with members elected for a term of office from 17/06/2020 to 16/06/2024, operates in the following composition:

prof. dr. Marina Dermastia (predsednica President);

doc. dr. Bojana Žegura (podpredsednica Vice President);

prof. dr. Kristina Gruden;

prof. dr. Lovrenc Lipej;

dr. Nataša Mori;

izr. prof. dr. Patricija Mozetič;

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 from 25. 10. 2010;

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

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

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

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

STRATEGIJA

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

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

V Strategiji NIB, ki temelji na in vključuje številne dokumente ter izhodišča, so poleg poslanstva in vizije jasno opredeljene vrednote NIB in naslednji strateški cilji:

- ustvarjanje vrhunske znanosti;
- prenos znanja uporabnikom;
- zaposlovanje, izobraževanje in 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.

STRATEGY

The NIB's strategic and long-term objectives and key approaches or the measures to achieve them are defined in the NIB Strategy, which is adopted by the NIB Management Board. The NIB Strategy details the policies and priorities for the implementation of its mission and the achievement of its objectives, taking into account global trends and societal challenges.

With its expertise and engagement in the national, European and international research spheres, the NIB addresses current challenges facing society and science (such as the environmental and biodiversity crisis, the assurance of food safety, access to water, quality of life, sustainable development, rapid biotechnological development, digitalisation, a changing society, current crises, etc.) and delivers results to help build a science-based and inclusive society. The NIB's diversity, interdisciplinarity and flexibility allow it to respond quickly and effectively to crises and other important situations, working with various stakeholders of our society (e.g. the broad community, the public administration, other laboratories performing services for the public administration in the EU and internationally, industry, academia and educational processes, and the general public).

In addition to its mission and vision, the NIB Strategy, which is based on and includes a number of documents and basic principles, clearly defines the NIB values and the following strategic objectives:
creating outstanding science;

- the transfer of knowledge to users;
- the employment, education and development of excellent and satisfied staff;
- an organisational structure that supports excellence and effective responses to current challenges and efforts for the independence of operation;
- provision of state-of-the-art infrastructure;
- sustainable funding that allows continuous growth and development.

NAČRT ZA ENAKOST SPOLOV

NIB je v letu 2021 oblikoval in sprejel Načrt za enakost spolov, s katerim NIB izboljšuje analizo stanja, planiranja, izvajanja in sledenja enakosti spolov ter izobraževanja vseh zaposlenih na tem področju. Cilj načrta za enakost spolov NIB je preprečevanje in premagovanje neenakosti in pristranskosti spolov ter spodbujanje enakosti spolov na področju znanosti in inovacij z institucionalnimi in kulturnimi spremembami. Načrt za enakost spolov vključuje in naslavlja 5 ključnih področij:

- usklajevanje poklicnega in zasebnega življenja znotraj organizacijske kulture,
- uravnotežena zastopanost spolov na vodilnih in odločevalskih položajih,
- enake možnosti spolov pri zaposlovanju in kariernem napredovanju,
- upoštevanje dimenzije spola v vsebini raziskovanja,
- ukrepi za preprečevanje nasilja na podlagi spola, vključno s spolnim nadlegovanjem.

Z namenom koordinacije izvedbe in spremljanja Načrta za enakost spolov NIB ter dajanja predlogov in priporočil vodstvu NIB in zaposlenim na področju enakosti spolov je bila v letu 2012 ustanovljena Komisija za etiko in enake možnosti.

GENDER EQUALITY PLAN

In 2021, the NIB formed and adopted a Gender Equality Plan to improve the analysis of the status, planning, implementation and monitoring of gender equality and the education of employees on this topic. The objective of the NIB Gender Equality Plan is to prevent and overcome gender inequality and bias and to promote gender equality in science and innovation through institutional and cultural change. The Gender Equality Plan includes and addresses 5 key areas:

- Work and life balance within the organisational culture,
- Balanced gender representation in executive and decision-making positions,
- Equal gender opportunities in recruitment and career advancement,
- Consideration of the gender factor in research content,
- Measures that prevent gender-based violence, including sexual harassment.

The responsibility of monitoring and coordinating the implementation of the NIB Gender Equality Plan and making proposals and recommendations to NIB management and employees with regard to gender equality was entrusted to the Ethics and Equal Opportunities Committee, established in 2012.

PREGLED POSLOVANJA NIB V LETU 2021

V letu 2021 je NIB nadaljeval z uspešnim poslovanjem in presegel rezultate iz leta 2020. Med uspehi v letu 2021 je treba najprej izpostaviti začetek gradnje novega objekta Biotehnološkega stičišča Nacionalnega inštituta za biologijo v juliju. To predstavlja zadnjo in hkrati najpomembnejšo fazo pridobivanja nove raziskovalne infrastrukture, izjemno pomembne za razvojni potencial NIB. Pred podpisom pogodbe z izvajalcem gradnje Kolektor Koling je NIB uspel v okviru Operativnega programa za izvajanje evropske kohezijske politike v obdobju 2020–2021 pridobiti manjkajoča sredstva za realizacijo gradnje v višini 7.738.753 EUR, kar prav tako pomeni velik uspeh. Tudi na področju raziskovalnega in strokovnega dela je NIB v letu 2021 dosegel veliko uspehov, navedenih v nadaljevanju tega poročila.

Finančno je NIB v letu 2021 posloval izjemno uspešno, čeprav so bili številni zaposleni zelo intenzivno vpeti v izvajanje investicije BTS-NIB, kar je zanje pomenilo veliko dodatno obremenitev, ter kljub nadaljevanju omejitev poslovanja zaradi pandemije covida-19. Ustvarjeni prihodki so znašali 12.255.262 EUR. Ustvarjeni prihodki so bili višji od načrtovanih za 901.195 EUR (7,94 %). Ustvarjeni presežek prihodkov nad odhodki (pred obračunom davka od dohodkov pravnih oseb) v višini 671.075 EUR je bistveno presegel načrtovanega (za 588.454 EUR oz. 493 %).

OVERVIEW OF THE NIB OPERATIONS IN 2021

In 2021, NIB continued its successful operations and exceeded the results of 2020. The first of the successes achieved in 2021 to be highlighted is the start of the construction of the new facility for the Biotechnological junction of the National Institute of Biology in July. This represents the final and at the same time the most important stage of the acquisition of new research infrastructure, which is extremely important for the development potential of NIB. Prior to signing the contract with the construction contractor Kolektor Koling, NIB managed to obtain the missing assets for the construction in the amount of EUR 7,738,753 from the Operational Programme for the Implementation of the EU Cohesion Policy 2020–2021, which is also a major success. NIB achieved many successes in 2021 also the field of its research and expertise work, all listed later in this report.

The operations of NIB were financially extremely successfully in 2021, despite the fact that many employees were very intensively involved in the implementation of the BTS NIB investment, which was a major additional burden for them, and despite the continued operating restrictions due to the COVID 19 pandemic. The revenue generated amounted to EUR 12,255,262. The revenue generated was higher than planned by EUR 901,195 (7.94%). The generated profit (before corporate income tax) in the amount of EUR 671,075 significantly exceeded the profit planned (by EUR 588,454 or 493%).

V primerjavi z letom 2020 so bili realizirani prihodki NIB v letu 2021 višji za 1.664.359 EUR (15,71 %), realizirani odhodki pa za 1.110.802 EUR (10,61 %). Tako je bil v letu 2021 ustvarjen bistveno boljši poslovni izid kot v letu 2020 (za 553.557 EUR oz. 571,04 %). Nominalno največja rast prihodkov v letu 2021 v primerjavi z letom 2020 je bila dosežena pri prihodkih od ARRS. Ti so v letu 2021 znašali 6.969.667 EUR in so bili od primerljivih prihodkov v letu 2020 višji za 983.039 EUR (16,42 %). Naslednji po rasti so prihodki na domačem trgu, ki so v letu 2021 znašali 983.635 EUR in so bili od primerljivih prihodkov v letu 2020 višji za 601.579 EUR (11,35 %). Tudi prihodki na tujem trgu v letu 2021 v višini 883.122 EUR so presegli prihodke v letu 2020 (za 242.837 EUR oz. 37,93 %), prav tako prihodki iz drugih javnih služb (za 152.254 EUR oz. 9,77 %). Samo prihodki iz različnih evropskih programov (OBZORJE 2020, INTERREG, LIFE itn.), ki so v letu 2021 znašali 1.692.701 EUR, so bili nekoliko nižji kot v letu 2020 (za 28.582 EUR oz. 1,66 %).

V letu 2021 je NIB kot samostojno delovno enoto znotraj Skupnih služb vzpostavil Projektno pisarno, ki predstavlja osrednje mesto celovite informacijske, svetovalne in administrativne podpore raziskovalcem NIB pri načrtovanju, prijavah, izvedbi in spremljanju projektov.

Compared to 2020, the NIB's revenues were higher by EUR 1,664,359 (15.71%) in 2021 and the expenses by EUR 1,110,802 (10.61%). As a result, a significantly better profit or loss was generated in 2021 than in 2020 (by 553,557 EUR or 571.04%). Nominally, the greatest revenue increase in 2021 compared to 2020 was achieved in relation to revenues from the Slovenian Research Agency (ARRS). These equalled EUR 6,969,667 in 2021 and were by EUR 983,039 (16.42%) higher than comparable revenues in 2020. The next in terms of the nominal amount of increase were the revenues generated in the domestic market, which in 2021 amounted to EUR 983,635 and were higher than comparable revenues in 2020 by EUR 601,579 (11.35%). Also, the revenue in the foreign market amounted to EUR 883,122 in 2021, exceeding the revenue in 2020 (by EUR 242,837 or 37.93%), as well as revenues from other public institutions (by EUR 152,254 or 9.77%). Only the revenue from various European programmes (HORIZON 2020, INTERREG, LIFE, etc.), which amounted to EUR 1,692,701 in 2021, was slightly lower than in 2020 (by EUR 28,582 or 1.66%).

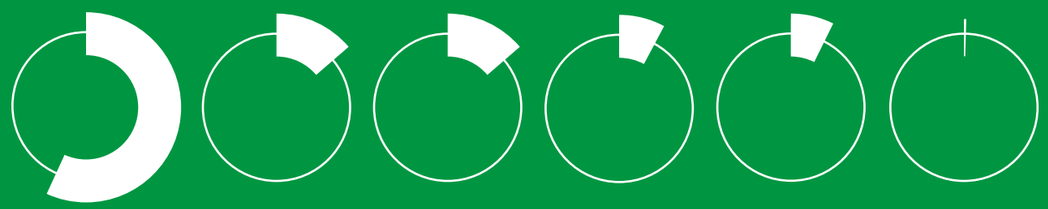
NIB established a Project Office in 2021 as an independent work unit within the Joint Services. The Project Office represents a central point of comprehensive information, advisory and administrative support for NIB researchers in designing, applying, executing and monitoring of projects.

PRIHODKI V EUR REVENUES IN EUR	2021	STRUKTURA 2021 (%) STRUCTURE 2021 (%)	2020	INDEKS/INDEX 2021/2020
ARRS/Slovenian Research Agency	**6.969.667,12**	56,87	5.986.627,82	116,42
Druge javne službe/Other public services	**1.710.401,34**	13,96	1.558.147,11	109,77
Evropski skladi/EU funds	**1.692.700,59**	13,81	1.721.282,68	98,34
Domači trg/Domestic market	**983.635,25**	8,03	682.351,81	144,15
Tuji trg/Foreign market	**883.122,22**	7,21	640.284,84	137,93
Drugi prihodki/Other revenues	**15.735,31**	0,13	2208,92	712,35
Skupaj prihodki/Total revenues	**12.255.261,83**	100,00	10.590.903,18	115,71

ODHODKI V EUR/EXPENSES IN EUR	2021	STRUKTURA 2021 (%) STRUCTURE 2021 (%)	2020	NDEKS/INDEX 2021/2020
Stroški dela/Labour	**7.026.760,30**	60,66	6.095.545,46	115,28
Stroški amortizacije/Amortization	**584.281,07**	5,04	552.228,62	105,80
Stroški materiala/Material	**1.429.302,54**	12,34	1.676.753,41	85,24
Stroški storitev/Services	**2.450.971,04**	21,16	2.009.389,72	121,98
Drugi stroški in odhodki/Other	**92.871,53**	0,80	139.467,15	66,59
Skupaj odhodki/Total expenditure	**11.584.186,48**	100,00	10.473.384,36	110,61

REZULTAT POSLOVANJA/BUSINESS RESULT	**671.075,35**	117.518,82	571,04

STRUKTURA PRIHODKOV NIB V LETU 2021
REVENUE STRUCTURE IN 2021



56,87 % Prihodki od ARRS Slovenian Research Agency

13,96 % Druge javne službe Other public institutions

13,81 % Evropski skladi EU funds

8,03 % Domači trg Domestic market

7,21 % Tuji trg Foreign markets

0,13 % Drugi prihodki Other revenues

PROJEKTNA PISARNA

Projektna pisarna NIB zagotavlja podporo vodstvu pri sprejemanju odločitev in strateškem usmerjanju na področju raziskovalnih dejavnosti; obvešča raziskovalce o aktualnih razpisih in drugih pomembnih informacijah za pridobivanje financiranja raziskovalnih projektov; sodeluje s ključnimi deležniki (nacionalne kontaktne točke) na področjih raziskav in inovacij; zagotavlja podporo pri iskanju in vzpostavljanju ustreznih stikov, partnerstev in mrež v nacionalnem, regionalnem in mednarodnem okolju; zagotavlja strokovno podporo v vseh fazah prijave projekta: iskanje ustreznega vira financiranja, ocena ustreznosti projektne ideje, pomoč pri zasnovi in oblikovanju projektne prijave, vključno s finančno-administrativnim pregledom prijave, spremljanje prijave do potrditve, sodelovanje pri oblikovanju krovnih in konzorcijskih pogodb ter druge relevantne dokumentacije, spremljanje finančno-administrativnih vidikov izvajanja projektov, sodelovanje pri zaključevanju projektov in pripravi poročil; sodeluje pri pripravi analiz in poročil o uspešnosti izvedenih projektov; sodeluje pri pripravi informacij o projektih za informiranje zainteresirane javnosti; organizira in izvaja interna izobraževanja, delavnice in svetovanja s področja upravljanja projektov in posameznih razpisov; skrbi za organizacijo in arhiviranje projektne dokumentacije ter pripadajočih seznamov in evidenc, povezanih s projekti; sodeluje pri pripravi in oblikovanju informacij o projektih na spletni strani NIB.

PROJEKT OFFICE

The NIB Project Office provides support to the management in decision-making and strategic direction in the field of research activities; it informs researchers about current tenders and other information important for obtaining funding of research projects; it cooperates with key stakeholders (national contact points) in the field of research and innovation; it provides support in finding and establishing appropriate contacts, partnerships and networks in a national, regional and international environment; it offers professional support in all phases of applying a project: a search for a suitable source of funding, evaluation of the suitability of the project idea, assistance in the design and creation of the project application, including the financial-administrative review of the application, monitoring of the application until confirmation, participation in the creation of umbrella and consortium contracts and other relevant documentation, monitoring of financial and administrative aspects of project implementation, participation in the completion of projects and preparation of reports; it participates in the preparation of analyses and reports on the success of implemented projects; it participates in the preparation of information about projects to inform the interested public; it organises and implements internal training, workshops and consulting in the field of project management and individual tenders; it takes care of the organisation and archiving of project documentation and associated lists and records related to projects; participates in the preparation and design of information about projects on the NIB website.

IZVAJANJE RAZISKOVALNIH PROGRAMOV IN PROJEKTOV

Kot nosilec je NIB v letu 2021 izvajal naslednje raziskovalne programe:

- P1-0237: Raziskave obalnega morja, ki se izvaja v organizacijski enoti MBP (7,78 FTE, 21 raziskovalcev, en upokojeni raziskovalec, štirje tehnični sodelavci, pet MR-jev, vodja dr. Patricija Mozetič), obdobje financiranja 2020–2025;
- P4-0165: Biotehnologija in sistemska biologija rastlin, ki se izvaja v organizacijski enoti FITO (5,40 FTE, 21 raziskovalcev, štirje tehnični sodelavci, osem MR-jev, obdobje financiranja 2015–2021). Z dnem 4. 1. 2021 je vodenje programa od dr. Maje Ravnikar prevzela dr. Kristina Gruden;
- P1-0255: Združbe, interakcije in komunikacije v ekosistemih, ki se izvaja v organizacijski enoti EKOS (6,40 FTE, 17 raziskovalcev, en upokojeni raziskovalec, trije tehnični sodelavci, sedem MR-jev, vodja dr. Meta Virant-Doberlet) in v soizvajalski organizaciji Prirodoslovni muzej Slovenije (0,19 FTE, dva raziskovalca), obdobje financiranja 2017–2022;
- P1-0245: Ekotoksikologija, toksikološka genomika in karcinogeneza, ki se izvaja v organizacijski enoti GEN (3,83 FTE, 14 raziskovalcev, štirje tehnični sodelavci, štirje MR-ji, obdobje financiranja 2019–2024). Z dnem 1. 2. 2021 je vodenje programa od dr. Tamare Lah Turnšek prevzela dr. Bojana Žegura;
- P4-0407: Okoljska in aplikativna virologija: virusi, prijatelji in sovražniki, ki se izvaja v organizacijski enoti FITO (2,46 FTE, sedem raziskovalcev, trije tehnični sodelavci, trije MR-ji, vodja dr. Jana Žel), obdobje financiranja 2019–2024.

Poleg zgoraj navedenih raziskovalnih programov je organizacijska enota MBP sodelovala še pri izvajanju programa P1-0143: Kroženje snovi v okolju, snovna bilanca in modeliranje okoljskih procesov ter ocena tveganja, katerega nosilec je Institut Jožef Stefan, vodja dr. Milena Horvat, obseg FTE za NIB 0,33.

IMPLEMENTATION OF RESEARCH PROGRAMMES AND PROJECTS

NIB carried out the following research programmes as the leader in 2021:

- P1-0237: "Coastal Sea Research", running at the MBS organisational unit (7.78 FTE, 21 researchers, one retired researcher, four technical assistants, five YRs, and the head Dr. Patricija Mozetič), the funding period 2020–2025;
- P4-0165: "Biotechnology and Plant Systems Biology", running at the FITO organisational unit (5.40 FTE, 21 researchers, four researchers, four technical assistants, eight YRs), the funding period 2015–2021. As of 04/01/2021, Dr. Kristina Gruden has been the head of the programme instead of Dr. Maja Ravnikar;
- P1-0255: "Communities, Interactions and Communications in Ecosystems", running at the EKOS organisational unit (6.40 FTE, 17 researchers, one retired researcher, three technical assistants, seven YRs, and the head Dr. Meta Virant-Doberlet), co-implemented by the Slovenian Museum of Natural History (0.19 FTE, two researchers), the funding period 2017–2022;
- P1-0245: "Ecotoxicology, Toxicogenomics, and Carcinogenesis", running at the GEN organisational unit (3.83 FTE, 14 researchers, four technical assistants, four YRs), the funding period 2019–2024. As of 01/02/2021, Dr. Bojana Žegura has been the head of the programme instead of Dr. Tamara Lah-Turnšek;
- P4-0407: "Environmental and Applicative Virology: Viruses, Friends and Foes", running at the FITO organisational unit (2.46 FTE, seven researchers, three technical assistants, three YRs, and the head Dr. Jana Žel), the funding period 2019–2024.

NIB je v letu 2021 izvajal tudi infrastrukturni program v obsegu 7 FTE.

Poleg raziskovalnih programov je NIB v letu 2021 izvajal tudi 63 raziskovalnih projektov ARRS (38 kot nosilna in 25 kot sodelujoča organizacija) v skupnem obsegu 24,4 FTE.

In addition to these five research programmes, the MBS organisational unit also collaborated in the implementation of programme P1-0143: "Cycling of Substances in the Environment, Mass Balances, Modeling of Environmental Processes and Risk Assessment" – with the Jožef Stefan Institute as the project leader, headed by Dr. Milena Horvat, in the amount of 0.33 FTE for NIB.

In 2021, NIB also implemented an infrastructure programme in the scope of 7 FTE.

Besides the research programmes, NIB also carried out 63 Slovenian Research Agency (ARRS) research projects in 2021 (38 as the leader and 25 as a participating organisation), in a total annual scope of 24.4 FTE.

RAZISKOVALNI PROJEKT RESEARCH PROJECTS	št. projektov Number of projects	št. letnih raziskovalnih ur Number of annual research hours	št. FTE Number of FTE
NIB nosilec - temeljni projekti NIB holder – basic projects	22	26.119	15,36
NIB nosilec - aplikativni projekti NIB holder – applied projects	5	2.982	1.75
NIB nosilec - podoktorski projekti NIB holder – post doctoral projects	9	479	0,28
NIB nosilec - komplementarna shema NIB holder – complementary scheme	2	5.955	3,5
NIB sodelujoča RO - temeljni projekti NIB participating RO – basic projects	19	4.191	2,47
NIB sodelujoča RO - aplikativni projekti NIB participating RO – applied projects	5	1.627	0,96
NIB sodelujoča RO - komplementarna shema NIB participating RO – complementary scheme	1	137	0,08
SKUPAJ TOTAL	63	41.490	24,4

Kot nosilna organizacija je v okviru Ciljnega raziskovalnega programa NIB izvajal tudi tri projekte v skupnem letnem obsegu 1 FTE; dva v okviru programa CRP Zagotovimo.si hrano za jutri in enega v okviru programa CRP 2019. Obseg financiranja projektov s strani ARRS je bil v letu 2021 za 5,21 FTE oz. 27,15 % večji kot v preteklem letu.

NIB je v letu 2021 sodeloval pri projektih okvirnega programa Obzorje 2020 v vlogi koordinatorja in partnerja/tretje stranke. Skupno se je izvajalo 14 projektov, od katerih so se v letu 2021 poleg dveh projektov NOČMOČ zaključili še trije: SeaDataCloud, Valitest in GoJelly. Projekt iz sheme RISE (NESTOR) se je začel izvajati z zamikom zaradi epidemioloških razmer. Projekt Assemble plus s prvotno načrtovanim zaključkom v letu 2021 pa je bil podaljšan v leto 2022. V letu 2021 je začel aktivnosti izvajati triletni projekt EMPIR Food-MetNet iz sheme Empir.

Višina ustvarjenih prihodkov je v letu 2021 pri projektih Obzorje 2020 znašala 656.973 EUR in je predstavljala 5,36 % vseh prihodkov NIB.

Raziskovalci NIB so sodelovali pri dvanajstih dejavnostih združenja COST (The European Cooperation in Science and Technology). Izvajali so tri projekte LIFE, enega kot koordinator in dva kot partner. Z izvajanjem treh strateških projektov iz progama INTERREG MED (SHAREMED, OSMOSIS in B-BLUE) in dveh iz programa INTERREG Slovenija – Italija (TRETAMARA in GreenHull) je NIB nadaljeval tudi v letu 2021. Poleg naštetih je NIB izvajal še skupno šest projektov iz shem European Food Safety Auhority (EFSA) in European Maritime and Fisheries Fund (EMFF). Partnersko sodelovanje je potekalo v dveh referenčnih laboratorijih EU za povzročitelje bolezni na rastlinah (viruse, vioride in fitoplazme ter bakterije). V letu 2021 se je začelo izvajanje projekta prek sheme Partnership for Research and Innovation in the Mediterranean Area (PRIMA), ki ga financira Javna agencija za raziskovalno dejavnost Republike Slovenije (ARRS).

NIB as a leading organisation, within the framework of the Targeted Research Programme also implemented three projects with a total annual scope of 1 FTE; two within the TRP programme "Securing Food for Tomorrow" and one within the framework of the "TRP 2019" programme. The amount of project funding provided by the Slovenian Research Agency (ARRS) in 2021 was 5.21 FTE or 27.15% higher than the year before.

NIB in 2021 worked on Horizon 2020 projects in the role of the coordinator and in the role of a partner/third party. A total of 14 projects were carried out, of which three projects were completed in 2021 besides the two projects publicly known as the Researchers' Night: SeaDataCloud, Valitest and GoJelly. The project under the RISE scheme (NESTOR) started with a delay due to the epidemiological situation. The Assemble plus project, with its original planned completion in 2021, was extended to 2022. In 2021, the activities of the three-year EMPIR Food-MetNet project from the Empir scheme started.

The amount of revenue in 2021 generated in Horizon 2020 projects amounted to EUR 656,973, representing 5.36% of total NIB revenues.

NIB researchers participated in twelve COST (The European Cooperation in Science and Technology) activities. They carried out three LIFE projects, one as coordinator and two as a partner. NIB in 2021 continued with the three strategic projects from the INTERREG MED programme (SHAREMED, OSMOSIS and B-BLUE) and two from the INTERREG Slovenia–Italy programme (TRETAMARA and GreenHull). Besides these, NIB carried out a total of six projects from the European Food Safety Authority (EFSA) scheme and the European Maritime and Fisheries Fund (EMFF) scheme. The partnership cooperation took place in two reference laboratories: Two EU reference laboratories for pests of plants (viruses, viroids and phytoplasmas, and bacteria). In 2021, the project started with the Partnership for Research and Innovation in the Mediterranean Area (PRIMA) scheme, which is financed through the Public Agency for Research Activity of the Republic of Slovenia.

NIB je v letu 2021 kot konzorcijski partner sodeloval pri izvedbi operacij razvoja raziskovalne infrastrukture za mednarodno konkurenčnost slovenskega RRI-prostora RI-SI-2, in sicer RI-SI Lifewatch: Evropska infrastruktura za e-znanost in tehnologijo za raziskave biotske raznovrstnosti in ekosistemov ter ELIXIR-SI kot osrednja nacionalna infrastruktura za pridobivanje podatkov visoke gostote, vzpostavitev osrednjega nacionalnega podatkovnega vozlišča v koordinaciji z drugimi komplementarnimi infrastrukturami znotraj NRRI ter vzpostavitev središča za izobraževanje in usposabljanje na področju ved o življenju za uporabo bioinformatskih orodij in storitev.

Poleg navedenega je NIB v letu 2021 sodeloval pri projektih, sofinanciranih s strani evropskih kohezijskih in investicijskih skladov, katerih sofinanciranje poteka prek slovenskih ministrstev. V letu 2021 so se začeli izvajati trije projekti iz razpisa MIZŠ za spodbujanje raziskovalcev na začetku kariere.

V letu 2021 je NIB nadaljeval z izvajanjem projekta iz razpisa Spodbujanje dejavnosti prenosa znanja preko delovanja pisarn za prenos tehnologij.

Na podlagi odločitve direktorja Strokovne komisije Nacionalnega inštituta za biologijo, ki je v letu 2020 objavila dva interna poziva Raziskovalnega sklada NIB za podporo raziskovalcem pri njihovem raziskovalnem in razvojem delu, se je v letu 2021 začelo izvajati osem odobrenih manjših projektov. Dva sta se v letu 2021 tudi zaključila. Prav tako je bil v okviru Raziskovalnega sklada NIB odobren večji projekt za vzpostavitev nove raziskovalne smeri na OE GEN Imunologija in celična imunoterapija. Zagon nove raziskovalne smeri je bil izveden v letu 2021, projekt pa se bo nadaljeval tudi v letu 2022.

As a consortium partner, NIB in 2021 took part in the running of operations for the development of research infrastructure for international competitiveness of Slovenian RDI space RI-SI-2 – RI-SI Lifewatch: European Infrastructure for e-Science and Technology for Biodiversity and Ecosystem Research, and ELIXIR-SI as the central national infrastructure for acquiring high-density data, for establishing a central national data hub in coordination with other complementary infrastructures as part of the Research Infrastructure Development Plan, and for establishing a life sciences education and training centre for the use of bioinformatics tools and services.

Besides the listed collaborations, NIB in 2021 participated in projects co-financed by the European Cohesion and Investment Funds, the co-financing of which takes place through Slovenian ministries. In 2021, three projects started from the Ministry of Education, Science and Sport tender for encouraging researchers at the beginning of their careers.

NIB continued the implementation of the project from the tender "Promotion of knowledge transfer activities through the operation of technology transfer offices" in 2021.

Based on the decision of the Expert Commission of the National Institute of Biology Director, after publishing two internal calls from the NIB Research Fund in 2020 to support researchers in their research and development work, eight approved smaller projects began to be carried out in 2021. Two were already completed in 2021. One major project was also approved within the scope of the NIB Research Fund – for establishing a new research direction "Immunology and cellular immunotherapy" at OE GEN. The launch of the new research direction was carried out in 2021 and the project will continue in 2022.

INVESTICIJE

NIB je v letu 2021 realiziral investicije v višini 1.944.156,22 EUR, od tega aktivirano v višini 909.634,67 EUR in v pridobivanju v višini 1.034.521,55 EUR. Viri nabav so neporabljena amortizacija preteklih let in obračunana amortizacija tekočega leta v višini 584.281 EUR, investicijski transfer s strani MO v višini 44.300,00 EUR, sredstva ARRS - paket 19 v višini 100.252,97 EUR, sredstva iz projektnega financiranja (LIFE IP, NAT2CARE, LIFEWATCH, GREENHULL, ELIXIR) v višini 142.723,10 EUR, sredstva zavarovalnice Sava v višini 12.066,50 EUR, sofinanciranje za BTS-NIB s strani MIZŠ (iz kohezijskih sredstev) v višini 1.033.402,55 EUR.

INVESTMENTS

In 2021, NIB realised investments in the amount of EUR1,944,156.22, of which EUR 909,634.67 was activated and EUR 1,034,521.55 in acquisitions. The sources of supply include a depreciation expense for the current year of EUR 584,281, investment transfer received from the Ministry of Defence in the amount of EUR 44,300.00, funds received from the 19 ARRS Package in the amount of EUR 100,252.97, funds received from project financing (LIFE IP, NAT2CARE, LIFEWATCH, GREENHULL, ELIXIR) in the amount of EUR 142,723.10, Sava insurance company in the amount of EUR 12,066.50 and the funds received from the Ministry of Education, Science and Sport (the cohesion funds) for BTS-NIB in the amount of EUR 1,033,402.55.

GRADNJA OBJEKTA BTS-NIB

Po večletni pripravi projektne in investicijske dokumentacije za pridobitev sredstev za realizacijo investicije Biotehnološkega stičišča Nacionalnega inštituta za biologijo na Večni poti je NIB konec junija 2021 z Ministrstvom za izobraževanje, znanost in šport podpisal aneks k pogodbi o sofinanciranju, s katerim je bilo NIB zagotovljenih 28,615 mio EUR, ki jih sofinancirata Ministrstvo za šolstvo, znanost in šport RS in EU iz Evropskega sklada za regionalni razvoj.

S tem so bili ustvarjeni pogoji za podpis pogodb z izvajalcem GOI del Kolektor Koling d. o. o. in nadzornikom nad izvajanjem GOI del Elea IC d. o. o. na začetku julija 2021. V tem času se je zaključil tudi postopek lokacijske preveritve za postavitev karantenskega rastlinjaka na streho severnega dela objekta BTS-NIB, ki je bil osnova za spremembo gradbenega dovoljenja, ki ga je NIB pridobil avgusta 2021.

CONSTRUCTION OF THE NIB'S BIOTECHNOLOGICAL JUNCTION

After preparing project documentation and investment documentation for several years to obtain funds for the realisation of the investment of the Biotechnology junction of the National Institute of Biology on Večna pot address in Ljubljana, NIB signed the Annex to the Agreement on co-financing with the Ministry of Education, Science and Sport at the end of June 2021. This ensured NIB with EUR 28.615 million co-financed by the Ministry of Education, Science and Sport of the Republic of Slovenia and the EU from the European Fund for Regional Development.

Načrtovana investicija Biotehnološko stičišče NIB (vir: Arhiv NIB).
Planned investment Biotechnological Hub NIB (Source: NIB archive).

Gradnja objekta BTS-NIB, za katerega je projektno dokumentacijo izdelal arhitekturni biro Styria d. o. o. iz Maribora, se je začela julija 2021. Zaradi zahteve po neprekinjenem delovanju Inštituta v času gradnje se objekt gradi v dveh etapah. Zaključek prve etape gradnje je predviden jeseni 2022, druge pa jeseni 2023.

V okviru izvedbe celotne investicije sta predvideni rušitev obstoječega trakta NIB, imenovanega Vhodni objekt, in novogradnja objekta, imenovanega BTS-NIB, z vso pripadajočo komunalno in energetsko infrastrukturo, ureditvijo okolja ter notranjo pohištveno in tehnološko opremo.

Objekt, ki bo v dolžino meril dobrih 152 m in v širino 23,5 m, bo imel 6600 m^2 uporabne površine in bo obsegal pritličje, nadstropje in tehnično etažo, na severni strani katere bo rastlinjak, na južni pa čebelnjak.

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

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

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

This created the conditions for signing the contract with the contractor Kolektor Koling d.o.o., and the supervisor on the implementation of the construction, craft and installation works – Elea IC d.o.o., both signed in early July 2021. The location verification process for the installation of a quarantine greenhouse on the roof of the northern part of the BTS NIB facility was also completed at that time. It was the basis for obtaining a change to the building permit, which NIB obtained in August 2021.

The construction of the BTS NIB building, for which the project documentation was prepared by the architectural bureau Styria d.o.o. in Maribor, started in July 2021. Due to the requirement for continuous operation of the Institute during construction, the building is being built in two stages. The completion of the first construction stage is planned in autumn 2022 and the completion of the second construction stage in autumn 2023.

The execution of the entire investment includes the demolition of the existing wing of NIB called “the Entrance Building” as well as the construction of the new BTS NIB building with all associated municipal and energy infrastructure, environmental regulation and interior furniture and technological equipment.

The facility of about 152m in length and 23.5m^2 in width will have 6,600m^2 of usable surface and will include ground floor, floor and technical floor with a greenhouse on the north side and a beehive on the south side.

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

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

Ker je poseg načrtovan na varovanem območju Krajinskega parka Tivoli, Rožnik in Šišenski hrib, se vsa dela izvajajo s posebno skrbnostjo, da se čim manj posega v varovani del črnojelševja, pred začetkom gradbenih posegov pa je bil zaščiten tudi drevored japonskih češenj.

V letu 2021 je bil porušen severni del Vhodnega objekta, prestavljene so bile energetske naprave, ki omogočajo nemoteno delovanje južnega dela Vhodnega objekta, izvedeno je bilo temeljenje prve etape novega objekta.

The project plans a two-stage demolition of the existing building and a two-stage construction of the new building. The ground floor and the first floor of the new building shall be vertically aligned without horizontal layouts. The technical floor above the 1st floor is divided into smaller individual buildings, shifted towards the inside of the edgings of facades and the roof. The height of the building in contact between the facade and the roof cornice does not exceed 8m, except for the part where the greenhouse will stand, where the permitted height is 14m. Permissible heights of technical premises for devices necessary for the operation of the building and access to the roof extend above the mentioned angle.

The facility is divided into sectors set from north to south from facility A in the north to facilities B, C, D and E in the south. An energy centre with utility connections is located in building A, from which, in accordance with the phased construction of the remaining sectors, parts of the buildings with internal house installation conduits are lined up.

The facility is designed as a set of laboratories, offices, lecture rooms, and all related technical and service premises and installations. The staged construction is necessary due to shared installations with the main facility of the Biological Centre, which must function smoothly throughout the construction period. Access and driveway to the building are via the existing internal access roads.

ZAPOSLENI V LETU 2021

Inštitut je bil v letu 2021 sestavljen iz štirih raziskovalnih enot in Skupnih služb. Zaposleni v dveh največjih enotah predstavljajo 59 % vseh zaposlenih na NIB. Oddelek za biotehnologijo in sistemsko biologijo je 31. 12. 2021 zaposloval 68 sodelavcev, enota Morska biološka postaja Piran 41 sodelavcev, Oddelek za genetsko toksikologijo in biologijo raka 21 sodelavcev, Oddelek za raziskave organizmov in ekosistemov 31 sodelavcev, Skupne službe pa 22 sodelavcev.

Na NIB je bilo tako 31. 12. 2021 183 zaposlenih, od tega 87 raziskovalcev, 23 mladih raziskovalcev ter 73 strokovno-tehničnih in administrativnih sodelavcev.

V letu 2021 se je na novo zaposlilo 29 sodelavcev, 12 pa jih je zaključilo delovno razmerje na NIB.

EMPLOYEES IN 2021

In 2021, the Institute was comprised of four research units and Joint Services. The employees in the biggest two units represent 59% of all NIB employees. On 31/12/2021, the Department of Biotechnology and Systems Biology had 68 employees, the Marine Biology Station Piran unit had 41, the Department of Genetic Toxicology and Cancer Biology had 21, the Department of Organisms and Ecosystems Research had 31, and Joint Services had 22.

On 31/12/2021, NIB had 183 employees of which 87 were researchers, 23 were young researchers, and 73 were the professional-technical and administrative staff.

In 2021, 29 new employees were hired and 12 employment relationships at NIB were terminated.

DOKTORATI, MAGISTERIJI IN DIPLOME V LETU 2021

Svojo doktorsko disertacijo so pripravili pod (so)mentorstvom raziskovalcev z NIB in jo zagovarjali v letu 2021:

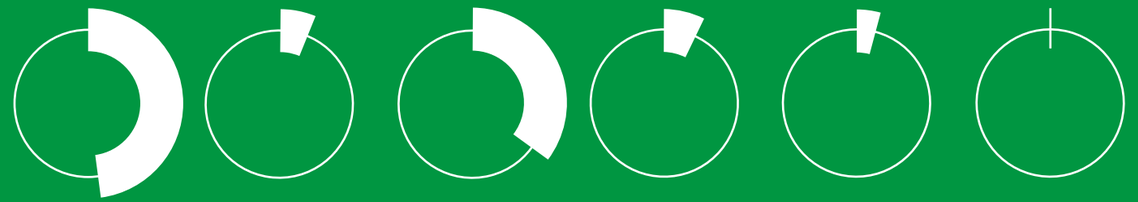
DOCTORAL DISSERTATIONS, MASTER'S THESES AND UNDERGRADUATE THESES IN 2021

Doctoral dissertations under the (co)supervision of NIB researchers in 2021:

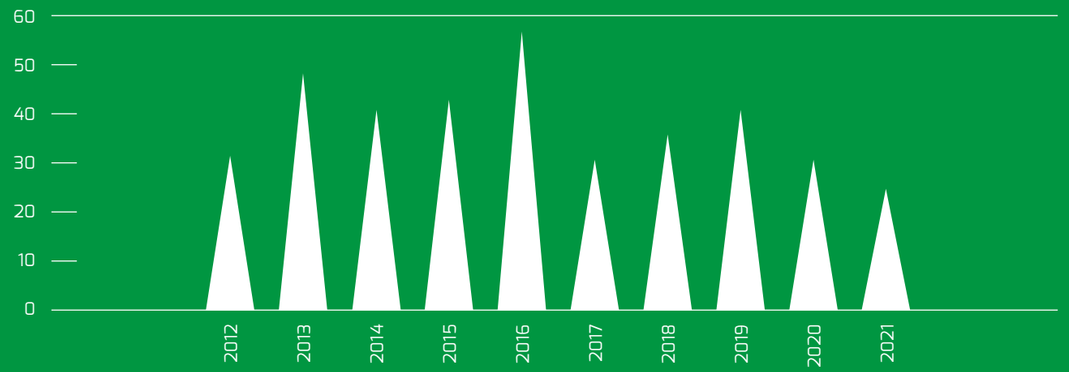
ŠTUDENT STUDENT	(SO) MENTOR (CO)SUPERVISOR
dr. Filipić, Arijana (FITO)	Mentorica izr. prof. dr Jana Žel (FITO), somentor doc. dr. David Dobnik (FITO)
dr. Štampar, Martina (GEN)	Mentorica doc. dr. Bojana Žegura (GEN)
dr, Šturm, Rok (EKOS)	Mentorica izr. prof. dr. Meta Virant-Doberlet (EKOS)
dr. Turk Dermastia, Timotej (MBP)	Mentorica izr. prof. dr. Patricija Mozetič (MBP), somentorica doc. dr. Andreja Ramšak (MBP)
dr. Zagorščak, Maja (FITO)	Mentor prof. dr. Andrej Blejec (EKOS), somentorica prof. dr. Kristina Gruden (FITO)

STANJE PO ORGANIZACIJSKIH ENOTAH NA DAN 31. 12. 2021
NUMBER OF STAFF BY UNITS ON 31. 12. 2021

IZOBRAZBENA STRUKTURA NA DAN 31. 12. 2021
EDUCATIONAL STRUCTURE ON 31. 12. 2021



ŠTEVILO DIPLOMSKIH, MAGISTRSKIH IN DOKTORSKIH NALOG POD (SO)MENTORSTVOM RAZISKOVALCEV Z NACIONALNEGA INŠTITUTA ZA BIOLOGIJO V OBDOBJU 2012-2021
NUMBER OF UNDERGRADUATE THESES, MASTER'S THESES AND DOCTORAL DISSERTATIONS UNDER (CO)SUPERVISION OF NIB RESEARCHERS IN YEARS 2012-2021



Fotografija z virtualne razstave pripravljene v počastitev kulturnega praznika (foto: David Dobnik).
Photo from the virtual exhibition prepared in honour of the cultural festival (Photo: David Dobnik).

ŠTEVILO ZAGOVARJANIH MAGISTRSKIH IN DOKTORSKIH NALOG TER MENTORSTEV IN SOMENTORSTEV S STRANI ZAPOSLENIH NA NIB V LETU 2021

NUMBER OF MASTER'S THESES, DOCTORAL DISSERTATIONS, SUPERVISIONS AND CO-SUPERVISIONS BY NIB EMPLOYEES IN YEAR 2021

magistska naloga / Master's Thesis	3
doktorska disertacija / Doctoral Dissertation	6
mentor pri doktorskih disertacijah / Supervisor for Doctoral Dissertations	5
mentor pri magistrskih delih / Supervisor for Master's Thesis	8
mentor pri diplomskih delih / Supervisor for Undergraduate Theses	7
somentor pri doktorskih disertacijah / Co-Supervisor for Doctoral Dissertations	3
somentor pri magistrskih delih / Co-Supervisor for Master's Thesis	7
somentor pri diplomskih delih / Co-Supervisor for Undergraduate Theses	5

OBJAVE IN CITIRANOST V LETU 2021

Objavljeni članki (izvirni in pregledni znanstveni članki, kratki znanstveni prispevki) po letu objave, povprečnem faktorju vpilva po JCR (Journal Citation Reports), povprečni umeščenosti revije, v kateri so bili objavljeni, v področne četrtine (»kvartile«) po JCR ter število čistih citatov po Web of Science/ Scopus:

PUBLICATIONS AND CITATIONS IN 2021

Published articles (Original Scientific Articles, Review Articlees and Short Scientific Articles) by year, average Impact Factor (JCR), average journal quarter position (JCR) and number of pure citations in Web of Science/Scopus:

LETO YEAR	ŠTEVILO OBJAVLJENIH ZNANSTVENIH ČLANKOV NUMBER OF PUBLISHED SCIENTIFIC ARTICLES	POVPREČNI IF (JCR) AVERAGE IF (JCR)	POVPREČNA UMEŠČENOST REVIJE V ČETRINE PO JCR AVERAGE JOURNAL QUARTER POSITION (JCR)	ŠTEVILO ČISTIH CITATOV NUMBER OF PURE CITATIONS
2017	113	2,899	2	2421
2018	109	3,148	2	3505
2019	119	3,887	2	4186
2020	125	4,315	2	5967
2021	168	4,439	2	6760

NAJVPLIVNEJŠE OBJAVE V LETU 2021

THE MOST INFLUENTIAL PUBLICATIONS IN 2021

NIB VODILNI PARTNER V RAZISKAVI
NIB AS COORDINATOR IN RESEARCH

MATJAŠIČ, Tjaša, SIMČIČ, Tatjana, KANDUČ, Tjaša, SAMARDŽIJA, Zoran, MORI, Nataša. Presence of polyethylene terephthalate (PET) fibers in hyporheic zone alters colonization patterns and seasonal dynamics of biofilm metabolic functioning. *Water Research*, ISSN 1879-2448. [Online ed.], Sep. 2021, vol. 203, str. 1-13, ilustr. https://www.sciencedirect.com/science/article/pii/S0043135421006539. [COBISS.SI-ID 72585475] IF (JCR)=13.400

MATJAŠIČ, Tjaša, SIMČIČ, Tatjana, MEDVEŠČEK, Neja, BAJT, Oliver, DREO, Tanja, MORI, Nataša. Critical evaluation of biodegradation studies on synthetic plastics through a systematic literature review. *Science of the total environment*, ISSN 0048-9697, 15 Jan. 2021, vol. 752, [article] 141959, str. 1-16, ilustr., doi: 10.1016/j.scitotenv.2020.141959. [COBISS.SI-ID 28975363] IF (JCR)=10.753

ŠTAMPAR, Martina, FRANDSEN, Helle, ROGOWSKA-WRZESINSKA, Adelina, WRZESINSKI, Krzysztof, FILIPIČ, Metka, ŽEGURA, Bojana. Hepatocellular carcinoma (HepG2/C3A) cell-based 3D model for genotoxicity testing of chemicals. *Science of the total environment*, ISSN 1879-1026. [Online ed.], 2021, vol. 755, pt. 2, str. 1-12, ilustr. doi: 10.1016/j.scitotenv.2020.143255. [COBISS.SI-ID 36593667] IF (JCR)=10.753

NOVAK, Matjaž, BAEBLER, Špela, ŽEGURA, Bojana, ROTTER, Ana, GAJSKI, Goran, GERIĆ, Marko, GARAJ VRHOVAC, Verica, BAKOS, Katalin, CSENKI, Zsolt, KOVÁCS, Róbert, HORVÁTH, Ákos, GAZSI, Gyöngyi, FILIPIČ, Metka. Deregulation of whole-transcriptome gene expression in zebrafish (Danio rerio) after chronic exposure to low doses of imatinib mesylate in a complete life cycle study. *Chemosphere*, ISSN 0045-6535. [Print ed.], Jan. 2021, vol. 263, [article] 128097, str. 1-10, ilustr., doi: 10.1016/j.chemosphere.2020.128097. [COBISS.SI-ID 28605955] IF (JCR)=8.943

DERMASTIA, Marina, ŠKRLJ, Blaž, STRAH, Rebeka, ANŽIČ, Barbara, TOMAŽ, Špela, KRIŽNIK, Maja, SCHÖNHUBER, Christina, RIEDLE-BAUER, Monika, RAMŠAK, Živa, PETEK, Marko, KLADNIK, Aleš, LAVRAČ, Nada, GRUDEN, Kristina, ROITSCH, Thomas, BRADER, Günter, POMPE NOVAK, Maruša. Differential response of grapevine to Infection with 'Candidatus Phytoplasma solani' in early and late growing season through complex regulation of mRNA and small RNA transcriptomes. *International journal of molecular sciences*, ISSN 1661-6596, 1 Apr. 2021, vol. 22, no. 7, str. 3531-1-3531-28. https://www.mdpi.com/1422-0067/22/7/3531. [COBISS.SI-ID 58895619] IF (JCR)=6.208

FRANCÉ, Janja, VARKITZI, Ioanna, STANCA, Elena, COZZOLI, Francesco, ŠKEJIĆ, Sanda, UNGARO, Nicola, VASCOTTO, Ivano, MOZETIČ, Patricija, NINČEVIĆ GLADAN, Živana, ASSIMAKOPOULOU, Georgia, PAVLIDOU, Alexandra, ZERVOUDAKI, Soultana, PAGOU, Kalliopi, BASSET, Alberto. Large-scale testing of phytoplankton diversity indices for environmental assessment in Mediterranean sub-regions (Adriatic, Ionian and Aegean Seas). *Ecological indicators : integrating monitoring, assessment and management*, ISSN 1470-160X, Jul. 2021, vol. 126, str. 107630-1-107630-21, ilustr. doi: 10.1016/j.ecolind.2021.107630. [COBISS.SI-ID 58907907] IF (JCR)= 6.263

ORLANDO-BONACA, Martina, PITACCO, Valentina, LIPEJ, Lovrenc. Loss of canopy-forming algal richness and coverage in the northern Adriatic Sea. *Ecological indicators : integrating monitoring, assessment and management*, ISSN 1470-160X, Jun. 2021, vol. 125, [article] 107501, str. 1-11, ilustr. doi: 10.1016/j.ecolind.2021.107501. [COBISS.SI-ID 52889091] IF (JCR)= 6.263

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BIBLIOGRAFIJA INŠTITUTA V LETIH 2012 – 2021 (ANALITIČNI PODATKI)
INSTITUTE'S BIBLIOGRAPHY IN 2012 – 2021 (ANALYTICAL DATA)

ZVRST DOKUMENTA TYPE OF DOCUMENT	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	SKUPAJ TOTAL
znanstveni članki z IF scientific papers with IF	86	83	79	80	82	97	91	99	109	139	**945**
znanstveni članki brez IF other scientific papers	16	7	13	18	16	16	18	20	16	29	**169**
strokovni in poljudni članki professional and popular articles	66	62	45	43	62	58	49	44	60	66	**555**
objavljeni prispevki s kongresov published conference papers	18	24	16	17	16	24	17	11	9	6	**158**
povzetki s kongresov published conference paper abstracts	101	166	166	156	149	159	178	178	72	93	**1418**
poglavja v knjigah book chapters	14	28	11	9	7	18	8	30	63	55	**243**
knjige books	4	3	6	1	6	5	1	2	3	17	**48**
poročila reports	28	34	23	35	38	51	51	40	33	33	**366**
doktorska dela doctoral dissertations	7	9	8	4	4	2	6	2	2	6	**50**
magistrska dela master's theses	1	0	2	1	2	1	5	0	3	3	**18**
patenti patents	3	2	2	2	0	1	1	2	2	6	**21**
razno other	121	207	138	161	151	217	250	198	207	314	**1964**
SKUPAJ TOTAL	**465**	**625**	**509**	**527**	**533**	**649**	**675**	**626**	**579**	**767**	**5955**

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 2021

NACIONALNI INŠTITUT ZA BIOLOGIJO JE USTANOVIL DRUGI »SPIN OUT« NIBA LABS

Ljubljana, 21. aprila 2021

NIB je na slavnostni prireditvi ob podpisu licenčne pogodbe z Niba Labs na mlado podjetje prenesel tehnologije za zdravljenje s terapevtskimi virusi. NIB in Niba Labs načrtujeta sodelovanje pri nadaljnjem razvoju in trženju tehnologij na področju karakterizacije in kvantifikacije terapevtskih virusov, ki se uporabljajo za gensko zdravljenje. Niba Labs je že drugo odcepljeno podjetje Nacionalnega inštituta za biologijo.

SLAVNOSTNI DOGODEK OB ZAČETKU GRADNJE PROJEKTA BIOTEHNOLOŠKO STIČIŠČE NACIONALNEGA INŠTITUTA ZA BIOLOGIJO

Ljubljana, 7. julija 2021

Začetek gradnje je NIB obeležil s slavnostnim dogodkom, saj gre za izjemno pomembno investicijo v znanstvenoraziskovalno infrastrukturo na področju biotehnologije in ved o življenju, ki bo izboljšala raziskovalne zmogljivosti za izkoriščanje razvojnih možnosti Nacionalnega inštituta za biologijo v domačem in mednarodnem okolju ter pomembno okrepila raziskovalno podporo slovenskemu gospodarstvu in zagonskim podjetjem. Slavnostna govorca na dogodku sta bila Simona Kustec, ministrica za izobraževanje, znanost in šport, in Zoran Janković, župan Mestne občine Ljubljana.

SUCCESSES, AWARDS AND RECOGNITIONS IN 2021

NATIONAL INSTITUTE OF BIOLOGY FOUNDED THE SECOND NIBA LABS SPIN OUT

Ljubljana, 21 April 2021

NIB transferred technologies for treatment with therapeutic viruses to a young company, at the ceremony of signing the licence agreement with Niba Labs. NIB and Niba Labs are planning to cooperate on the further development and marketing of technologies in the field of characterisation and quantification of therapeutic viruses used for gene therapy. Niba Labs is already the second spin-off of the National Institute of Biology.

CEREMONY EVENT AT THE BEGINNING OF THE PROJECT "BIOTECHNOLOGICAL JUNCTION OF THE NATIONAL INSTITUTE OF BIOLOGY"

Ljubljana, 7 July 2021

The beginning of the construction was marked by a ceremony event, as it is an extremely important investment in scientific research infrastructure in biotechnology and life sciences, which will improve the research capacity to exploit the development possibilities of the National Institute of Biology in the domestic and international environment and significantly strengthen the research support for the Slovenian economy and start-up environment. The main speakers at the event were: Simona Kustec, Minister of Education, Science and Sport and Zoran Janković, Mayor of the City Municipality of Ljubljana.

OB VSTOPU V DESETLETJE OCEANOV 2021–2030 SO NA MORSKI BIOLOŠKI POSTAJI PIRAN PREDSTAVILI KNJIGO O OGROŽENIH MORSKIH EKOSISTEMIH IN PRIMERJALI SEVERNI JADRAN Z ZALIVOM CHESAPEAKE NA VZHODNI OBALI ZDA

Piran, 7. oktobra 2021

V okviru praznovanja 50. obletnice Morske biološke postaje Piran Nacionalnega inštituta za biologijo pred nekaj leti je letos pri ugledni založbi Wiley AGU izšla knjiga z naslovom *Obalni ekosistemi na prehodu: Primerjalna analiza severnega Jadrana in zaliva Chesapeake* (2021). Knjiga je nastala v sodelovanju med raziskovalci ZDA, Slovenije, Hrvaške in Italije ter je nadgradila raziskovanje ekosistemov v severnem Jadranu in zalivu Chesapeake, ki je bilo leta 1999 že objavljeno v knjigi z naslovom *Ekosistemi na prehodu kopno-morje: Od porečja do morja*.

MEDNARODNI VIRTUALNI SIMPOZIJ V VRTINCU SPREMEMB

Ljubljana, 14. in 15. oktobra 2021

»Za rešitev planeta je treba ukrepati hitro,« je bilo sporočilo simpozija raziskovalk/raziskovalcev in strokovnjakinj/strokovnjakov, ki sta jih tik pred COP26 k dialogu povabila NIB in gibanje Mladi za podnebno pravičnost. Organizatorji simpozija z Nacionalnega inštituta za biologijo in iz gibanja Mladi za podnebno pravičnost so svoje misli strnili v Okoljskem manifestu, ki je bil po simpoziju na voljo najširši javnosti. V njem so predstavljeni ključni predlogi in rešitve v treh tematskih razpravah: o biotski raznovrstnosti, vodi in energetskem prehodu. NIB je želel s simpozijem ozavestiti in prispevati k povezovanju in sodelovanju v interdisciplinarnem dialogu med znanostjo, odločevalci in mladimi, na katere bo padlo največje breme spopadanja s težavami planeta v prihodnosti. Simpozij je potekal v času prvega dela 15. Konference pogodbenic o Konvenciji o biološki raznovrstnosti (COP15) in tik pred 26. Konferenco pogodbenic o podnebnih spremembah (COP26), osrednja tema simpozija pa so bili vodni ekosistemi. Izdana je bila tudi knjiga povzetkov s simpozija. Na dogodku je v

UPON ENTERING THE DECADE OF OCEANS 2021–2030, THE PIRAN MARINE BIOLOGICAL STATION PRESENTED A BOOK ON THREATENED MARINE ECOSYSTEMS AND COMPARED THE NORTHERN ADRIATIC WITH CHESAPEAKE BAY ON THE EAST COAST OF THE USA

Piran, 7 October 2021

As part of the commemoration of the 50th anniversary of the of the National Institute of Biology a few years ago, a book "Coastal ecosystems in transition: Comparative analysis of the northern Adriatic and Chesapeake bay" (2021) was published this year the renowned publishing house Wiley AGU. The book was created in collaboration between researchers from the USA, Slovenia, Croatia and Italy and upgraded the research of ecosystems in the northern Adriatic and Chesapeake Bay, which was already published in 1999 in the book titled "Ecosystems at the crossing of the mainland and the sea: From the river basin to the sea".

INTERNATIONAL VIRTUAL SYMPOSIUM "IN THE WHIRLWIND OF CHANGE"

Ljubljana, 14 and 15 October 2021

"It is necessary to act quickly to save the planet," was the message of the symposium of researchers and experts invited by the NIB and the Youth for Climate Justice Movement just before COP26. The symposium organisers from the National Institute of Biology and the Youth for Climate Justice summarised their thoughts into the Environmental manifesto, which was made available to the broadest public after the symposium. It presents key proposals and solutions in three thematic discussions: biodiversity, water and energy transition. The decision of the NIB to organise the symposium was based on the aim to raise awareness and contribute to the integration and cooperation in the interdisciplinary dialogue between science, decision makers and the young people, who will carry the greatest burden of addressing the planet problems in the future. The symposium took

dveh dneh sodelovalo kar 44 razpravljavk in razpravljavcev ter 21 predavateljev iz Slovenije, Francije, Brazilije in Avstralije. Medijski partner dogodka je bila agencija STA, kar je povečalo vidnost dogodka, zlasti med mediji. Prek kanalov na družbenih omrežjih NIB je promocija simpozija zabeležila več kot 59.700 prikazov, na dogodek se je prijavilo več kot 300 poslušalcev, aktivno pa je oba dneva predavanja poslušalo več kot 400 oseb.

NAGRADE MIROSLAVA ZEIA IN PRIZNANJA NACIONALNEGA INŠTITUTA ZA BIOLOGIJO

Ljubljana, 15. 12. 2021

Nacionalni inštitut za biologijo (NIB) je že dvanajstič podelil nagrade in priznanja Nacionalnega inštituta za biologijo, poimenovana po prof. dr. Miroslavu Zeiu, enem od njegovih ustanoviteljev. Nagrade Miroslava Zeia so bile podeljene posameznikom za izjemne dosežke na področjih osnovnih in uporabnih raziskav ved o življenju ter uresničevanja vizij in poslanstva NIB. Slavnostna podelitev nagrad Miroslava Zeia in priznanj Nacionalnega inštituta za biologijo je potekala v obliki video obeležja v sredo 15. 12. 2021. Slavnostni govorec dogodka je bil prof. dr. Franci Demšar, direktor Nacionalne agencije za kakovost v visokem šolstvu in predsednik UO NIB. V intervjuju je kot častni gost nastopil prof. dr. Alojz Ihan z Inštituta za mikrobiologijo in imunologijo Medicinske fakultete Univerze v Ljubljani.

Veliko nagrado Miroslava Zeia za življenjsko delo na področju dejavnosti NIB za leto 2021 je prejela izr. prof. dr. Jana Žel, vrhunska in mednarodno uveljavljena znanstvenica.

Strokovno nagrado Miroslava Zeia za izjemen prispevek na področju dejavnosti NIB za leto 2021 je prejel mag. Franc Potočnik, pomočnik direktorice in že vrsto let vodja finančno-računovodskega in splošnega področja na Nacionalnem inštitutu za biologijo.

MIROSLAV ZEI AWARDS AND RECOGNITIONS BY THE NATIONAL INSTITUTE OF BIOLOGY

Ljubljana, 15/12/2021

The National Institute of Biology held its twelfth presentation of awards and recognitions, named after Prof. Dr. Miroslav Zei, one of the institute's founders. The Miroslav Zei Awards were presented to individuals for their outstanding achievements in the area of basic and applicable research of life sciences, and fulfilling NIB visions and mission. A gala event of Miroslav Zei Awards presentation and the National Institute of Biology recognitions presentation took place over a video conference on Wednesday, 15/12/2021. The honorary patron of the event was Prof. Dr. Franci Demšar, director of the Slovenian Quality Assurance Agency for Higher Education and president of the NIB Board of Directors. Prof. dr. Alojz Ihan from the Institute of Microbiology and Immunology, Faculty of Medicine, University of Ljubljana participated in the interview as a guest of honour.

Nagrado Miroslava Zeia za izjemne znanstveno-raziskovalne dosežke na področju dejavnosti NIB v zadnjih petih letih so prejeli doc. dr. Bojana Žegura, dr. Polona Kogovšek in doc. dr. David Dobnik.

Prejemnici nagrade Miroslava Zeia za izjemno doktorsko delo na področju dejavnosti NIB v letu 2021 sta bili dr. Arijana Filipić in dr. Klara Hercog. Prejemniki priznanj za uspešno opravljeno doktorsko delo na področju dejavnosti NIB pa so bili dr. Martina Štampar, dr. Maja Zagorščak in dr. Domen Trkov.

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

Dr. Martina Štampar je prejela nagrado L'Oreal za ženske v znanosti za leto 2021.

Prof. dr. Kristina Gruden je prejela Preglovo nagrado Kemijskega inštituta za izjemne znanstvene dosežke.

Izr. prof. dr. Matjaž Kuntner, ki znanstveno deluje tako na ZRC SAZU kot NIB, je v letu 2021 kot priznanje za vrhunske znanstvene objave v zadnjih letih postal dobitnik priznanja zlati znak.

The Miroslav Zei Grand Award for lifetime achievement in the field of NIB activities for 2021 was awarded to Assoc. Prof. Dr. Jana Žel, top-level and internationally renowned scientist.

The Miroslav Zei Professional Award for outstanding contribution in the field of NIB activities for 2021 was awarded to M.Sc. Franc Potočnik – assistant to the director and for many years the head of the financial-accounting and general area at the National Institute of Biology.

Miroslav Zei Award for outstanding scientific research achievements in the field of NIB activity in the last five years was received by Doc. Dr. Bojana Žegura and Dr. Polona Kogovšek, and Doc. Dr. David Dobnik.

The recipients of the Miroslav Zei Award for outstanding doctoral work in the field of NIB activities in 2021 were Dr. Arijana Filipić and Dr. Klara Herzog. The recipients of the awards for successfully completed doctoral work in the field of NIB activities were Dr. Martina Štampar, Dr. Maja Zagorščak and Dr. Domen Trkov.

NIB'S RESEARCHERS RECEIVED SEVERAL AWARDS FROM SLOVENIAN PROFESSIONAL ASSOCIATIONS AND OTHER AWARDS:

Dr. Martina Štampar received the L'Oreal For Women in Science Award for 2021.

Prof. Dr. Kristina Gruden received the Pregl Award of the National Institute of Chemistry for outstanding scientific achievements.

Assoc. Prof. Dr. Matjaž Kuntner, who works scientifically at both Research Centre of the Slovenian Academy of Sciences and Arts (ZRC SAZU) and NIB, became the winner of the Golden Sign Award in 2021 in recognition of top-level scientific publications in recent years.

IZUMI IN INOVACIJE

Izumi in inovacije so rezultat raziskovalnega dela ter hkrati pomenijo nove možnosti in priložnosti za komercializacijo teh 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 predstavniki oddelkov NIB, Poslovnega odbora NIB in Službe za prenos tehnologij.

V letu 2021 je bila na podlagi skupne patentne prijave raziskovalcev NIB, IJS in FS UNI LJ z naslovom »Method and device for disinfection of liquid« vložena patentna prijava pri patentnem uradu ZDA.

Podobno je bila za skupni patent s podjetjem Ichorlabs d. o. o., po zahtevi za popolni preizkus na EPO, v letu 2021 vložena patentna prijava pri patentnem urad ZDA.

Raziskovalci Nacionalnega inštituta za biologijo, Kemijskega inštituta in Univerze v Ljubljani so novembra 2021 za izum Stabilizacijski pufer za zaščito RNA v slini vložili skupno patentno prijavo pri URSIL. Na podlagi predmetnega izuma so raziskovalci v kategoriji študenti/alumni prejeli tudi rektorjevo nagrado za naj inovacijo 2021 Univerze v Ljubljani.

V okviru projekta Prenos tehnologij iz JRO v gospodarstvo (KTT) so sodelavci v Službi za prenos tehnologij v letu 2021 z namenom krepitve znanj in kompetenc s področja obvladovanja intelektualne lastnine in prenosa tehnologij za zaposlene v Službi in za raziskovalce (so)organizirali širok nabor posvetov, izobraževanj in delavnic s področja upravljanja intelektualne lastnine.

INVENTIONS AND INNOVATIONS

Inventions and innovations are the results of research work and also represent a note of opportunities for commercialising the results in cooperation with partners in the industry. The field of inventions and innovations at NIB is managed by the Inventions Commission, comprised of researchers, put forward by the various NIB departments, NIB Business Committee and representatives of the Technology Transfer Office.

In 2021, a patent application "Method and device for disinfection of liquid" to the US Patent Office was filed on the basis of a common patent application by the researchers of NIB, IJS and FS UNI LJ.

Similarly, a patent application to the US Patent Office was filed in 2021 for the joint patent with Ichorlabs d.o.o., following a request for a full test for the EPO.

In November 2021, researchers of the National Institute of Biology, the Institute of Chemistry and the University of Ljubljana submitted a joint patent application to URSIL for the invention "Stabilisation buffer for the protection of RNA in saliva". On the basis of this invention, researchers in the Students/Alumni category also received the Rector Award for the best innovation of the University of Ljubljana 2021.

As part of the Technology Transfer from Public Research Agencies to the Economy (CTT) project, the colleagues in the Technology Transfer Office (co)organised a wide range of consultations, trainings and workshops in 2021 in the field of intellectual property management for the employees of the Office and the researchers – with the aim of strengthening knowledge and competences in the field of intellectual property management and technology transfer.

Za namene osveščanja in usposabljanja raziskovalcev na področju upravljanja z intelektualno lastnino v najširšem pomenu ter drugih deležnikov inovacijskega okolja sta bila v letu 2021 v okviru istega projekta izdana priročnika Zaščita in trženje tehnologij za raziskovalce in podjetja (zbornik prispevkov partnerjev konzorcija za prenos tehnologij iz JRO v gospodarstvo) ter priročnik za upravljavce inovacijskega sistema z naslovom Modrosti iz podpornega okolja za inovacije.

For the purpose of raising awareness and training of researchers in the field of intellectual property management in the broadest sense, as well as other stakeholders in the innovation environment, the manuals titled "The Protection and marketing of technologies for the researchers and companies (the collection of contributions by partners of the consortium for the transfer of technologies from Public Research Agencies to the economy") and the Handbook for managers of the innovation system "Wisdom from the supporting environment for innovation" were published in 2021.

Rak koščak (*Austropotamobius torrentium*) živi v celinskih vodah, čez dan se večinoma skriva pod kamni (foto: Davorin Tome).
The stone crayfish lives (*Austropotamobius torrentium*) in inland waters and usually hides under stones during the day (Photo: Davorin Tome).

PRENOS ZNANJA V GOSPODARSTVO

Upravljanje trženja izdelkov in storitev na NIB je sistemsko v domeni Službe za prenos tehnologij.

V okviru Konzorcija za prenos tehnologij iz JRO v gospodarstvo, ustanovljenega leta 2017, tudi pisarna na NIB izvaja različne dejavnosti za podporo raziskovalcem z namenom pospešitve prenosa znanj v gospodarstvo oziroma povečanja deleža tržnih prihodkov v celotnih prihodkih NIB.

Pri tem gre za izvedbo izobraževanj, usposabljanj in svetovanj na področjih izdelave poslovnih načrtov, trženja izdelkov in storitev ter načinov sodelovanja z gospodarstvom.

Te dejavnosti se izvajajo v okviru petletnega projekta KTT (2017–2022) Konzorcija za prenos tehnologij iz JRO v gospodarstvo, financiranega s strani MIZŠ, katerega namen je spodbuditi krepitev povezav in sodelovanja med javnimi raziskovalnimi organizacijami in gospodarstvom ter krepitev kompetenc pisarn za prenos tehnologij, raziskovalcev in podjetij.

V letu 2021 velja posebej izpostaviti ustanovitev Svetovalnega odbora projekta KTT. Ta odbor je ponudil izjemno priložnost za izmenjavo izkušenj in dobrih praks na področju prenosa tehnologij med predstavniki pisarn za prenos znanja ter vodstvi izobraževalnih in raziskovalnih organizacij, drugih deležnikov inovacijskega okolja v Sloveniji in predstavnikov industrije.

Raziskovalci NIB so na povabilo organizatorjev in naših partnerjev iz konzorcija KTT (Univerza v Ljubljani, Univerza v Mariboru) tudi v letu 2021 sodelovali na spletnem festivalu UNI.MINDS (povezovanje med industrijo in univerzo, november 2021).

Po večletnih sistematičnih raziskovalnih in trženjskih dejavnostih na področju izvajanja molekularnih metod za kvantifikacijo virusov za gensko terapijo je v letu 2021 prišlo do realizacije licenčne pogodbe z ustanovljenim odcepljenim podjetjem Niba Labs d. o. o.

TRANSFER OF KNOWLEDGE TO THE ECONOMY

The management of the marketing of products and services at NIB is systemically in the domain of the Technology Transfer Office.

Within the framework of the Consortium for Technology Transfer from Public Research Agencies to the Economy, established in 2017, the NIB office also performs various activities for the support of researchers with an intention to accelerate the transfer of knowledge to the economy and to increase the share of market revenues in the total NIB revenues.

This includes education, training, and consultations on business planning, marketing of products and services, and ways of cooperating with the economy.

These activities are performed as part of a five-year CTT project (2017–2022) – the Consortium for Technology Transfer from Public Research Agencies to the Economy, funded by the Ministry of Education, Science and Sport, which aims to encourage strengthening links and cooperation between public research organisations and the economy, and strengthening the competences of technology transfer offices, researchers, and businesses.

In 2021, special emphasis should be placed on the establishment of the Advisory Committee of the CTT. This forum offered an excellent opportunity to exchange experiences and good practices in the field of technology transfer between representatives of the Knowledge Transfer Offices and the leaders of educational and research organisations, other stakeholders of the innovation environment in Slovenia and representatives of the industry.

At the invitation of organisers and our partners from the CTT consortium (University of Ljubljana, University of Maribor), NIB researchers again took part in the online festival UNI.MINDS in 2021 (joining industry and university, November 2021).

NIB je na novoustanovljeno podjetje Niba Labs z licenčno pogodbo prenesel znanje in tehnologije s področja analitskih postopkov v procesih proizvodnje in karakterizacije ter kvantifikacije virusov kot genskih vektorjev ali cepiv in nečistoč. NIB in Niba Labs načrtujeta sodelovanje pri nadaljnjem razvoju in trženju tehnologij na področju karakterizacije in kvantifikacije terapevtskih virusov, ki se uporabljajo za gensko zdravljenje.

Raziskovalne dejavnosti na področju razvoja metod za preizkušanje učinkovitosti materialov za protivirusno in protibakterijsko delovanje so vodile k licenčnemu dogovoru o prenosu znanja in postopkih preizkušanja zaščitnih mask – določanje učinkovitosti filtracije bakterij BFE – s podjetjem Lotrič Meroslovje, s katerim je NIB sodeloval že v fazi razvoja. Podjetje bo zdaj lahko ponudilo tržno zanimiv nabor preizkusov za zaščitne maske.

V drugi polovici leta 2021 je bila posebna pozornost namenjena dejavnostim oziroma prepoznavanju projektov NIB s tržnim potencialom za pridobivanje sredstev iz v letu 2022 načrtovanega sklada CEETT (Central Eastern European Technology Transfer Platform) Proof of concept SID banke, Hrvaške banke za obnovo in razvoj in Evropskega investicijskega sklada EIF.

V letu 2021 smo pripravili pogodbo z gospodarstvom (Lek d. d.) za izvajanje študij mutagenosti skladno z načeli dobre laboratorijske prakse (DLP) po OECD. S številnimi domačimi in tujimi podjetji smo sodelovali pri preizkušanju biološke združljivosti medicinskih pripomočkov, vključno s preizkusi zaščitnih obraznih mask *in vitro*, in njihove ustreznosti za človekovo uporabo po standardu ISO 10993-1.

V letu 2021 smo nadaljevali s projektom v sodelovanju z večnacionalnim biofarmacevtskim podjetjem MGC Pharmaceuticals Ltd., v okviru katerega preizkušamo protirakavo delovanje kanabinoidnih pripravkov.

Following systematic multiannual research and marketing activities in the field of the implementation of molecular methods for the quantification of viruses for gene therapy, the licensing contract with the spin-off company of Niba Labs d.o.o. was realised in 2021.

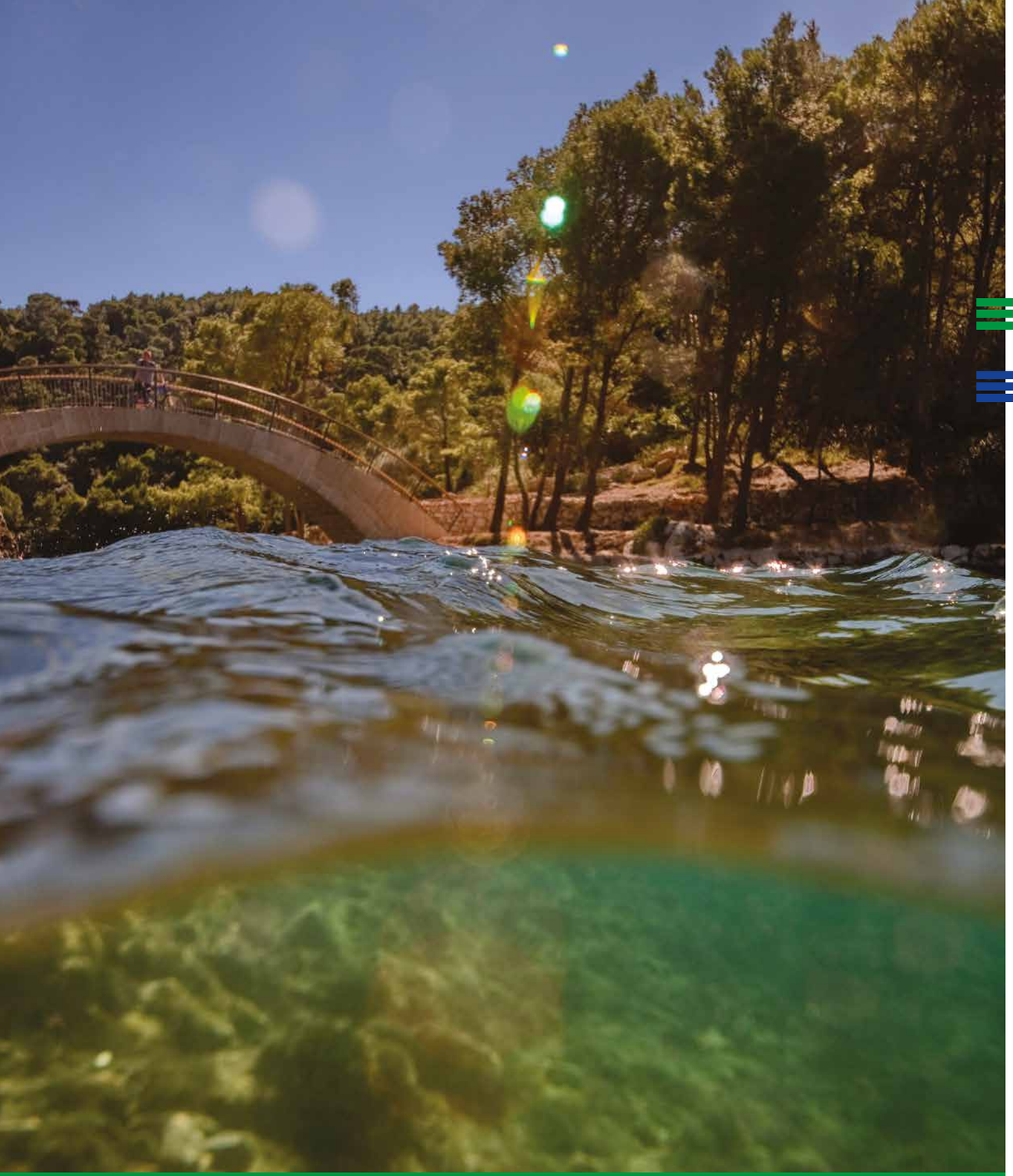
NIB transferred the knowledge and technology with a license agreement to the newly founded company of Niba Labs in the field of analytical procedures in production processes, and characterisation and quantification of viruses as genetic vectors or vaccines and impurities. NIB and Niba Labs are planning to cooperate on the further development and marketing of technologies in the field of characterisation and quantification of therapeutic viruses used for gene therapy.

Research activities in the field of development of methods for testing the effectiveness of antivirus and antibacterial materials have resulted in a licensing agreement on the transfer of knowledge and testing procedures for protective masks – determining the effectiveness of filtration of BFE bacteria – with Lotrič Meroslovje, with whom the NIB cooperated already in the development phase. The company will now be able to offer a market interesting set of tests for protective masks.

In the second half of 2021, special attention was paid to the activities or identifications of NIB projects with a market potential for obtaining funds from the CEETT (Central Eastern European Technology Transfer Platform) Proof of concept of the SID Bank, the Croatian Bank for Reconstruction and Development and the EIF European Investment Fund, planned in 2022.

In 2021, we prepared a contract with the economy (Lek d.d.) for the implementation of mutagenicity studies in accordance with the OECD Good Laboratory Practice principles (GLP). We have worked with many domestic and foreign companies in testing the biocompatibility of medical devices, including in vitro protective facial masks, and their suitability for human use, according to ISO10993-1 standard.

In 2021, we continued the project with the multinational biopharmaceutical company MGC Pharmaceuticals Ltd., testing the anti-cancer activity of cannabinoid preparations.



Na vhodu v Mljetsko jezero (foto: Tihomir Makovec).
At the entrance to Lake Mljet (Photo: Tihomir Makovec).

SKUPNE SLUŽBE

JOINT 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-a 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.

Joint services manages individual business functions at the Institute, for example finance and accounting, staff administration, public procurement, general affairs, IT system management, administrative support for NIB bodies and the like. It also performs support activities for the research organisational units, particularly administrative technical support for project management and support for the transfer of knowledge and technologies.

The Biology Library operates within Joint Services and is managed jointly by NIB and the Department of Biology of the Biotechnical Faculty. It is situated at two locations: at the Biology Centre in Ljubljana and at Marine Biology Station Piran.

OSEBJE
STAFF

DIREKTORICA DIRECTOR
Ravnikar, Maja

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

POMOČNICA DIREKTORICE ZA PRAVNO IN SPLOŠNO PODROČJE TER JAVNA NAROČILA
Tomšič, Alenka

GLAVNA PISARNA MAIN OFFICE
Jogan, Neža
(od septembra from September 2021)
Malec, Maja

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

RAČUNOVODSTVO ACCOUNTING
Čižman, Anka
(od septembra from September 2021)
Pestotnik, Irena
(od avgusta from August 2021)
Praček, Mateja
Rak, Mojca
(do avgusta until August 2021)
Retelj, Andreja
Župevec, Nataša

KADROVSKE ZADEVE HUMAN RESOURCES
Goršič, Dunja

PROJEKTNA PISARNA PROJECT OFFICE
Končar, Helena
Miklič Milek, Damjana
(od aprila from April 2021)
Tekavec Bembič, Martina

PISARNA ZA PRENOS TEHNOLOGIJ TECHNOLOGY TRANSFER OFFICE
Vindišar, Jure

JAVNA NAROČILA LEGAL DEPARTMENT
Čretnik, Metka
(od septembra from September 2021)
Tomšič, Alenka

SLUŽBA ZA UPRAVLJANJE STAVB
Gostinčar, Majda
(od julija from July 2021)
Pikovnik, Simon
(do februarja from February 2021)

KNJIŽNJICA LIBRARY
Černač, Barbara
Glavač, Lučka

Vetrnice *Paranemonia cinerea* kot epibionti na listu morske trave (foto: Borut Mavrič).
Anemones of *Paranemonia cinerea* as epibionts on a seagrass leaf (Photo: Borut Mavrič).

Kamnite skale v infralitoralnem pasu slovenskega morja (foto: Tihomir Makovec).
Rocks in the infralittoral zone of the Slovenian Sea (Photo: Tihomir Makovec).

MORSKA BIOLOŠKA POSTAJA PIRAN

MARINE BIOLOGY STATION PIRAN

spremenljivost in odzivnost morskih ekosistemov

variability and resilience of marine ecosystems

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 tudi vodja raziskovalnega programa ARRS Raziskave obalnega morja ter izredna profesorica za področje ekologije na Univerzi na Primorskem. Njeno področje dela so raziskave fitoplanktona obalnih morij, kar vključuje raziskave dolgoročnih sprememb fitoplanktonske združbe, zlasti z vidika 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 (UNESCO/IOC HAB program).

Assoc. Prof. Dr. Patricija Mozetič has been Head of Unit Marine Biological Station Piran since March 2018. She is also Head of the Slovenian Research Agency (ARRS) research programme “Coastal Sea Research” and Associate Professor of Ecology at the University of Primorska. Her research work focuses on research of phytoplankton in coastal seas, which includes research into long-term changes in phytoplankton communities – especially in the light of climate changes –, ecology and the taxonomy of harmful algal blooms, photosynthetic properties and primary production. She is the chairperson of the National Committee of the Intergovernmental Oceanographic Commission (NO IOC) at the Slovenian National Commission for UNESCO and represents Slovenia in the Intergovernmental Panel on Harmful Algal Blooms (UNESCO/IOC HAB programme).

Vzorčevanje na grebenu sredozemske kamene korale (*Cladocora caespitosa*) v Velikem Mljetskem jezeru (foto: Tihomir Makovec).
Sampling on the reef of the Mediterranean stony coral (*Cladocora caespitosa*) in the Great Mljet Sea (Photo: Tihomir Makovec).

KLJUČNE DEJAVNOSTI

Na Morski biološki postaji Piran (MBP) raziskujemo morske ekosisteme ter ustvarjamo znanja za razumevanje procesov in sprememb v morju, ki jih sprožajo podnebne spremembe in drugi antropogeni dejavniki. S tem zagotavljamo strokovne podlage za trajnostni razvoj morskega in obalnega prostora. Večina temeljnih raziskav poteka v okviru programa ARRS Raziskave obalnega morja (P1-0237), ki se v manjši meri dopolnjuje z raziskovalnim programom P1-0143, ki večinoma poteka na IJS.

Specifična področja raziskav in druge dejavnosti MBP:

- Preučevanje različnih ravni biološke raznovrstnosti – od genov in vrst 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 preučujemo tudi procese.
- Prepoznavanje gonilnih sil sprememb v morskem okolju in biotski raznovrstnosti. Poudarek je na antropogenih pritiskih in vplivih, ki so najpomembnejši dejavniki sprememb morskega okolja in biotske raznovrstnosti na lokalni in globalni ravni (onesnaževanje, urbanizacija, promet, marikultura, evtrofikacija, podnebne spremembe in bioinvazija). Posebno mesto med onesnažili ima (mikro)plastika. Učinke onesnažil v organizmih preučujemo predvsem na subcelični ravni.
- Raziskave raznovrstnosti morskih mikrobnih združb, interakcij mikroorganizmov z drugimi organizmi, zlasti želatinoznim planktonom, in vloge mikrobov pri biogeokemičnem kroženju snovi.
- Obravnavanje družbenih potreb na področju proizvodnje hrane in biotehnologije, ki v ravnovesju z varstvom narave ohranjajo zdrava morja.
- Raziskujemo dinamiko vodnih mas v obalnem in odprtem morju z meritvami in modeliranjem, razvijamo avtomatizirano obdelavo podatkov ter krepimo razvoj opazovalne in informacijske infrastrukture na morju.
- Na podlagi javnega pooblastila Agencije RS za okolje izvajamo programe monitoringa morja za vrednotenje ekološkega in okoljskega stanja z biološkimi elementi skladno z državno in evropsko okoljsko zakonodajo (ODMS 2008/56/ES in ODV 2000/60/ES) ter sodelujemo pri oblikovanju evropskih okoljskih politik.
- Povezujemo se v mrežo evropskih morskih bioloških postaj (MARS), smo člani združenj EuroMarine in EuroGOOS ter partner v slovenskem konzorciju LifeWatch Slovenija. V okviru teh povezav in evropskih projektov razvijamo inovativne raziskovalne metodologije in raziskovalne koncepte, omogočamo dostop do bioloških virov in zgodovinskih podatkov iz opazovanj, najsodobnejše eksperimentalne in analitske zmogljivosti ter napredne možnosti izobraževanja.
- Z različnimi stalnimi dejavnostmi, kot so dan odprtih vrat Morske biološke postaje Piran, objavljanje prispevkov 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.

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

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

KEY ACTIVITIES

We at the Marine Biology Station Piran (MBP) explore marine ecosystems and create knowledge to understand the processes and changes in the sea caused by climate change and other anthropogenic factors. Thus, we provide professional bases for the sustainable development of the marine and coastal space. Most of the basic research is carried out under the programme "Coastal Sea Research" (P1-0237) of the Slovenian Research Agency (ARRS), which is complemented to a lesser extent by the P1-0143 research programme, taking place mostly at the IJS.

Specific areas of research and other activities of MBP

- Researching various levels of biological diversity – from genes and species to the diversity of habitats and communities (plankton, benthic invertebrates, macroalgae, riparian fish communities, seagrass meadows, biogenic formations). We include comparative genomics approaches and evolutionary aspects in our research, and we also study processes in addition to the structure.
- Recognising the main driving force behind the changes in the marine environment and biodiversity. The focus is on anthropogenic impacts, which is the main reason for changes in the marine ecosystem and biodiversity at a local as well as global level (pollution, urbanisation, traffic, mariculture, eutrophication, climate changes and bioinvasion). A special place among pollutants belongs to (micro) plastics. The effect of pollutants in organisms is mostly studied at a subcellular level.
- Studying the diversity of marine microbial communities, interactions of microorganisms with other organisms, especially gelatinous plankton, and the role of microbes in the biogeochemical cycle of matter.
- Addressing the societal needs related to food production and biotechnology that – in balance with nature protection – maintain healthy seas.
- Studying the dynamics of water masses and modelling in the coastal and open sea, develop automated data processing, and strengthen the development of observation and information infrastructure at sea.
- Implementing marine monitoring programmes – based on the public authorisation of the Slovenia Environment Agency – for the assessment of ecological and environmental status with biological elements in compliance with national and European environmental legislation (ODMS 2008/56/EC and ODV 2000/60/EC). We participate in the planning of international environmental policies.
- Being a member of the European Network of Marine Stations (MARS), a member of the EuroMarine and EuroGOOS associations and a partner in the Slovenian consortium LifeWatch Slovenia. Through these links and European projects, we develop innovative research methods and concepts, provide access to biological resources and historical observational data, state-of-the-art experimental and analytical capabilities, and advanced training opportunities.
- Various ongoing activities, such as the Marine Biology Station Open Day, publishing articles in popular and professional journals, providing information to the media and organising lectures for different age groups help to spread knowledge about the sea and improve marine literacy among professionals and the general public.

The research programme is complemented by basic and applied projects of the Slovenian Research Agency (ARRS), where we have the role of leading or participating partner, and European projects from various funding programmes (H2020, Interreg, DG).

By performing professional tasks for different users, we support both governmental and public institutions and companies in the sustainable economic and social development of the coastal zone and the sea. MBP researchers participate in knowledge and technology transfer to the business community by conducting oceanographic and ecological research, and to users in the fisheries and agricultural sectors.

GLAVNI DOSEŽKI V LETU 2021

PROJEKTI

MBP je pridobila nov raziskovalni program Morska in mikrobna biotehnologija (P4-0432) v obsegu 2,5 FTE (obdobje financiranja 2022–2027), ki ga vodi dr. Ana Rotter, sodelujoči instituciji pa sta IJS in UL BF. S tem se na MBP odpira novo raziskovalno področje, ki ima velik potencial pri temeljnih, zlasti pa uporabnih raziskavah ter pri sodelovanju z industrijo in drugimi deležniki (npr. ribištvo).

Začel se je projekt LIFE z naslovom Conservation and re-stocking of the *Pinna nobilis* in the western Mediterranean and Adriatic sea, ki ga vodi Deželna agencija za okolje Ligurija (ARPAL, Italija), MBP pa sodeluje kot partner. Cilj projekta je ohraniti leščurje v zahodnem Sredozemlju in Jadranskem morju, vključno s slovenskim, s posebnimi ukrepi za ohranjanje in ponovno naselitvijo na pilotnih območjih, ki so skladni s Strategijo za biotsko raznovrstnost in Morsko strategijo.

Postali smo partnerji dveh projektov COST (CA20102 MAF-WORLD – Marine Animal Forest of the world in CA20106 – Tomorrow's 'wheat of the sea': Ulva, a model for an innovative mariculture). Pri obeh, ki bosta trajala štiri leta, sodelujemo v upravljalnem odboru.

V okviru projekta COST (CA18238 – Ocena4Biotech) je MBP organizirala več delavnic za zunanje udeležence in sestankov za partnerje projekta. Odmevna je bila tudi delavnica za zagon modre biotehnologije v Sloveniji, na kateri so se predstavili MBP s projektom B-Blue (Interreg Med), IJS in Tehnološki park Ljubljana s projektoma Blue Biomed in Panoramed ter SVRK v okviru strateških načrtov za Slovenijo.

Oktobra je na MBP potekala predstavitev knjige Coastal Ecosystems in Transition: A Comparative Analysis of the Northern Adriatic and Chesapeake Bay, ki je izšla 2021 pri založbi AGU-Wiley. Častna gosta na dogodku sta bila g. Michael Marble z veleposlaništva ZDA v Sloveniji, ki je izrazil zadovoljstvo ob uspešnih raziskovalnih projektih, in g. Karlo Radovac, podžupan Občine Piran, ki je poudaril pomen raziskave za lokalno okolje. Hibridni dogodek si je prek kanalov NIB in na spletni strani STA v živo ogledalo 230 gledalcev. Knjigo je založba AGU-Wiley pozneje uvrstila med štiri knjige, s katerimi se je predstavila v zbirki COP26. na Konferenci ZN o podnebnih spremembah v Glasgowu.

Ob zaključku dogodka je Robert Turk, predsednik Nacionalnega odbora za Desetletje oceanov pri Slovenski nacionalni komisiji za UNESCO, obeležil začetek programa OZN Desetletje oceanov 2021–2030 v Sloveniji. Odbor šteje 15 članov, vanj pa so bili imenovani tudi raziskovalci MBP.

Uspešno smo zaključili projekt Konzorcij evropske infrastrukture za e-znanost in tehnologijo za raziskave biotske raznovrstnosti in ekosistemov RI-SI-2 LifeWatch, ki ga je financiralo MIZŠ iz sredstev Evropskega sklada za regionalni razvoj (december 2019–december 2021). Vrednost dodeljenih sredstev za NIB je znašala 340.556,65 EUR za nakup opreme in stroške dela. Projekt je vključeval partnerje slovenskega konzorcija LifeWatch, vodil pa ga je ZRC SAZU, Inštitut za raziskovanje Krasa. Kupili smo naslednjo opremo: centrifugo, Q-PCR, vrstični elektronski mikroskop na MBP in mini sekvenator nove generacije na oddelku EKOS. Nakup opreme podpira vključevanje slovenskih institucij v LifeWatch – ERIC, katerega polnopravna članica je tudi Slovenija. Nova oprema bo omogočila razvoj raziskav od genomov do sestave združb.

MAJOR ACHIEVEMENTS IN 2021

PROJECTS

MBP has acquired a new research programme entitled "Marine and microbial biotechnology" (P4-0432) with 2.5 FTE (the funding period 2022–2027), led by Dr. Ana Rotter, and the participating institutions are the IJS and the UL BF. This opens up a new research area at the MBP, which has a great potential in fundamental, useful research and in cooperation with industry and other stakeholders (e.g. fisheries).

LIFE project titled "Conservation and restocking of the *Pinna nobilis* in the western Mediterranean and Adriatic sea" started, led by the Liguria Regional Environment Agency (ARPAL, Italy) and MBP cooperating as a partner. The aim of the project is to preserve the fan mussel in the western Mediterranean and the Adriatic Sea, including the Slovenian one, with special conservation and reintroduction measures in pilot areas in compliance with the Biodiversity Strategy and the Marine Strategy.

We have become partners of two COST projects (CA20102 MAF-WORLD – Marine Animal Forest of the world in CA20106 – Tomorrow's "wheat of the sea": Ulva, a model for an innovative mariculture). Both will last four years and we participate in the Management Board.

Within the COST project (CA18238 Ocena4Biotech) MBP organised several workshops for external participants and meetings for the project partners. The workshop for the launch of blue biotechnology in Slovenia was also highly visible, where MBP presented itself with the B-Blue project (Interreg Med), IJS and Technology Park Ljubljana with the Blue Biomed and Panoramed projects, and SVRK within the strategic plans for Slovenia.

MBP hosted the presentation of the book "Coastal Ecosystems in Transition: A Comparative Analysis of the Northern Adriatic and Chesapeake Bay", published by AGU-Wiley in 2021. Honourable guests at the event were Mr. Michael Marble from the U.S. Embassy in Slovenia, who expressed satisfaction with successful research projects and Mr. Karlo Radovac, Deputy Mayor of the Municipality of Piran, who emphasised the importance of research conclusions for the local environment. The hybrid event was followed by 230 viewers via the NIB channels and the Slovenian Press Agency (STA) website. The publisher AGU-Wiley later included the book in its collection, which was used for the presentation in the COP26 showcase at the UN Climate Change Conference in Glasgow.

At the end of the event, the president of the National Decade Committee at the Slovenian National Commission for UNESCO, Robert Turk, marked the start of the UN Decade of Ocean Science 2021–2030 in Slovenia. The Committee has 15 members, with MBP researchers also appointed.

We have successfully completed the project Consortium of European Infrastructure for e-Science and Technology for Biodiversity and Ecosystem Research RI-SI-2 LifeWatch, funded by the Ministry of Education, Science and Sport from the Regional Development Fund (December 2019–December 2021). The value of the funds allocated to NIB amounted to EUR 340,556.65 for the purchase of equipment and labour costs. The project included partners of the Slovenian LifeWatch consortium and was led by Research Centre of the Slovenian Academy of Sciences and Arts (ZRC SAZU), the Karst Research Institute. We purchased the following equipment: centrifuge, Q-PCR, scanning electron microscope at MBP and a new generation mini sequencer in the EKOS department. The procurement of equipment supports the integration of Slovenian institutions into LifeWatch – ERIC, with Slovenia being a full member. The new equipment will make it possible to advance research from the genome to community composition.

ZNANSTVENA ODLIČNOST

V letu 2021 smo objavili 34 izvirnih in osem preglednih znanstvenih člankov. Od skupno 42 znanstvenih člankov jih je bilo 37 objavljenih v revijah s faktorjem vpliva (IF), večina (17) je bila kategoriziranih kot veliki znanstveni dosežki (A'), dva pa sta bila iz kategorije izjemnih dosežkov (A''). Bili smo tudi uredniki in soavtorji sedmih poglavij v znanstveni monografiji Coastal Ecosystems in Transition: A Comparative Analysis of the Northern Adriatic and Chesapeake Bay [COBISS.SI-ID 48797699] in soavtorji enega poglavja v drugi znanstveni monografiji The Montenegrin Adriatic coast: marine chemistry pollution iz serijske publikacije *The handbook of environmental chemistry* [COBISS.SI-ID 81495299], ki sta izšli pri tujih založbah (AGU-Wiley in Springer).

Kot velike dosežke izpostavljamo članka v reviji *Ecological Indicators*, ki spada v kategorijo A'', [COBISS.SI-ID 58907907] in [COBISS.SI-ID 52889091], ter pregledni članek o osnovah morske biotehnologije v reviji *Frontiers in marine science*, ki je po manj kot enem letu od objave prejel že 20 čistih citatov [COBISS.SI-ID 55345411].

Oktobra 2021 je z zagovorom doktorata na Mednarodni podiplomski šoli IJS uspešno zaključil usposabljanje mladi raziskovalec Timotej Turk Dermastia pod mentorstvom dr. Patricije Mozetič in somentorstvom dr. Andreje Ramšak.

PRISPEVEK K PROMOCIJI IN POPULARIZACIJI ZNANOSTI

Raziskave in druge dejavnosti MBP so bile tudi v letu 2021 deležne velikega odziva v javnosti in medijih.

Eden odmevnejših projektov je bil Pirati plastike – dajmo, Evropa, ki ima značilnosti ljubiteljske znanosti. Pirati so bili predstavljeni na več domačih in tujih dogodkih s strani vodje projekta dr. Mateje Grego z MBP in takratne ministrice dr. Simone Kustec z MIZŠ v času predsedovanja Slovenije Svetu EU (npr. Dnevi LAK, konferenca All-Atlantic 2021, konferenca Novi evropski raziskovalni prostor, Mesec znanosti).

Predstavniki GZS so organizirali obisk partnerjev projekta QUALIFY Interreg Europe na MBP. Večinoma so to bili predstavniki inšpekcijskih služb iz več evropskih držav in z Uprave za varno hrano, veterinarstvo in varstvo rastlin iz Slovenije. Dr. Andreja Ramšak je imela predavanje o poneverbah lignjev na slovenskem tržišču, ki je bilo opravljeno v okviru projekta CRP projekta »Uporaba tehnologije DNA za ugotavljanje poneverb v ribiških proizvodih z vrednotenjem socioekonomskih vidikov«.

MBP je oktobra je obiskalo 35 znanstvenih atašejev članic EU in predstavnikov MIZŠ kot gostiteljev v Sloveniji. Večdnevni delovni obisk v Sloveniji so gostje zaključili na MBP, kjer so se seznanili z raziskavami in znanstveno odličnostjo NIB in MBP.

SCIENTIFIC EXCELLENCE

In 2021, we published 34 original and eight review scientific articles. Out of a total of 42 scientific articles, 37 were published in journals with an impact factor (IF), most (17) were categorised as major scientific achievements (A'), and two were categorised as outstanding achievements (A''). We participated as editors and co-authors in seven chapters in a scientific monograph titled "Coastal Ecosystems in Transition: A Comparative Analysis of the Northern Adriatic and Chesapeake Bay" [COBISS.SI-ID 48797699], and co-authors of one chapter in another scientific monograph titled "The Montenegrin Adriatic coast: marine chemistry pollution" from *The handbook of environmental chemistry* [COBISS.SI-ID 81495299], published by the foreign publisher (AGU-Wiley and Springer).

As a major achievement, we highlight two articles in the journal *Ecological Indicators*, which belong to a category A'' [COBISS.SI-ID 58907907], [COBISS.SI-ID 52889091], and a review article about the basics of marine biotechnology in the journal *Frontiers in marine science*, which got 20 clean quotes [COBISS.SI-ID 55345411] in less than a year after its publication.

A young researcher Timotej Turk Dermastia, under the mentorship of Dr. Patricija Mozetič and Dr. Andreja Ramšak as a co-menthor, successfully completed his training with the defence of his doctorate in 2021 at the Jožef Stefan International Postgraduate School.

CONTRIBUTION TO THE PROMOTION AND POPULARISATION OF SCIENCE

Research and other activities of the MBP were highly visible among the public and the media in 2021 too.

One of the most visible projects was the citizen science project entitled "The pirates of plastics – Let's go, Europe". The Pirates were presented at several domestic and foreign events, both by the project manager Dr. Mateja Grego from MBP and Dr. Simona Kustec, Minister of Education, Science and Sport during Slovenia's presidency of the EU Council (e.g. LAK Days, All-Atlantic 2021 conference, New European Research Area conference, the Science Month).

Representatives of the Chamber of Commerce and Industry of Slovenia (GZS) organised a visit of the partners of the QUALIFY Interreg Europe project at MBP. They were mostly representatives of inspection services from several European countries and from the Administration for Food Safety, Veterinary and Plant Protection from Slovenia. Dr. Andreja Ramšak gave a lecture on squid fraud on the Slovenian market, which was carried out as a part of the CRP project "The use of DNA technology in fishery products with socioeconomic impact assessment".

In October, MBP was visited by 35 scientific attachés of EU members and representatives of the Ministry of Education, Science and Sport as their hosts in Slovenia. The guests concluded their multi-day working visit to Slovenia at MBP, where they learned about the research and scientific excellence of NIB and MBP.

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BIBLIOGRAPHY

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2	Predgovor, spremna beseda Preface, Afterword
1	Polemika, diskusijski prispevek, komentar Polemic, Discussion, Commentary
7	Intervju Interview
2	Drugi sestavni deli Other Component Parts
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1	Magistrsko delo Master's Thesis
4	Končno poročilo o rezultatih raziskav Final Research Report
3	Elaborat, predštudija, študija Treatise, Preliminary Study, Study
12	Radijska ali televizijska oddaja Radio or Television Broadcast
2	Zaključena znanstvena zbirka raziskovalnih podatkov
11	Druge monografije in druga zaključena dela Other Monographs and Other Completed Works
2	Strokovni film, videoposnetek ali zvočni posnetek
13	Radijski ali TV dogodek Radio or Television Event
12	Prispevek na konferenci brez natisa Unpublished Conference Contribution
3	Vabljeno predavanje na konferenci brez natisa Unpublished Invited Conference Lecture
5	Druga izvedena dela Other Performed Works
12	Uredništvo Editorship

Boj za prostor - preplet različnih filtratorskih organizmov v obrasti (foto: Tihomir Makovec).
Struggle for space - intertwining of different philtre-feeding organisms in vegetation (Photo: Tihomir Makovec).

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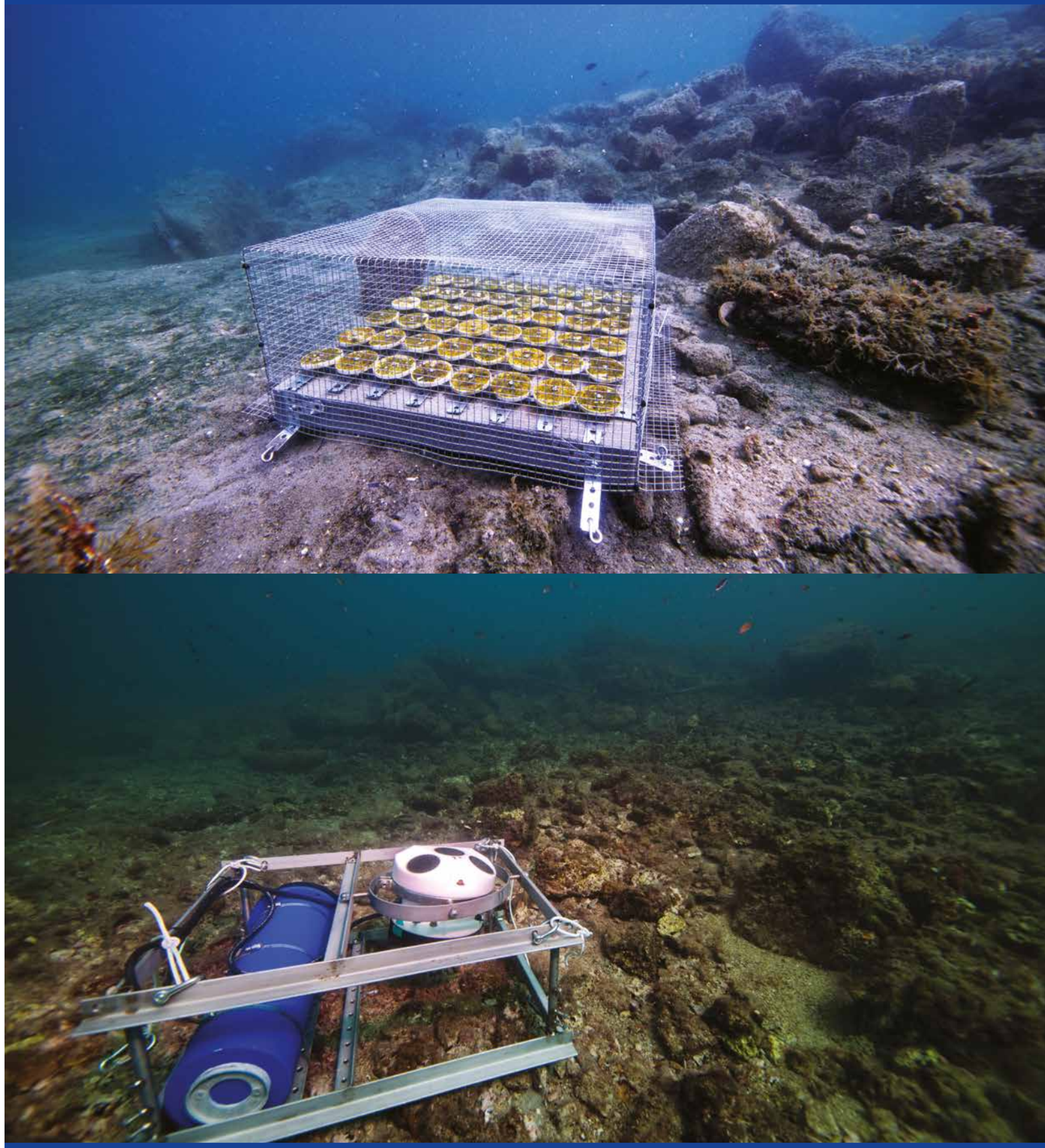
Eksperiment vzgoje in ponovnega naseljevanja alg cistozir (foto: Tihomir Makovec).
An experiment on the rearing and recolonization of cystozyra algae (Photo: Tihomir Makovec).



Merjenje tokov na grebenu sredozemske kamene korale v Velikem Mljetskem jezeru (foto: Tihomir Makovec).
Measurement of currents on the reef of the Mediterranean stony coral in the Great Mljet Sea (Photo: Tihomir Makovec).

Če si nečesa zares želite,
res trdo delate in nikoli
ne obupate, boste našli pot.
Sledite svojim sanjam.

Jane Goodall,
primatologinja, etologinja in antropologinja

If you really want something,
and really work hard,
and take advantage of opportunities,
and never give up, you will find a way.
Follow your Dreams.

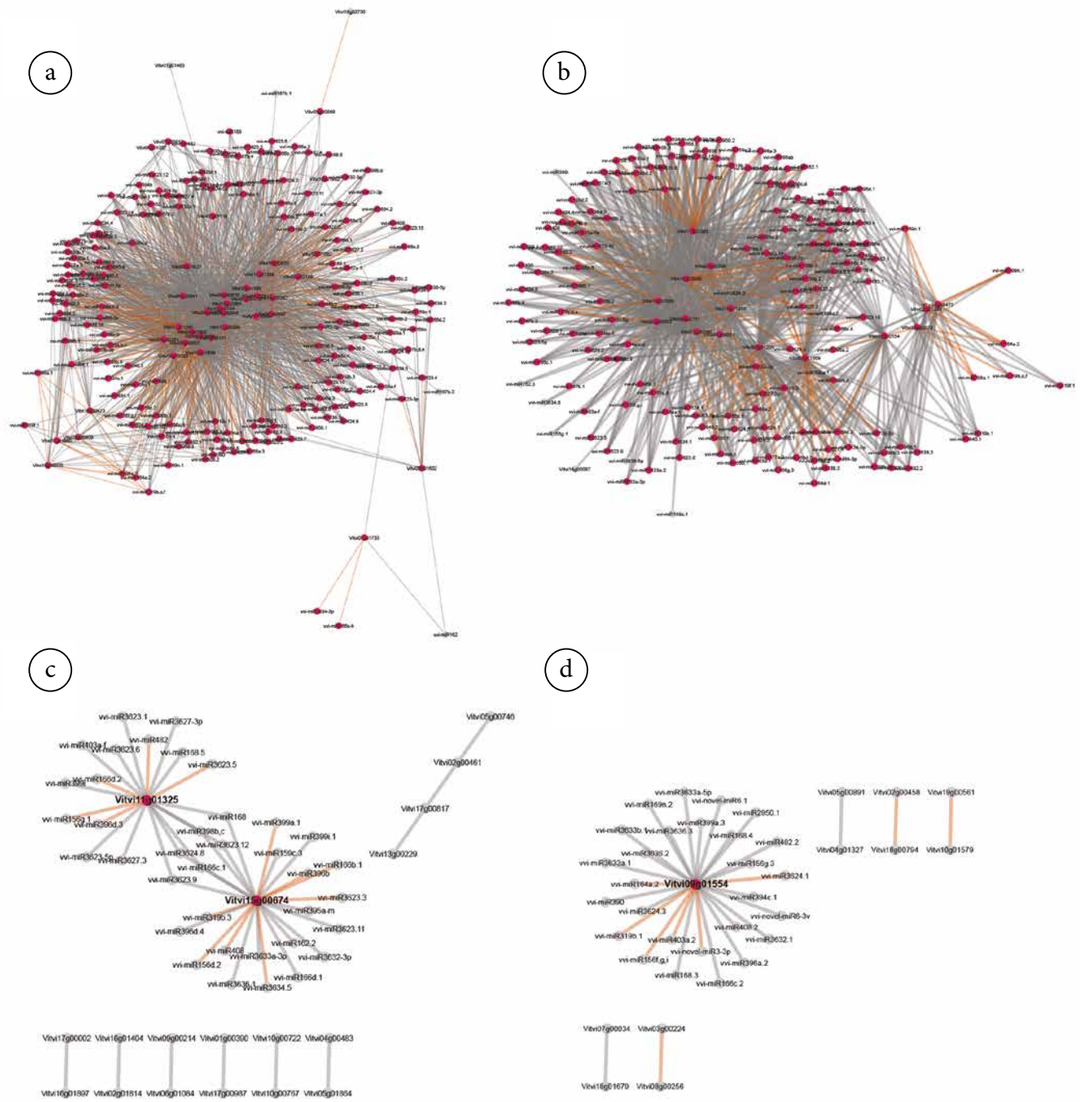
Jane Goodall,
primatologist, ethologist and anthropologist

FITO izlet na Vogel (foto: FITO arhiv).
FITO excursion to Vogel (Photo: FITO archive).

VODJA: prof. dr. Kristina Gruden
HEAD: Prof. Dr. Kristina Gruden

Prof. dr. Kristina Gruden, znanstvena svetnica, je bila v letu 2021 vodja Oddelka za biotehnologijo in sistemsko biologijo (FITO) ter redna profesorica na Univerzi v Ljubljani in na Mednarodni podiplomski šoli Jožef Stefan. Z raziskavami procesov na molekularni ravni želi razumeti delovanje rastlin v interakcijah z mikroorganizmi in njihovo odzivanje na stresne dejavnike okolja, kot so suša, vročina in 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, scientific counsellor, was the head of FITO in 2021 and is a full professor at the University of Ljubljana and the International Graduate School Jožef Stefan. The main topic of her research is understanding how plants function at the molecular level in their interactions with microorganisms and their responses to environmental stresses such as drought, heat or flood. For her research, she develops advanced tools and methodological approaches that combine biology with statistics, computer science and mathematics in a multidisciplinary way.



Vizualizacija omrežij, ki vključujejo mRNA in miRNA. *Vir: Int. J. Mol. Sci. 2021, 22(7), 3531; https://doi.org/10.3390/ijms22073531*
Visualisation of networks that included mRNAs and miRNAs. *Source: Int. J. Mol. Sci. 2021, 22(7), 3531; https://doi.org/10.3390/ijms22073531*

KLJUČNE DEJAVNOSTI

Glavne raziskovalne usmeritve FITO so:

- preučiti odzive rastlin v kompleksnih okoljih s kombinacijo celične, sistemske in sintetične biologije na molekulski ravni in pri prostorsko-časovni ločenosti;
- preučiti biologijo, raznolikost, epidemiologijo, razvoj in razširjanje patogenih in nepatogenih mikroorganizmov, povezanih z rastlinami, ter razviti zanesljive vrhunske tehnološke platforme in preizkuse za njihovo odkrivanje in določanje njihovih lastnosti;
- pridobiti boljši vpogled v prisotnost in morebitno vlogo mikrobov, s poudarkom na virusih, v različnih okoljih, kot so voda, zrak in zemlja, ter raziskati njihov pomen za zdravje ljudi in rastlin,
- razviti nove strategije varstva rastlin in strategije za varnost hrane, ki temeljijo na trajnostnih biotehnoloških metodah;
- razviti učinkovite sisteme deaktivacije ali uničevanja mikrobov, ki se jih bo dalo uporabiti na različnih matriksih;
- razviti holističen pristop določanja virusnih lastnosti na molekulski in morfološki ravni;
- v biomedicinskih proizvodnih postopkih, kot sta proizvodnja cepiv in virusnih vektorjev za gensko terapijo, izboljšati določanje virusnih lastnosti;
- 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;
- partnersko sodelovanje z drugimi raziskovalnimi skupinami na NIB ali zunaj njega v Sloveniji in po svetu pri komplementarnih raziskavah za pridobivanje vrhunskega znanja;
- partnersko povezovanje z državnimi in evropskimi institucijami, visokošolskimi organizacijami in industrijo za skupni prispevek k reševanju aktualnih problemov s področja delovanja oddelka.

GLAVNI DOSEŽKI V LETU 2021

NAŠI REZULTATI SO DEL SVETOVNE ZAKLADNICE ZNANJA

> *Ne obstaja posebna kategorija znanosti, imenovana uporabna znanost; obstajajo znanost in njene uporabe, ki so med seboj povezane, kot je sadež povezan z drevesom, ki ga je rodilo.*
>
> Louis Pasteur (1822–1895), mikrobiolog in kemik

Raziskave metod za deaktivacijo virusov na FITO v zadnjih letih vključujejo tudi uporabo hladne atmosferske plazme. V znanstvenem članku, ki je nastal v sodelovanju z raziskovalci Instituta Jožef Stefan, so avtorji opisali, kako lahko s to metodo deaktivirajo zelo odporen tobamovirus blage lisavosti paprike (PMMoV).

> *V stoletju po Newtonu so izjemni posamezniki še vedno lahko obvladovali vsa področja znanosti. Po letu 1800 je to postalo popolnoma nemogoče.*
>
> Isaac Asimov (1920–1992), pisatelj in profesor biokemije na Bostonski univerzi

Dve članici FITO sta v okviru projekta KC BRIN sodelovali v veliki raziskovalni skupini, ki je preučevala možnosti izboljšanja bakterijskih celic za proizvodnjo antibiotika. Odmevni rezultati so bili objavljeni v odlični reviji *Microbial Cell Factories*.

KEY ACTIVITIES

FITO's research agenda includes:

- explore plant responses in complex environments using a combination of the cell, systems and synthetic biology at the molecular level and spatio-temporal separation;
- explore the biology, diversity, epidemiology, evolution and spread of pathogenic and non-pathogenic plant-related microorganisms and develop reliable, state-of-the-art technology platforms and assays to detect and determine their characteristics;
- gain greater insight into the presence and potential role of microbes, with emphasis on viruses, in diverse environments such as water, air and soil, and explore their importance to human and plant health;
- develop new strategies for crop protection and food safety based on sustainable biotechnological methods;
- develop effective systems that can be used on different matrices to inactivate or destroy microbes;
- develop a holistic approach to determine viral properties at the molecular and morphological levels;
- improve viral property determination in biomedical production processes, e.g. vaccine production and viral vectors for gene therapy;
- improve the technology platform to support the redevelopment of systems biology and quantitative molecular biology tools and develop advanced, metrologically reliable technological support for these tools that can be used in pharmacology, human health and environmental applications;
- cooperative partnerships with other research groups at or outside NIB, in Slovenia and worldwide in complementary research to acquire state-of-the-art knowledge;
- partnerships with Slovenian and European institutions, academic organisations and industry for joint contribution to solving current problems in the fields of activity of the department.

MAJOR ACHIEVEMENTS IN 2021

OUR RESULTS ARE PART OF THE WORLD'S TREASURE TROVE OF KNOWLEDGE

> *There is no such thing as a special category of science called applied science; there is science and its applications, which are related to one another as the fruit is related to the tree that has borne it.*
>
> Louis Pasteur (1822–1895), chemist and microbiologist

FITO research methods for inactivating viruses in recent years have included the use of a cold atmospheric plasma. In the scientific paper, which was part of a joint project between the researchers of FITO and the Jožef Stefan Institute, the authors describe the method of inactivation of a very tough tobamovirus PMMpV.

> *During the century after Newton, it was still possible for a man of unusual attainments to master all fields of scientific knowledge. But by 1800, this had become entirely impracticable.*
>
> Isaac Asimov (1920–1992), writer and professor of biochemistry at Boston University

As part of the KC BRIN project, two FITO members participated in a large research group that investigated ways to improve bacterial cells for antibiotic production. High-profile results were published in the excellent scientific journal Microbial Cell Factories.

Če bi vedeli, kaj počnemo, se to ne bi imenovalo raziskovanje, kajne?

Albert Einstein (1879–1955), fizik

Kot prvi rezultat novofinanciranega projekta o ciljani mutagenezi s CRISPR/CAS9 za odpornost vinske trte in krompirja proti fitoplazmam so raziskovalci s FITO, Avstrijskega inštituta za tehnologijo, Univerze v Veroni v Italiji in Univerze v Stellenboschu v Južnoafriški republiki v reviji *International Journal of Molecular Sciences* objavili članek o različnih odgovorih vinske trte na ravni transkriptoma mRNA in malih RNA v zgodnji in pozni fazi rasti na okužbo s '*Candidatus* Phytoplasma solani'.

Z NAŠIM ZNANJEM OBLIKUJEMO BOLJŠI SVET ZA VSE

Člani FITO so tudi partnerji v dveh evropskih referenčnih laboratorijih za bakteriologijo in virologijo (viruse, viroide in fitoplazme) (https://eurlplanthealth.pleio.nl/). V okviru dejavnosti teh dveh laboratorijev so v letu 2021 organizirali več spletnih delavnic o tem, kako organizirati medlaboratorijske primerjave in interpretirati rezultate preizkusa usposobljenosti laboratorijev, kako ekstrahirati nukleinske kisline in izvesti PCR v realnem času, kako v diagnostiki določiti limito detekcije ter kako določiti različne povzročitelje bolezni rastlin.

ZNANSTVENIKI SE ZAČENJAMO UČITI SVOJIH OBVEZNOSTI DO SPLOŠNE JAVNOSTI

Za družbo so brez pomena znanstveni rezultati, ki družbi niso predstavljeni.

Anne Roe (1904–1991), klinična psihologinja in pisateljica

S komuniciranjem znanosti splošni javnosti pokažemo, kam je bil vložen njen denar, hkrati pa ji predstavljamo različne izzive našega časa in navdušujemo mlade generacije za raziskovanje in poklic znanstvenika – raziskovalca. V letu 2021 so člani FITO na poljuden način javnost seznanjali z določanjem virusa SARS-CoV-2 v odpadnih vodah, novimi patogeni na rastlinah in udomačevanjem rastlin. Kot urednice in piske poglavij so tri članice FITO sodelovale pri izdaji knjige za osnovnošolce *Očarljivi poskusi z rastlinami*.

USTVARJAMO KULTURO PRIZNANJ

Če opraviš svoje delo, boš nagrajen.

Michael Jordan, košarkar

V letu 2021 so bili člani FITO večkrat nagrajeni za svoje študijsko in raziskovalno delo ter dosežke na področju komunikacije znanosti.

Kristina Gruden je prejela Preglovo nagrado Kemijskega inštituta za izjemne znanstvene dosežke.

Posebne pozornosti znanstvene javnosti sta bila deležna znanstvena članka FITO: eden je bil objavljen v reviji, katere uredništvo ga je izbralo kot nekaj posebnega, drugi pa je bil izbran za javno predstavitev na Dnevu ARRS 2021 v okviru projekta Odlični v znanosti 2021.

If we knew what it was we were doing, it would not be called research, would it?

Albert Einstein (1879–1955), physicist

The first result of the newly funded CRISPR/CAS9-mediated targeted mutagenesis project for grapevine and potato resistance to phytoplasmas, involving researchers from the Department of Biotechnology and Systems Biology at the Austrian Institute of Technology, the University of Verona in Italy and the University of Stellenbosch in South Africa, is a differential response of grapevine to infection with '*Candidatus* Phytoplasma solani' in the early and late growth phases through complex regulation of mRNA and small RNA transcriptomes, published in the International Journal of Molecular Sciences.

WITH OUR KNOWLEDGE, WE HELP TO SHAPE A BETTER WORLD FOR ALL

FITO members are partners in two European Union Reference Laboratories (EURL): EURL for Bacteriology and EURL for Viruses, Viroids and Phytoplasmas (https://eurlplanthealth.pleio.nl/). In 2021, several virtual workshops were organised under the umbrella of these laboratories: e.g. on the organisation of test performance studies, nucleic acid extraction, real-time PCR, determination of detection limit in diagnostics, diagnostics of various plant pathogens.

SCIENTISTS ARE BEGINNING TO LEARN THEIR SOCIAL OBLIGATIONS.

Nothing in science has any value to society if it is not communicated.

Anne Roe (1904–1991), klinična psihologinja in pisateljica

By communicating our research, we as scientists can not only better inform taxpayers about where their money is being spent, but also help contextualise society's most pressing challenges and problems and inspire new generations about research in general and careers in science.

In 2021, FITO members are informing the public about the determination of SARS-CoV-2 in wastewater, new plant pathogens, and a domestication of plants. Two FITO members are collaborating as editors and authors on the preparation of a book for primary school children on fascinating experiments with plants.

CREATING A CULTURE OF RECOGNITION

If you do the work, you will get rewarded.

Michael Jordan, basketball player

In 2021, FITO members received several awards for their academic and research work and for achievements in the field of science communication.

Kristina Gruden received the Pregl Award from the Institute of Chemistry for outstanding scientific achievements.

Two scientific articles published by FITO received special attention from the scientific community: one was selected as an Editor Choice in a journal and the other was selected for public presentation at ARRS Day 2021 as Excellence in Science 2021.

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9	Končno poročilo o rezultatih raziskav Final Research Report
3	Elaborat, predštudija, študija Treatise, Preliminary Study, Study
1	Projektna dokumentacija (idejni projekt, izvedbeni projekt) Project Documentation (preliminary design, working design)
10	Radijska ali televizijska oddaja Radio or Television Broadcast
1	Zaključena znanstvena zbirka raziskovalnih podatkov
1	Programska oprema
2	Patent Patent
19	Druge monografije in druga zaključena dela Other Monographs and Other Completed Works

12	Radijski ali TV dogodek Radio or Television Event
2	Predavanje na tuji univerzi Invited Lecture at Foreign University
18	Prispevek na konferenci brez natisa Unpublished Conference Contribution
2	Vabljeno predavanje na konferenci brez natisa Unpublished Invited Conference Lecture
5	Druga izvedena dela Other Performed Works
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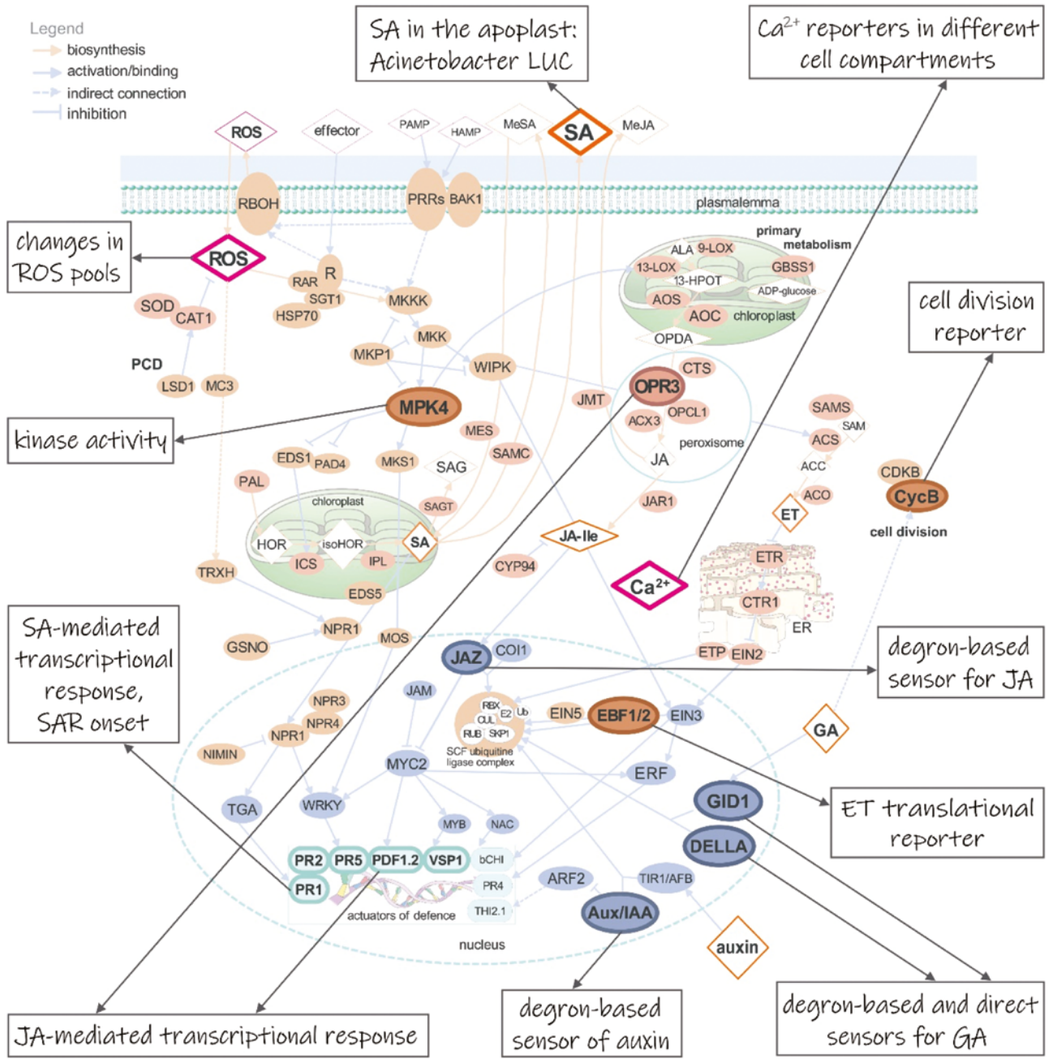

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A scientific article that was marked as an editor choice describes biosensors associated with the plant cell immunity.
Source: Life 2021, 11(3), 209; https://doi.org/10.3390/life11030209

Priprava vzorcev odpadne vode v laboratoriju (foto: Aleš Rosa).
Waste water sample preparation (Photo: Aleš Rosa).

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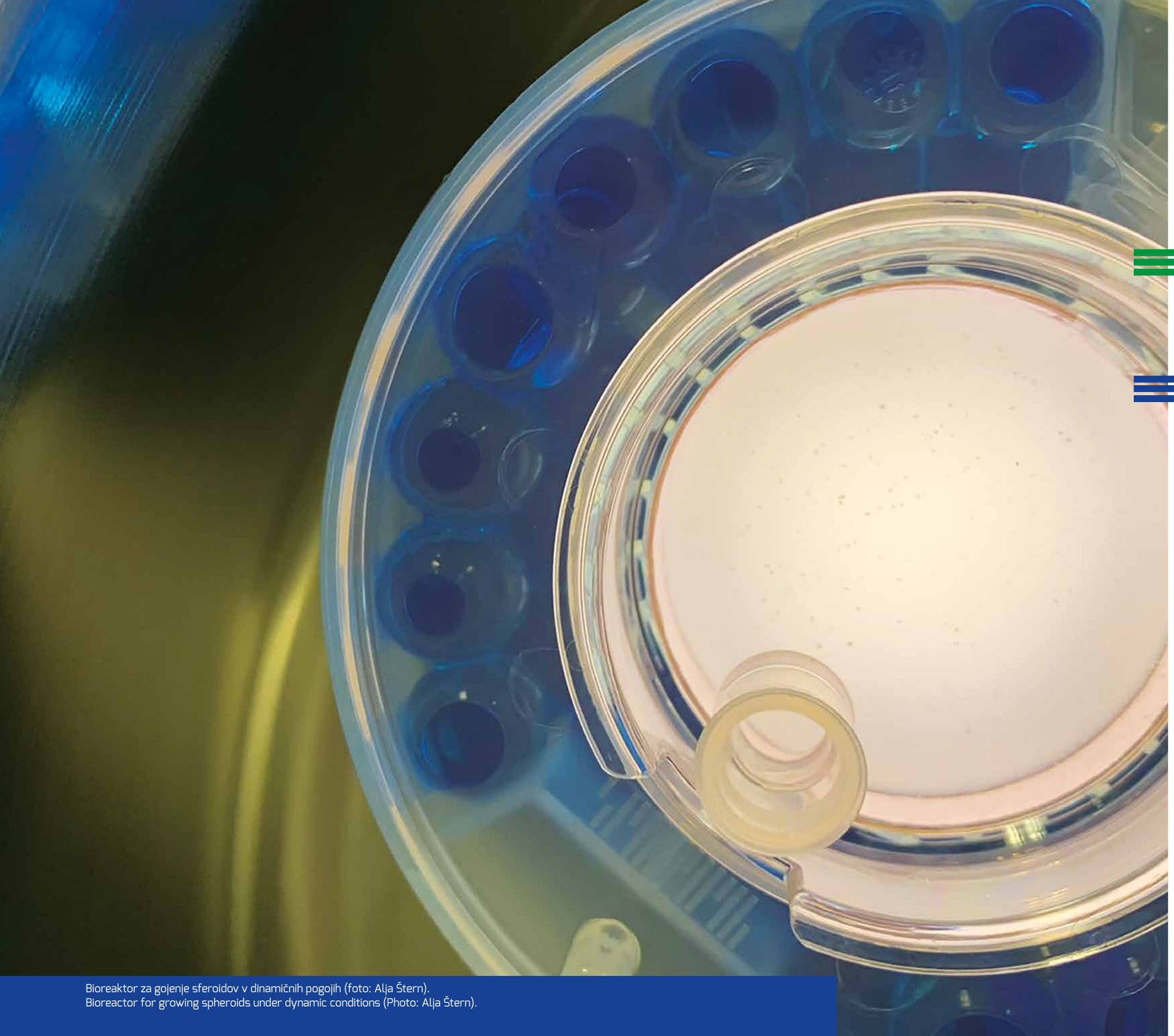


Bioreaktor za gojenje sferoidov v dinamičnih pogojih (foto: Alja Štern).
Bioreactor for growing spheroids under dynamic conditions (Photo: Alja Štern).

ODDELEK ZA GENETSKO TOKSIKOLOGIJO IN BIOLOGIJO RAKA

DEPARTMENT OF GENETIC TOXICOLOGY AND CANCER BIOLOGY

Kakovost okolja in zdravje ljudi sta neločljiva.

The quality of the environment and human health are inherently connected.

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

Paracelsus,
rojen Philippus Aureolus Theophrastus Bombastus von Hohenheimborn (1493–1534), »oče« toksikologije

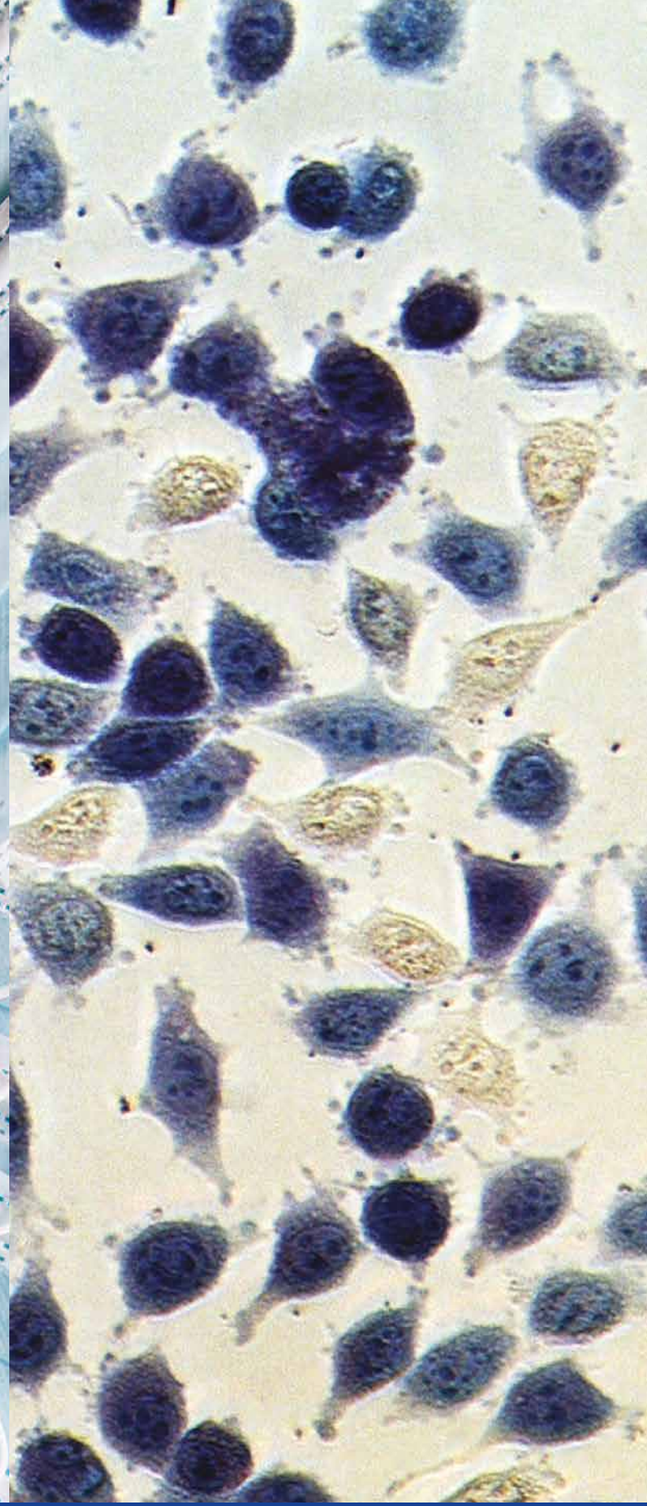
All things are poison and nothing is without poison; only the dose makes that a thing is not poison.

Paracelsus,
born Philippus Aureolus Theophrastus Bombastus von Hohenheimborn (1493–1534), the “father” of toxicology

VODJA: prof. dr. Metka Filipič
HEAD: Prof. Dr. Metka Filipič

Prof. dr. Metka Filipič, znanstvena svetnica, je od leta 2005 vodja Oddelka za genetsko toksikologijo in biologijo raka ter redna profesorica toksikološke kemije na Fakulteti za farmacijo Univerze v Ljubljani. Njeno raziskovalno področje so raziskave mehanizmov genotoksičnega in potencialno karcinogenega delovanja antropogenih in naravnih onesnažil okolja in hrane, raziskave potencialnih antigenotoksičnih snovi ter razvoj novih in vitro testnih sistemov za proučevanje genotoksičnosti. Njene raziskave so pomembno doprinesle tudi na področju znanosti o okolju, predvsem k razumevanju škodljivih vplivov ostankov zdravil na okolje in zdravje ljudi, za kar je prejela Zoisovo priznanje za pomembne dosežke.

Prof. Dr Metka Filipič, scientific councillor, is the Head of the Department of Genetic Toxicology and Cancer Biology since 2005 and professor of Toxicological chemistry at the Faculty of Pharmacy, University of Ljubljana. Her research is focused on the studies of the mechanisms of genotoxicity and potential carcinogenicity of man-made and natural environmental and food pollutants, studies of potential anti-genotoxic substances and development of new in vitro test systems in genetic toxicology. She is recognised also for her important contribution in the field of environmental sciences particularly in understanding of the adverse effects of residues of pharmaceuticals on the environment and human health for which she received the national Zois award for important achievements.



Testiranje biološke združljivosti obraznih mask v skladu s standardom ISO10993-5 (foto: Alja Štern).
Biocompatibility testing of face masks accordance to ISO10993-5 standard (Photo: Alja Štern).

KLJUČNE DEJAVNOSTI

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

Specifična področja naših raziskav so:

- Raziskave molekularnih mehanizmov toksičnega in genotoksičnega delovanja okoljskih onesnažil. Osredotočamo se na preučevanje potencialnih škodljivih učinkov posameznih onesnažil (bisfenoli, cianobakterijski toksini, mikotoksini, ostanki zdravil, nanodelci itn.) in tudi njihovih zmesi na zdravje ljudi in vodne organizme.
- 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 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*).
- Ekološki monitoring kakovosti površinskih voda in razvoj novih metodologij ekološkega vrednotenja kakovosti voda na osnovi analiz okoljske DNK v vodnih telesih.
- Na področju imunologije in celične imunoterapije vzpostavljamo vsebinske in infrastrukturne raziskovalne platforme za preučevanje celičnih in molekularnih mehanizmov, ki so vključeni v protitumorsko delovanje imunskega sistema, odpornost raka proti terapijam in avtoimunost. To znanje uporabljamo za razvoj sodobnih pristopov zdravljenja bolezenskih stanj, kot so rak in avtoimunske bolezni. Primer je CAR (Chimeric Antigen Receptor) T-celična imunoterapija, ki je prvi pristop zdravljenja raka z uporabo gensko spremenjenih celic T, ki ga je odobrila FDA.

Na vseh raziskovalnih področjih partnersko sodelujemo z raziskovalnimi skupinami v Sloveniji in tujini. Za potrebe državnih institucij in partnerje iz gospodarstva izvajamo naročniške raziskovalne projekte in svetovanje. Izvajamo preizkušanja varnosti proizvodov za potrebe registracij (testiranje mutagenosti skladno z načeli dobre laboratorijske prakse (DLP) po OECD in preizkušanje biološke združljivosti medicinskih pripomočkov skladno s standardi ISO). V letu 2021 smo zaradi epidemije covida-19 in povečanega povpraševanja po zaščitnih maskah na trgu okrepili učinkovito sodelovanje s podjetjem Lotrič Meroslovje d.o.o. na področju preizkušanja zaščitnih obraznih mask, v okviru katerega na našem oddelku izvajamo preizkušanje biološke združljivosti različnih tipov zaščitnih mask in materialov za njihovo izdelavo skladno s standardom ISO 10993-5.

KEY ACTIVITIES

Research at the Department of Genetic Toxicology and Cancer Biology is performed within the framework of the research program (P1-0245) and several national and international projects. Research is focused on understanding the complex mechanisms through which the environment affects human health and vice versa, and how human activities affect the environment.

Specific areas of our research include:

- Investigation of the molecular mechanisms of toxic and genotoxic activity of environmental contaminants. We focus on studying the potential adverse effects of individual contaminants (bisphenols, cyanobacterial toxins, mycotoxins, drug residues, nanoparticles, etc.), as well as their mixtures, on human health and aquatic organisms.
- Research on the development of brain tumours – gliomas, glioblastoma stem cells and their role in tumour progression and therapeutic resistance. Our research focuses on the study of the role of cancer stem cells and the tumour microenvironment in chemo and radio resistance as well as the search for new therapeutic approaches.
- Development of new *in vitro* test systems to replace experimental animal use in genetic toxicology and cancer research. We are developing three-dimensional (3D) cell models and models with zebrafish embryos (*Danio rerio*).
- Ecological monitoring of surface water quality and development of new methodologies for ecological assessment of water quality based on the analysis of environmental DNA in water bodies.
- In the field of immunology and cellular immunotherapy, we are establishing conceptual and infrastructural research platforms for the study of cellular and molecular mechanisms involved in the antitumour activity of the immune system, cancer resistance to therapies, and autoimmunity. We are utilising this knowledge to develop next-generation approaches to treat disease states such as cancer or autoimmune diseases. One example is Chimeric Antigen Receptor (CAR) T cell immunotherapy, the first FDA-approved approach to treat cancer using genetically modified T cells.

In all research fields, we collaborate with research groups in Slovenia and abroad. For the needs of government institutions and industrial partners, we carry out contract research and consultancy projects. We perform product safety testing for registration purposes (mutagenicity testing in accordance with the OECD Good Laboratory Practice (GLP) standards and biocompatibility testing of medical devices in accordance with ISO standards). In 2021, due to the COVID-19 epidemic and increased demand for protective face masks on the market, we strengthened an effective cooperation with the company Lotrič Meroslovje d.o.o. in the field of testing of protective face masks, as part of which we perform biocompatibility testing, of various types of protective masks and materials for their manufacture, in accordance with ISO 10993-5.

GLAVNI RAZISKOVALNI DOSEŽKI V LETU 2021

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 našem razumevanju, kako te kemikalije vplivajo na organizme, kar nam preprečuje ustrezno oceno tveganja za okolje in zdravje ljudi, zlasti za nastanek in razvoj rakavih obolenj. Že vrsto let preučujemo škodljivo delovanje naravnih toksinov, kot so cianotoksini, ki jih proizvajajo cianobakterije. Te so v okolju vseprisotni mikroorganizmi, ki jih zaradi povečane evtrofikacije celinskih voda in globalnega segrevanja vse pogosteje najdemo v vodnih okoljih zmernega pasu. V sodelovanju s kolegi iz centra RECETOX z Univerze Masaryk v Češki republiki smo prvi opisali citotoksične in genotoksične učinke izvlečkov cianobakterij in alg, ki vsebujejo mikrocistine in retinojsko kislino, kar smo objavili v reviji *Toxins* (https://www.mdpi.com/2072-6651/13/2/107).

Druga skupina genotoksičnih snovi naravnega izvora so mikotoksini, stabilni strupeni metaboliti, ki jih proizvajajo različne vrste nitastih gliv in jih pogosto najdemo na rastlinah, namenjenih za prehrano, kot so žita in oreščki. Med njimi aflatoksini veljajo kot najbolj nevarni za zdravje ljudi, zlasti aflatoksin B1 (AFB1), ki mu je kronično izpostavljena več kot polovica svetovnega prebivalstva. IARC uvršča AFB1 v skupino 1 rakotvornih snovi. Skupaj z raziskovalno skupino z Instituta Jožef Stefan smo preučevali razgradnjo AFB1 s plazmo pod hladnim atmosferskim tlakom, rezultati pa so objavljeni v reviji *Journal of Hazardous Materials* (https://doi.org/10.1016/j.jhazmat.2020.123593).

V zadnjih desetletjih se je močno povečala zaskrbljenost zaradi posebne skupine novih perečih onesnaževal, tako imenovanih endokrinih motilcev (EDC). EDC, kot so ftalati, bisfenol A (BPA) in nonilfenol (NP), povzročajo številne škodljive učinke na zdravje ljudi in živali, povezane z motnjami endokrinega sistema, ter veljajo za reproduktivne in razvojne strupe. Vse več je dokazov, da povzročajo tudi druge škodljive učinke, vključno s citotoksičnostjo in genotoksičnostjo, vendar so podatki o njihovih citotoksičnih/genotoksičnih učinkih omejeni. Čeprav so v okolju večinoma prisotni v nizkih koncentracijah, EDC predstavljajo potencialno nevarnost za zdravje, saj se običajno kopičijo v vodnih organizmih in tako z uživanjem onesnaženih rib ali pri uporabi onesnažene rečne vode za namakanje dosežejo prehranjevalno verigo ljudi. V sodelovanju s Fakulteto za industrijski inženiring smo preučevali genotoksične učinke več skupin EDCs, ki jih najdemo v odpadnih vodah papirne industrije (*Science of Total Environment*, https://doi.org/10.1016/j.scitotenv.2021.148489).

Prehrana in dieta sta močno povezani z etiologijo in preprečevanjem nastanka raka pri ljudeh. Človeška prehrana je zelo kompleksna in raznolika ter lahko vsebuje številne potencialno mutagene in rakotvorne sestavine, spojine in onesnaževala, po drugi strani pa vsebuje različne antioksidante ter potencialno kemoprotektivne in antikancerogene bioaktivne spojine. V okviru naših raziskav smo preučevali kemopreventivne učinke preniliranega flavonoida, ksantohumola (XN) proti genotoksičnemu delovanju aflatoksina B1. Študija je bila izvedena v sodelovanju s Fakulteto za kemijo in kemijsko tehnologijo Univerze v Mariboru (*Foods*, https://www.mdpi.com/2304-8158/10/6/1331).

MAJOR RESEARCH ACHIEVEMENTS IN 2021

RESEARCH OF MOLECULAR MECHANISMS OF TOXIC AND GENOTOXIC ACTIVITY OF CHEMICALS AND ENVIRONMENTAL POLLUTANTS

Environmental pollution by toxic substances is one of the major problems of our time and poses a serious threat to ecosystems and human health. Source of chemical pollution is chemicals produced by human activities and are released into the environment, as well as natural compounds produced by various organisms. Despite growing evidence of the presence of these compounds in the environment and, consequently, in the food we eat, there are still knowledge gaps in our understanding of the impact of these chemicals on living organisms, which prevents us from adequate risk assessment for the environment and human health, particularly in relation to cancer development. For many years, we have been studying the adverse effects of natural toxins, such as cyanotoxins that are produced by cyanobacteria. These are ubiquitous microorganisms that are increasingly found in temperate aquatic environments due to increased eutrophication of inland waters and global warming. In collaboration with colleagues from the RECETOX, Masaryk University, Czech Republic, we were the first to describe cytotoxic and genotoxic effects of cyanobacterial and algal extracts containing microcystins and retinoic acid, which we published in the journal *Toxins* (https://www.mdpi.com/2072-6651/13/2/107).

Another group of genotoxic substances that are naturally occurring are mycotoxins stable toxic metabolites produced by various filamentous fungi species, which are frequently found on food crops such as cereals and nuts. Among them aflatoxins are considered the greatest threat to human health, especially aflatoxin B1 (AFB1), to which more than half of the world's population is chronically exposed. AFB1 is classified by IARC as group 1 carcinogen. Together with research group from Jožef Stefan Institute we have been studying the degradation of AFB1 with cold atmospheric pressure plasma and the results are published in *Journal of Hazardous Materials* (https://doi.org/10.1016/j.jhazmat.2020.123593).

In the last decades, there has been a huge increase in concern about a specific group of emerging pollutants, the so-called endoscrine disrupting compounds (EDCs). EDCs such as phthalates, bisphenol A (BPA) and nonylphenol (NP) induce several adverse health effects related to the disruption of the endocrine system and have been identified as reproductive and developmental toxicants, but there is increasing evidence that they also cause other harmful effects, including cytotoxicity and genotoxicity, but data on their cytotoxic/genotoxic effects are limited. Although they are mostly present in the environment in low concentrations, EDCs are a potential health hazard, as they tend to accumulate in aquatic organisms and thus reach the human food chain through consumption of contaminated fish or when polluted river water is used for irrigation. In collaboration with Faculty of Industrial Engineering, we have studied the genotoxic effects of several groups of EDCs that are found in paper mill effluents (*Science of Total Environment*, https://doi.org/10.1016/j.scitotenv.2021.148489).

Nutrition and diet are fundamentally involved in human cancer etiology and prevention. The human diet is highly complex and versatile, containing numerous potentially mutagenic and carcinogenic ingredients, compounds and contaminants, as well as various antioxidants and potentially chemoprotective and anticarcinogenic bioactive chemicals. As part of our research, we have studied the chemopreventive effects of prenylated flavonoids, xanthohumol (XN) against genotoxic activity of aflatoxin B1. The study was performed in collaboration with the Faculty of Chemistry and Chemical Technology at the University of Maribor (*Foods*, https://www.mdpi.com/2304-8158/10/6/1331).

V okviru raziskav programa ARRS, projekta Eco-AlpsWater, evropske mreže DNAqaNet COST in pogodbe z Ministrstvom za obrambo RS smo nadaljevali z raziskavami zgodnjega zaznavanja toksičnih cianobakterij na osnovi okoljske DNA (eDNA), katerih cilj je zaznavanje potencialno strupenih cianobakterij v fitoplanktonu in fitobentosu. 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. Ugotavljanje cianotoksinskega potenciala v vodnih okoljih predlagamo kot del razširjene ocene ekološkega stanja celinskih voda, kar smo objavili v reviji *Water research* (https://doi.org/10.1016/j.watres.2020.116767), in raziskujemo možnosti cianotoksinskega potenciala v ekstremnih okoljih, kar smo objavili v reviji *Microorganisms* (DOI: 10.3390/microorganisms9112326). Samo z zgodnjo in specifično zaznavo te toksične grožnje lahko pristojne institucije dovolj hitro ukrepajo in s tem zmanjšajo razsežnosti in negativne posledice tega pojava ter tako izboljšajo upravljanje z vodami.

RAZISKAVE INICIACIJE IN RAZVOJA RAKA

V okviru projektov nadaljujemo z raziskavami molekularnih mehanizmov napredovanja raka in iskanjem novih pristopov zdravljenja, ki so nujni za učinkovitejše zdravljenje bolnikov z rakom. Naše raziskave se osredotočajo na najagresivnejši in najpogostejši možganski tumor glioblastom (GBM), ki je neozdravljiv. Najnovejše ugotovitve o biologiji in zdravljenju glioblastoma (GBM) smo objavili v znanstvenih revijah *Cells* (https://doi.org/10.3390/cells10030705) in *Journal of histochemistry and cytochemistry* (https://doi.org/10.1369/0022155421994679, https://doi.org/10.1369/00221554211035192).

V seriji humanih tumorskih vzorcev GBM in celičnih linij GBM smo prepoznali TRIM28 kot pomemben biološki označevalec in tarčo pri invaziji rakavih celic (*Molecules*, https://doi.org/10.3390/molecules26175141). Nadaljevali smo z raziskavami na področju imunosupresije možganskih tumorjev in imunoterapije z naravnimi celicami ubijalkami (NK) v sodelovanju s Fakulteto za farmacijo Univerze v Ljubljani, Institutom Jožef Stefan in Univerzo v Kaliforniji v Los Angelesu (UCLA) (*Cells*, https://doi.org/10.3390/cells10020265). Ugotovili smo, da je inhibitor cisteinskih proteoliznih encimov cistatin F mediator imunosupresije v glioblastomu (*Cellular oncology*, https://doi.org/10.1007/s13402-021-00618-9).

V okviru raziskav o učinkih kanabinoidov smo ugotovili, da ima kanabigerol (CBG) protirakavo delovanje, saj spodbuja rast in invazijo rakavih celic ter sproži njihovo apoptozo sam ali v kombinaciji s kemoterapijo ali kanabidiolom (CBD) (*Cells*, https://doi.org/10.3390/cells10020340).

NOVE ALTERNATIVE ZA POSKUSE NA ŽIVALIH

V okviru razvoja novih alternativnih *in vitro* sistemov preizkušanja, ki bi v prihodnosti lahko nadomestili ali zmanjšali število laboratorijskih živali za preučevanje in preizkušanje genotoksičnega delovanja spojin, smo uspešno razvili napreden *in vitro* tridimenzionalni (3D) eksperimentalni model (tj. sferoide) iz celic hepatocelularnega karcinoma, gojenih v dinamičnih pogojih klinostata. Dokazali smo večjo presnovno aktivnost novorazvitega dinamičnega 3D celičnega modela v primerjavi z enoslojnimi 2D kulturami in 3D model prvič uporabili za preizkušanje genotoksičnosti. Študija je bila izvedena v sodelovanju z Univerzo Južne Danske v Odenseju in je objavljena v reviji *Science of Total Environment* (https://doi.org/10.1016/j.scitotenv.2020.143255).

As a part of the ARRS program research, Eco-AlpsWater project, European DNAqaNet COST network and the contract with the Ministry of Defence, we have continued with research into the early detection of toxic cyanobacteria based on environmental DNA (eDNA), aimed at detecting potentially toxic cyanobacteria in phytoplankton and phytobenthos. The appearance of cyanobacteria in inland waters and the associated release of cyanotoxins into the environment endangers human and animal health, destroys aquatic environments and thus causes economic damage. Determining the cyanotoxin potential in aquatic environments is proposed as part of an extended assessment of the ecological status of inland waters, published in the journal *Water research* (https://doi.org/10.1016/j.watres.2020.116767) and exploring the potential of cyanotoxin potential in extreme environments, published in the journal *Microorganisms* (DOI: 10.3390/microorganisms9112326). Only by early and specific detection of this toxic threat can the competent institutions act quickly enough to reduce the scale and negative consequences of this phenomenon and thus improve water management.

CANCER INITIATION AND DEVELOPMENT

We are continuing with research on the molecular mechanisms of cancer progression and to find new treatment approaches that are necessary for more effective treatment of cancer patients. Our research focuses on the most aggressive and most common brain tumour glioblastoma (GBM), which remains incurable. The latest findings on the biology and treatment of GBM have been published in the scientific journals *Cells* (https://doi.org/10.3390/cells10030705) and *Journal of histochemistry and cytochemistry* (https://doi.org/10.1369/0022155421994679, https://doi.org/10.1369/ 00221554211035192).

In a series of human GBM tumour samples and GBM cell lines, we identified TRIM28 as an important biological marker and target in cancer cell invasion (*Molecules*, https://doi.org/10.3390/molecules26175141). We continued our research in the field of brain tumour immunosuppression and natural killer (NK) immunotherapy in collaboration with the Faculty of Pharmacy at University of Ljubljana, the Jožef Stefan Institute and the University of California, Los Angeles (UCLA) (*Cells*, https://doi.org/10.3390/ cells10020265). We found that the inhibitor of cysteine proteases, cystatin F, is a mediator of immunosuppression in glioblastoma (*Cellular oncology*, https://doi.org/10.1007/s13402-021-00618-9).

Research on the effects of cannabinoids has shown that cannabigerol (CBG) has anticancer activity, as it inhibits the growth and invasion of cancer cells and triggers their apoptosis alone or in combination with chemotherapy or cannabidiol (CBD) (Cells, https://doi.org /10.3390/cells10020340).

NEW ALTERNATIVES TO ANIMAL EXPERIMENTS

In the frame of the development of new alternative *in vitro* test systems to replace and reduce the number of laboratory animals for studying and testing the genotoxic activity of compounds, we have successfully developed an advanced *in vitro* three-dimensional (3D) experimental model (i.e. spheroids) from hepatocellular carcinoma cells grown under dynamic clinostat conditions. We have demonstrated enhanced metabolic activity of the newly developed dynamic 3D cell model compared to monolayer 2D cultures and used the 3D model for the first time for genotoxicity testing. The study was carried out in collaboration with the University of Southern Denmark in Odense (*Science of Total Environment*, https://doi.org/10.1016/j.scitotenv.2020.143255).

GLAVNI PROJEKTI V LETU 2021

Leta 2021 smo kot vodilni partner pridobili tri projekte ARRS. Podoktorski projekt Bisfenol A in njegovi analogi: Ali so analogi BPA nevarni za zdravje ljudi? (BPAnalogues) se osredotoča na mehanizme genotoksičnega delovanja in endokrinih motenj bisfenola A in njegovih analogov, ki se uporabljajo kot njegov nadomestek v različnih izdelkih za potrošnike. Aplikativni projekt Vrednotenje varnosti kanabidiolov in pomen za javno zdravje in vedenje potrošnikov raziskuje varnost in molekularne mehanizme delovanja kanabidiola (CBD), ki spada med naravne kanabinoide, edinstveno skupino bioaktivnih sestavin konoplje. Tretji projekt, ki smo ga pridobili, je manjši temeljni raziskovalni projekt programa ARRS dr. Aleša Debeljaka Inducibilno programiranje intrinzičnih lastnosti celic car t za imunoterapijo raka, pri katerem se osredotočamo na razvoj celic CAR T, genetsko opremljenih za izboljšano delitev, obstojnost in protitumorsko delovanje.

V oktobru se je začel mednarodni projekt 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, Argentine in naše skupine.

Nadaljevali smo večji raziskovalni projekt Diagnostična platforma za precizno zdravljenje bolnikov z rakom s kanabinoidi z večnacionalnim biofarmacevtskim podjetjem MGC Pharmaceuticals Ltd. s sedežem v Avstraliji. Splošni cilj projekta je razvoj formulacij in določitev protokolov za zdravljenje možganskih tumorjev glioblastomov s kanabinoidi kot samostojno zdravljenje ali kot dodatna terapija *in vitro* s ciljem prenosa v klinično prakso.

Nadaljevali smo s projektom Interreg Alpski prostor (2018–2021) Eco-AlpsWater, ki na osnovi pilotnih vzorčnih mest in preizkušanja novih molekularnih orodij na osnovi eDNA vpeljuje inovativno oceno ekološkega stanja in strategijo upravljanja z vodami za varovanje ekosistemskih storitev v alpskih jezerih in rekah.

V oktobru smo kot partnerji začeli izvajati raziskovalni projekt ARRS Računalniško in eksperimentalno proučevanje modulacije senescentnih celic kot novo orodje za boj proti s starostjo povezanim boleznim (J1-3019), pri katerem Kemijski inštitut deluje kot vodilni partner. Cilj projekta je povečati razumevanje mehanizma tvorbe senescentnih celic in z zunanjimi intervencijami z molekulami poskušati modulirati število senescentnih celic v telesu.

V oktobru se je začel izvajati tudi aplikativni projekt ARRS Vloga in možna uporaba imunomodulatornih mezenhimskih matičnih celic v zdravljenju bolezni COVID-19, ki ga sofinancira Educell Ltd., koordinator je Fakulteta za farmacijo, NIB pa pri njem sodeluje kot partner. Cilj projekta je raziskati možnost uporabe mezenhimskih matičnih celic za zdravljenje bolezni covid-19.

MAJOR PROJECTS IN 2021

In 2021, we acquired three ARRS projects as lead partners. The postdoctoral project "Bisphenol A and its analogues: Are BPA analogues hazardous for human health? (BPAnalogues)" focuses on the development of new *in vitro* 3D cell models with improved hepatic properties compared to traditional *in vitro* 2D cell models. The applicative project "Safety evaluation of cannabidiols and implications for public health and consumers behaviour" investigates the molecular mechanisms of the influence of microenvironment and tissue niches on the resistance of cancer stem cells to therapy and thus seeks innovative approaches to GBM treatment. The third ARRS project was from the scheme - ARRS Program dr. Aleš Debeljak: "Inducible Programming of CAR T Cell Intrinsic Properties for Cancer Immunotherapy", where we are focusing on the development of CAR T cells, genetically equipped for improved expansion, persistence, and antitumour activity.

In October, the international EU H2020-MSCA-RISE-2020 project "Nanomaterials for enzymatic control of toxic oxidative stress and free radical formation (NESTOR)" was launched in a consortium with partners from Spain (coordinator), Italy, Argentina and our group.

We continued a major research project "Diagnostic platform for the precision cannabinoids treatment of cancer patients" with the multinational biopharmaceutical company MGC Pharmaceuticals Ltd. The overall goal of the project is to develop formulations and establish protocols for the treatment of glioblastoma brain tumours with cannabinoids as a stand-alone treatment or as adjunctive *in vitro* therapy with the aim of transfer to clinical practice.

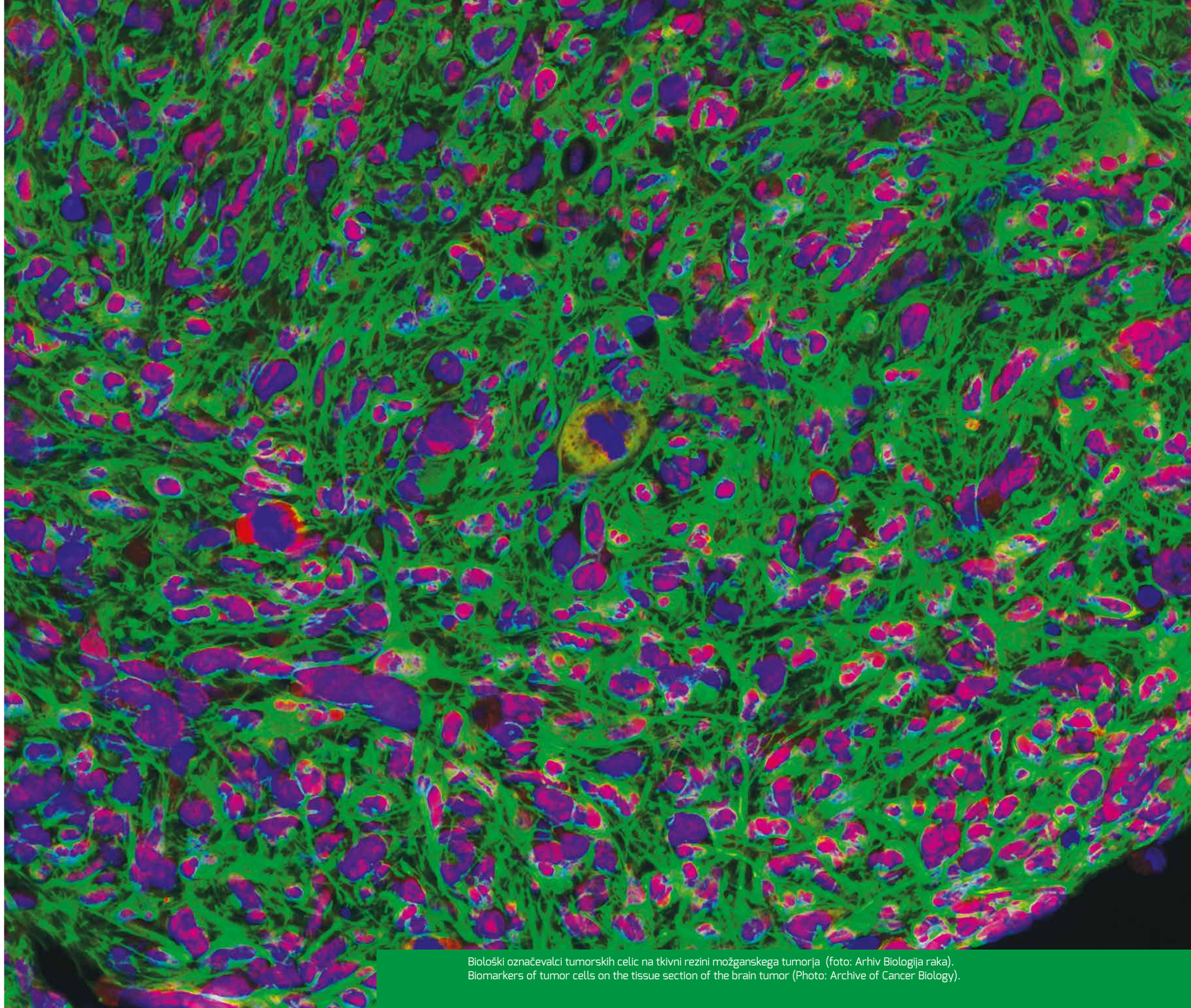
We continued with the Interreg Alpine Space (2018–2021) Eco-AlpsWater project, which introduces an innovative ecological status assessment and water management strategy to protect ecosystem services in Alpine lakes and rivers, based on pilot sampling sites and testing of new molecular tools based on eDNA.

In October, we started as partners the ARRS research project "Computational and experimental investigation of senescent cells modulation as a new tool to combat age-related diseases" (J1-3019), where the Institute of Chemistry is the lead partner. The aim of the project is to increase the understanding of mechanisms behind the senescent cells formation as well as try to modulate the number of senescent cells in the body with external molecules.

In October, the ARRS application project "Role and possible use of immunomodulatory mesenchymal stem cells in the treatment of COVID-19" was launched, co-financed by Educell Ltd. and coordinated by the Faculty of Pharmacy, NIB is participating as a partner. The aim of the project is to explore the possibility of using mesenchymal stem cells to treat COVID-19 disease.

BIBLIOGRAFIJA
BIBLIOGRAPHY

26	Izvirni znanstveni članek Original Scientific Article
9	Pregledni znanstveni članek Review Article
3	Strokovni članek Professional Article
1	Poljudni članek Popular Article
1	Objavljeni znanstveni prispevek na konferenci Published Scientific Conference Contribution
3	Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje) Published Scientific Conference Contribution Abstract (invited lecture)
19	Objavljeni povzetek znanstvenega prispevka na konferenci Published Scientific Conference Contribution Abstract
1	Objavljeni povzetek strokovnega prispevka na konferenci Published Professional Conference Contribution Abstract
3	Samostojni znanstveni sestavek ali poglavje v monografski publikaciji Independent Scientific Component Part or a Chapter in a Monograph
1	Polemika, diskusijski prispevek, komentar Polemic, Discussion, Commentary
5	Intervju Interview
10	Strokovna monografija Professional Monograph
2	Doktorska disertacija Doctoral Dissertation
1	Elaborat, predštudija, študija Treatise, Preliminary Study, Study
1	Patentna prijava Patent Application
3	Patent Patent
1	Radijski ali TV dogodek Radio or Television Event
1	Prispevek na konferenci brez natisa Unpublished Conference Contribution
2	Vabljeno predavanje na konferenci brez natisa Unpublished Invited Conference Lecture
13	Uredništvo Editorship



Biološki označevalci tumorskih celic na tkivni rezini možganskega tumorja (foto: Arhiv Biologija raka).
Biomarkers of tumor cells on the tissue section of the brain tumor (Photo: Archive of Cancer Biology).

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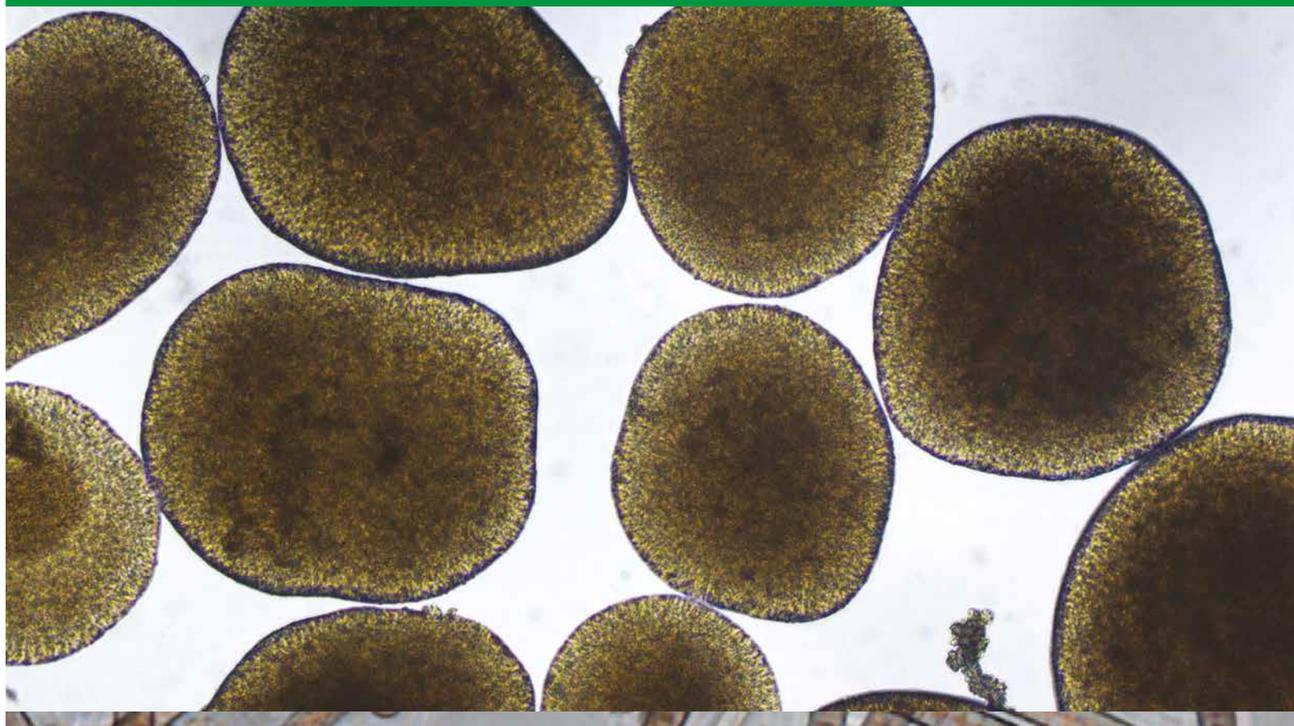
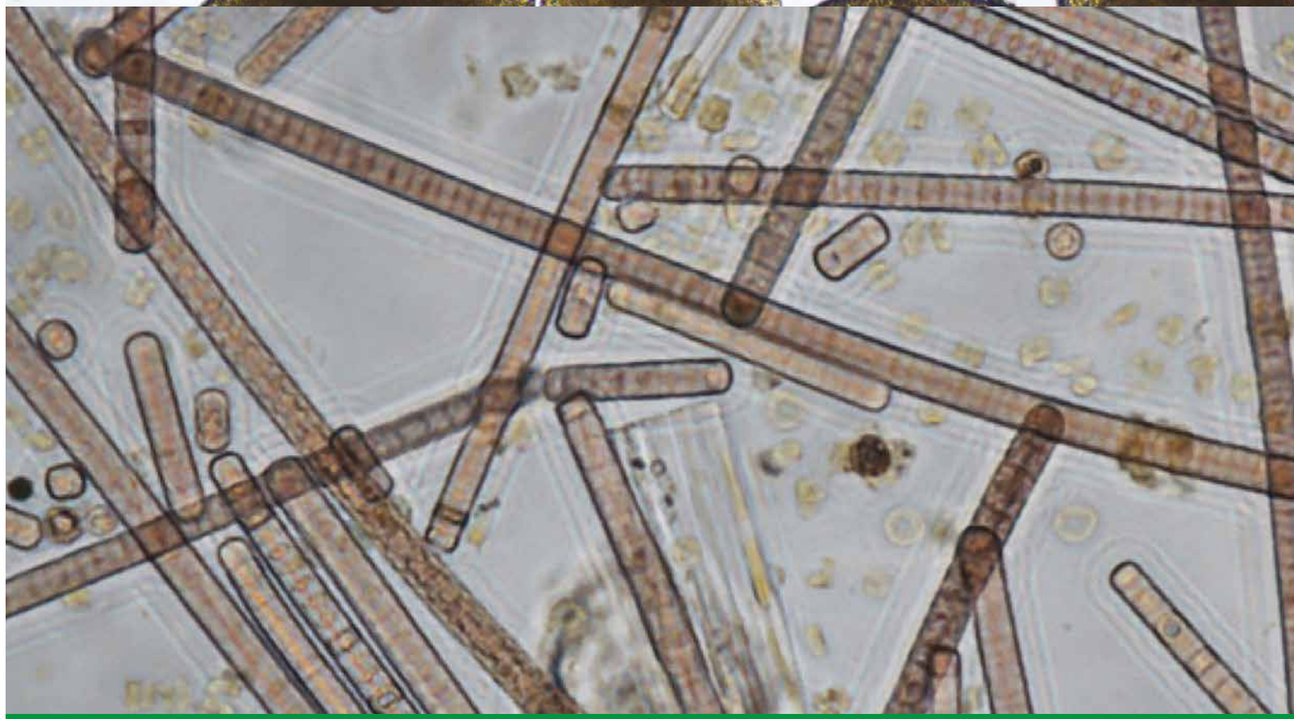
Tridimenzionalni tumorski organoidi v gojitveni plošči (foto: Arhiv Biologija raka).
Three-dimensional tumor organoids in the culture plate (Photo: Archive of Cancer Biology).





Cianobakterije vrste *Planktothrix rubescens* iz Blejskega jezera pod mikroskopom (foto: Tina Eleršek).
Cyanobacteria *Planktothrix rubescens* from Lake Bled under a microscope (Photo: Tina Eleršek).

Študija, ki je nastala v sodelovanju z Veterinarsko fakulteto UL, je bila prva, ki je odkrila virus herpesa v populaciji kozače (*Strix uralensis*), ki ni kazala nobenih kliničnih znakov bolezni ali odstopanj v razmnoževanju. Herpesvirus smo odkrili pri odraslih in mladičih kozače (zadaj), pri lesni sovi (*Strix aluco*; spredaj) pa ne, kljub dejstvu, da so bile v istem gnezdu in v neposrednem stiku z okuženimi kozačami (foto: Al Vrezec).
The study published in collaboration with Veterinary Faculty UL was the first that detected herpesvirus in a breeding population of Ural Owls (*Strix uralensis*), which showed no clinical signs of illness nor productivity deviances. Herpesvirus was detected in Ural Owl adults and chicks (in the back), but not in Tawny Owls (*Strix aluco*; in the front), despite the fact that they were in same nest and in persistent contact (Photo: Al Vrezec).

ODDELEK ZA RAZISKAVE ORGANIZMOV IN EKOSISTEMOV

DEPARTMENT OF ORGANISMS AND ECOSYSTEMS RESEARCH

Neokrnjeni naravni ekosistemi so naše bogastvo.

Pristine Natural Ecosystems are our Asset

VODJA: izr. prof. dr. Meta Virant-Doberlet
HEAD: Assoc. Prof. Dr. Meta Virant-Doberlet

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

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

Protokol za spremljanje populalcije rogača (*Lucanus cervus*), vrste evropskega varstvenega pomena, je bil prvič predlagan v Španiji, vendar je bila njegova prva širša uporaba za spremljanje rogača izvedena v Sloveniji v okviru monitoringa hroščev na NIB, ki ima daleč najdaljšo sistematično časovno serijo podatkov o populaciji rogača v Evropi (foto: Al Vrezec).
The protocol for monitoring of the Stag Beetle (*Lucanus cervus*), species of European conservation concern, was first proposed in Spain, but the first extensive use of it for monitoring of the species was conducted in Slovenia in the scope of beetle monitoring at NIB, which has far the longest systematic time series of Stag Beetle data in Europe (Photo: Al Vrezec).

KLJUČNE DEJAVNOSTI ODDELKA

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

Specifična področja raziskav so naslednja:

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

KEY ACTIVITIES OF THE DEPARTMENT:

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

Our specific areas of research include:

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

GLAVNI DOSEŽKI V LETU 2021

V vodilni reviji sistematske in evolucijske biologije *Systematic Biology* je bil objavljen članek, ki soustvarja trende v živalski sistematiki, ki odločno prehaja od filogenij, ki temeljijo na peščici genetskih markerjev proti filogenomiki, ki temelji na nukleotidnih podatkih stotine genov, razpršenih po celotnem genomu. V študiji z naslovom Filogenomska analiza ultra-ohranjenih elementov razreši evolucijsko in biogeografsko zgodovino členjenih pajkov so avtorji rekonstruirali biogeografske vzorce segmentiranih pajkov (*Liphistiidae*) skozi 100 milijonov let evolucijske zgodovine z analizo 2765 genetskih markerjev, pridobljenih z metodo ultra-ohranjenih genomskih elementov (UCE). Filogenije na osnovi metode UCE predstavljajo velik preskok v robustnosti in ponovljivosti ter tako podajajo odlično osnovo za natančnejše evolucijske analize lastnosti organizmov in s tem preizkuse bioloških napovedi.

Ljudje v okolju zaznavamo mehanske signale, ki se prenašajo prek trdne snovi, skoraj izključno z uporabo specializiranih naprav, zato so se pri kopenskih habitatih raziskave do zdaj osredotočale izključno na zvočno krajino, hkrati pa je bil ekološki vidik vibracijske komunikacije skoraj povsem spregledan. V naši raziskavi, objavljeni v reviji *iScience*, smo opisali vibracijsko krajino v travniškem habitatu in pokazali, da je vibracijska krajina zanesljiv vir informacij v okolju ter razširja naše razumevanje ekoloških in evolucijskih procesov. Rezultati so razkrili, da je vibracijska krajina posneta na travniških rastlinah dinamično, nizkofrekvenčno okolje, bogato z vibracijskimi signali, značilnimi za vrsto. Sestava vibracijske krajine se je med letom spreminjala ter je bila odvisna tudi od rastlinske vrste in lokacije rastline znotraj travnika. Člani vibracijske združbe so se izogibali medsebojnemu motenju predvsem tako, da so si razdelili vibracijski prostor v času.

Za spremljanje upadanja biotske raznovrstnosti je potrebno mednarodno sodelovanje pri monitoringu ogroženih vrst. Ljubiteljska znanost ima lahko pri tem ključno vlogo, vendar večina teh dejavnosti deluje zgolj na nacionalni ravni. V reviji *Insects* smo poročali o vzpostavitvi in prvih rezultatih Evropske mreže za monitoring rogača (*Lucanus cervus*) po usklajenem protokolu. Protokol je osnovan na večernem transektnem popisu, ki je bil prvič predlagan v Španiji, vendar je bila njegova prva širša uporaba za spremljanje rogača izvedena v Sloveniji (NIB), ki ima daleč najdaljšo sistematično časovno serijo podatkov o populaciji rogača v Evropi. Mednarodna mreža je bila vzpostavljena leta 2016 in danes vključuje 14 držav, vendar z velikimi razlikami glede intenzivnosti popisov. Po evropskih regijah smo ugotovili razlike v številu zabeleženih rogačev in razlike v fenologiji glede na temperaturo. Za mednarodno sodelovanje in upravljanje s podatki je bistven mednarodni standardiziran protokol, analize pa je najbolje izvajati na mednarodni ravni.

Za ublažitev upadanja števila opraševalcev v kmetijski krajini je nujno vključevanje kmetov, da sprejmejo opraševalcem prijazno kmetijsko prakso. Vendar pa se znanje, dojemanje in ukrepi kmetov za podporo opraševalcem ter njihova skladnost z znanstveno podprtim znanjem in priporočili ocenjujejo zgolj redko. Da bi zapolnili to vrzel v znanju, smo v članku za revijo *Global Ecology and Conservation* skupaj s sodelavci iz 11 držav predstavili rezultate intervjujev s 560 kmeti. Skoraj polovica je v zadnjih desetih letih spremenila prakso v zvezi z upravljanjem populacij opraševalcev na kmetiji, kmetijske prakse pa so se med državami zelo razlikovale. Naše ugotovitve poudarjajo pomen preučevanja lokalnega znanja kot ključnega dejavnika za sooblikovanje lokalno prilagojenih ukrepov za opraševalcem bolj prilagojeno pridelavo hrane.

MAJOR ACHIEVEMENTS IN 2021

In the leading journal of systematic and evolutionary biology, Systematic Biology, an article outlined the current trends in animal systematics, a field that is resolutely moving from phylogenies based on a handful of markers to phylogenomics based on nucleotide data of hundreds of genes scattered throughout the genome. In this study, titled "Phylogenomic analysis of ultraconserved elements resolves the evolutionary and biogeographic history of segmented trapdoor spiders", the authors reconstructed biogeographic patterns of segmented trapdoor spiders (Liphistiidae) over 100 million years of evolutionary history by analysing nucleotide data from 2765 genes obtained by ultra conserved genomic elements (UCE). Phylogenies obtained through UCE methodologies represent a huge leap in robustness and repeatability, thus presenting an excellent basis for more accurate evolutionary analyses of organismal traits, and with it, biological predictions.

Humans detect mechanical signals transmitted through a solid medium (i.e. substrate), almost exclusively with the aid of specialised equipment and consequently, so far in terrestrial habitats the research was focused almost exclusively on soundscape, while the ecological context of vibrational communication has been overlooked up to now. In our study published in the journal iScience, we showed that the vibroscape is a reliable source of information in the environment and expands our understanding of ecological and evolutionary processes. Our results revealed that the vibroscape recorded on plants in a temperate hay meadow is a dynamic low-frequency world, rich in species-specific vibrational signals. The overall vibroscape composition changed throughout the season and also depended on the plant species, as well as on the spatial position of individual plants within the meadow. Within the studied community, vibrationally signalling species sharing this communication channel avoided interference primarily by partitioning vibrational space on a fine temporal scale.

To address the decline in biodiversity, international cooperation in monitoring of threatened species is needed. Citizen science can play a crucial role in achieving this challenging goal, but most citizen science projects have been established at national or regional scales. In the journal Insects, we reported on the establishment and initial findings of the European Stag Beetle Monitoring Network (ESBMN), an international network of Stag Beetle (Lucanus cervus) monitoring schemes using the same protocol. The protocol used evening transect walk that was first proposed in Spain, but the first extensive use of it for monitoring of the Stag Beetle was conducted in Slovenia (NIB), which has, by far, the longest systematic time series of Stag Beetle data in Europe. The international network started in 2016 and currently includes 14 countries but with a strong variation in output. We found differences across European regions in the number of stag beetles recorded, related to phenology and temperature. An international standardised protocol is essential for international collaboration and data management, and analysis is best performed at international level.

Mitigating pollinator declines in agricultural landscapes requires the involvement of farmers to adopt pollinator-friendly management. However, farmer knowledge, perceptions and actions to support on-farm pollinators and their alignment with science-based knowledge and recommendations are rarely evaluated. To close this knowledge gap, together with collaborators from 11 countries, we published the results of interviews with 560 farmers in the journal Global Ecology and Conservation. Almost half of the farmers had changed on-farm pollination management in the past 10 years and farm practices differed greatly between countries. Our findings highlight the importance of studying local knowledge as a key to co-design locally-adapted measures to facilitate pollinator-integrated food production.

Čeprav je bila okužba z virusom herpesa pri sovah opisana kot zelo smrtonosna bolezen, je zelo malo podatkov o prisotnosti virusa herpesa in njegovem možnem vplivu na žive sove v naravi. Naša študija, objavljena v reviji *Animals*, je bila prva, ki je odkrila virus herpesa pri populaciji kozače (*Strix uralensis*), ki ni kazala nobenih kliničnih znakov bolezni ali odstopanj pri razmnoževanju. Virus herpesa smo odkrili pri odraslih kozačah in njihovih mladičih, pri lesni sovi (*Strix aluco*) pa ne, čeprav so bile v istem gnezdu in v neposrednem stiku z okuženimi kozačami. Viruse herpesa smo odkrili tudi pri rumenogrlih miših (*Apodemus flavicollis*), ki so glavni plen obeh sov, vendar so molekularne analize pokazale, da so bili virusi herpesa, odkriti pri glodavcih, drugačni od tistih pri sovah. Rezultati te študije kažejo, da je virus herpesa lahko latentno prisoten v populaciji kozače, lesne sove pa, kot kaže, niso dovzetne za okužbo, kar bi lahko bilo povezano z njihovim polimorfizmom. Mali sesalci očitno niso vir okužbe z virusom herpesa pri sovah, verjetna pot prenosa pa poteka intraspecifično, večinoma z odraslih na mladiče.

Prisotnost plastike v celinskih vodah je globalen problem, ki je slabo raziskan. V članku, objavljenem v reviji *Water research*, smo poročali o tem, kako prisotnost vlaken PET vpliva tako na kolonizacijske procese vodnih biofilmov v rečnih sedimentih kot tudi na njihovo sezonsko dinamiko. Ugotovili smo, da prisotnost vlaken PET v rečnih sedimentih zavira mikrobno aktivnost, kar lahko negativno vpliva na samočistilno sposobnost vodnih ekosistemov.

Bakterijska razgradnja plastičnih materialov je ena od možnih rešitev za globalen problem onesnaženja okolja s plastiko. V reviji *Science of the Total Environment* smo objavili pregleden članek, ki sistematično analizira sicer razpršene podatke o danes znanih mikrobih, ki so potencialno sposobni razgradnje plastike. Po sistematičnem pregledu 145 člankov smo ugotovili, da večina bakterij pripada trem deblom: *Proteobacteria*, *Firmicutes* in *Actinobacteria* in da so bile te večinoma izolirane iz močno onesnaženih območij. Zaradi opaženega nestandardiziranega pristopa pri poročanju o poskusih, povezanih s potencialno bakterijsko razgradnjo, smo objavili tudi priporočila za izboljšave.

Na prestižni lokaciji na Jakopičevem sprehajališču v Tivoliju v Ljubljani smo pripravili zunanjo razstavo z naslovom Biodiverziteta Slovenije, ki je vključevala 80 fotografij, natisnjenih v velikosti oglasne deske, s kratkim besedilom, ki so predstavljale nekatere vrhunce slovenske biotske raznovrstnosti.

V okviru oddelka EKOS vodimo Slovensko entomološko društvo Štefana Michielija. V letu 2021 smo bili sourediki ene od številk revije *Acta Entomologica Slovenica*, ki jo društvo izdaja in ki je bila posvečena rezultatom naših raziskav hroščev iz seznama vrst Natura 2000.

Znanstvenoraziskovalni center Slovenske akademije znanosti in umetnosti (ZRC SAZU) podeljuje raziskovalkam in raziskovalcem priznanja in nagrade za pomembne dosežke pri razvoju humanističnih, družboslovnih in naravoslovnih ved, s katerimi so prispevali k uveljavitvi ZRC SAZU doma in v svetu. Zlati znak ZRC SAZU letno prejme ena domača ali tuja raziskovalka oz. raziskovalec, ki sodeluje pri programih in projektih ZRC SAZU, za vrhunske znanstvenoraziskovalne rezultate. V letu 2021 je kot priznanje za vrhunske znanstvene objave v zadnjih letih zlati znak prejel naš sodelavec dr. Matjaž Kuntner, ki znanstveno deluje tako na ZRC SAZU kot NIB.

Although infection with herpesvirus in owls has commonly been described as a highly lethal disease, there is very little information about the presence of herpesvirus and its potential impact in living owls in wild populations. Our study published in Animals was the first that detected herpesvirus in a breeding population of Ural Owls (Strix uralensis), which showed no clinical signs of illness nor productivity deviances. Herpesvirus was detected in Ural Owl adults and chicks, but not in Tawny Owls (Strix aluco), despite the fact that they were in the same nest and in persistent contact. Herpesviruses were also detected in Yellow-necked Mice (Apodemus flavicollis) as both owls' main prey, but molecular analyses revealed that the herpesviruses detected in rodents were different from those in owls. The results of this study show that herpesvirus may be latently present in a Ural Owl breeding population, while Tawny Owls seems not to be susceptible to infection, which could be related to their polymorphism. It seems that small rodents are not a source of herpesvirus infection in owls and that the probable herpesvirus transmission pathway takes place intraspecifically, mostly from adults to young.

The presence of plastic pollutants in freshwaters is a global problem that is still poorly understood. In our paper published in Water research, we present, how the presence of PET fibres affected both colonisation patterns and seasonal dynamics of aquatic biofilms from river sediments. We found out that the presence of PET fibres inhibits microbial activity normally present in (with PET) uncontaminated river sediments, which may have negative impacts on self-purification processes.

Bacterial degradation of plastic materials is one possible solution to the global problem of plastic pollution. We have published a review article in the journal Science of the Total Environment that systematically analyses currently scattered information on microbes that are potentially capable of degrading plastics. After a systematic review of 145 papers, we found that the majority of bacteria belong to 3 phyla: Proteobacteria, Firmicutes and Actinobacteria, and that these were mostly isolated from heavily polluted areas. Due to the observed non-standardised approach in reporting on experiments related to potential bacterial degradation, we have also published recommendations for improvement.

On a prime location in Tivoli Park in Ljubljana, we prepared an outdoor exhibition "Biodiversity of Slovenia", which included 80 photos printed in a billboard size with short text, representing some of the highlights of Slovenian biodiversity.

Within the Department, we manage the Slovenian Entomological Society Štefan Michieli. In 2021, we co-edited one issue of Acta Entomologica Slovenica published by the Society that was dedicated to our research results on Natura 2000 beetle species.

The Scientific Research Center of the Slovenian Academy of Sciences and Arts (ZRC SAZU) awards researchers with prizes and awards for important achievements in the development of the humanities, social sciences and natural sciences, with which they have contributed to the establishment of ZRC SAZU at home and abroad. The ZRC SAZU Golden Badge is awarded to one domestic or foreign researcher per year who participates in the programs and projects of ZRC SAZU, for top scientific research results. In recognition of the excellent scientific publications in recent years, our colleague dr. Matjaž Kuntner, who does scientific work both at ZRC SAZU and NIB, was the recipient of this award in 2021.

BIBLIOGRAFIJA
BIBLIOGRAPHY

43	Izvirni znanstveni članek Original Scientific Article
3	Pregledni znanstveni članek Review Article
2	Kratki znanstveni prispevek Short Scientific Article
18	Strokovni članek Professional Article
15	Poljudni članek Popular Article
4	Objavljeni znanstveni prispevek na konferenci Published Scientific Conference Contribution
1	Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje) Published Scientific Conference Contribution Abstract (invited lecture)
7	Objavljeni povzetek znanstvenega prispevka na konferenci Published Scientific Conference Contribution Abstract
2	Objavljeni povzetek strokovnega prispevka na konferenci Published Professional Conference Contribution Abstract
1	Samostojni znanstveni sestavek ali poglavje v monografski publikaciji Independent Scientific Component Part or a Chapter in a Monograph
33	Samostojni strokovni sestavek ali poglavje v monografski publikaciji Independent Professional Component Part or a Chapter in a Monograph
6	Intervju Interview
1	Bibliografija, kazalo ipd.
4	Drugi sestavni deli Other Component Parts
59	Znanstveni sestavek v slovarju, enciklopediji, leksikonu Scientific Entry in Dictionary, Encyclopaedia or Lexicon
1	Znanstvena monografija Scientific Monograph
2	Strokovna monografija Professional Monograph
2	Drugo učno gradivo Other Educational Material
1	Slovar, enciklopedija, leksikon, priročnik, atlas, zemljevid Dictionary, Encyclopaedia, Lexicon, Manual, Atlas, Map
1	Doktorska disertacija Doctoral Dissertation
1	Magistrsko delo Master's Thesis
11	Končno poročilo o rezultatih raziskav Final Research Report
3	Elaborat, predštudija, študija Treatise, Preliminary Study, Study
12	Radijska ali televizijska oddaja Radio or Television Broadcast
15	Druge monografije in druga zaključena dela Other Monographs and Other Completed Works
2	Radijski ali TV dogodek Radio or Television Event
8	Razstava Exhibition
1	Predavanje na tuji univerzi Invited Lecture at Foreign University
8	Prispevek na konferenci brez natisa Unpublished Conference Contribution
4	Druga izvedena dela Other Performed Works
23	Uredništvo Editorship

Pragozdni rezervat Donačka gora je del območja Natura 2000 Boč-Haloze-Donačka gora. V okviru večletnega naravovarstvenega projekta »*LIFE Integrirani projekt za okrepljeno upravljanje Nature 2000 v Sloveniji*«, v katerem sodeluje NIB, na tem pilotnem območju med drugim raziskujemo močno ogroženega hrošča brazdarja (*Rhysodes sulcatus*) (foto: Matjaž Bedjanič).
Old-growth forest reserve Donačka gora is part of the Natura 2000 site Boč-Haloze-Donačka gora. In frame of the multi-year nature conservation project *"LIFE Integrated project for enhanced management of Nature 2000 in Slovenia"*, in which NIB participates, we are also researching the highly endangered Wrinkled Bark Beetle (*Rhysodes sulcatus*) in this pilot area.
(Photo: Matjaž Bedjanič).

foto: Jernej Poljanar Photo: Jernej Polajnar

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Milimetrski raki dvoklopniki (*Ostracoda*), ki jih v celoti prekriva dvodelna lupinica so pogosti prebivalci ribnikov in mlak, pa tudi izvirov in podzemnih voda (foto: EKOS arhiv).
Small crustaceans (*Ostracoda*), which are completely covered by a two-part shell, are frequent inhabitants of fishponds and ponds, as well as springs and groundwater (Photo: EKOS archive).

Aparatura KingFisher Apex (foto Maruša Pompe Novak).
KingFisher Apex instrument (Photo Maruša Pompe Novak).

INFRASTRUKTURNI CENTER NIB

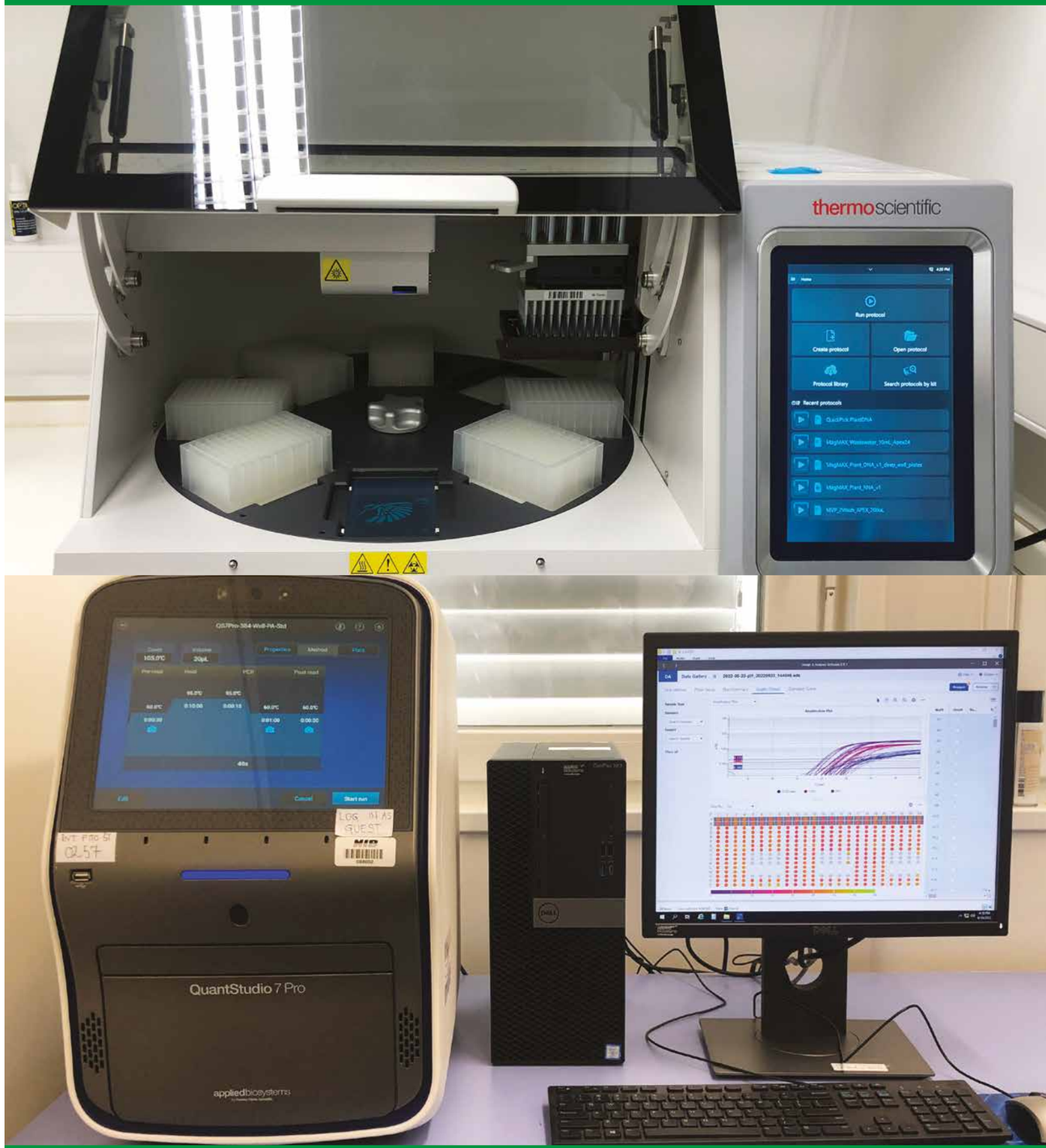
NIB INFRASTRUCTURAL CENTRE

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). IC NIB sofinancira Agencija za raziskovalno dejavnost RS prek infrastrukturnega programa NIB (IP NIB), v katerega je bilo leta 2021 poleg IC Planta in IC MBP vključeno tudi vozlišče evropske infrastrukture ELIXIR-SI Sistemska biologija. Vsak del IC NIB ponuja uporabo opreme ter storitve javnemu in zasebnemu sektorju.

The NIB Infrastructural Centre (IC NIB) consists of two distinct centres in terms of programmes and organisation: Infrastructural Centre Planta (IC Planta), which is part of the Department of Biotechnology and Systems Biology, and Infrastructural Centre MBP (IC MBP) as part of Marine Biology Station Piran (MBP). The IC NIB is co-financed by the Slovenian Research Agency through the NIB Infrastructural Programme (IP NIB), which in 2021 also included a node of European infrastructure ELIXIR-SI Systems Biology in addition to IC Planta and the IC MBP. Each part of the IC NIB offers services and equipment to the public and private sector.

Aparatura KingFisher Apex (foto Maruša Pompe Novak)
KingFisher Apex instrument (Photo Maruša Pompe Novak)



Aparatura za PCR v realnem času QuantStudio7 Pro (foto Maruša Pompe Novak).
Real-time PCR instrument QuantStudio7 Pro (Photo Maruša Pompe Novak).

Veliko infrastrukturno opremo IC Planta so v letu 2021 sestavljali:

- presevni elektronski mikroskop (Talos L120C);
- presevni elektronski mikroskop (Philips CM100) s CCD-kamerama (Gatan Orius SC200 in Gatan BioScan 792), ki je v solastništvu Nacionalnega inštituta za biologijo (NIB) in Oddelka za biologijo Biotehniške fakultete (BF) Univerze v Ljubljani (UL);
- konfokalni stereomikroskop (Leica TCS LSI);
- aparature za PCR v realnem času (ABI 7900HT Fast, Roche Light Cycler 480, 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);
- sistem za hitro pripravo in koncentriranje bioloških vzorcev z možnostjo bioloških analiz na gojiščih;
- komore za gojenje rastlin in tkivnih kultur (Kambič);
- komore za ločeno gojenje rastlin (Kambič) in
- dva karantenska rastlinjaka.

Poleg tega je mogoča tudi uporaba:

- spektrofluorometrov (SynergyMx, BioTek) in
- sistema za identifikacijo bakterij z analizo celičnih maščobnih kislin s plinsko kromatografijo (Sherlock Microbial Identification System), ki je trenutno na Biotehniški fakulteti (BF) Univerze v Ljubljani (UL).

Veliko infrastrukturno opremo IC MBP so v letu 2021 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) in
- aparatura za pomnoževanje DNA v realnem času (Thermo Fisher QuantiStudio 3).

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

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

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

In 2021, the large infrastructural equipment of IC Planta consisted of:

- Transmission electron microscope (TEM) (Talos L120C);
- Transmission electron microscope (TEM) (Philips CM100) with two CCD cameras (Gatan Orius SC200 and Gatan BioScan 792), co-owned by NIB and the Department of Biology at the Biotechnical Faculty of the University of Ljubljana;
- Confocal stereomicroscope (Leica TCS LSI);
- Real-time PCR instruments (ABI 7900HT Fast, Roche Light Cycler 480, 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);
- System for rapid preparation and concentration of biological samples with the possibility of biological analysis on the media;
- Growth chambers for plant and tissue culture breeding (Kambič);
- Plant growth chambers for separate breeding (Kambič);
- Two quarantine greenhouses.

Additionally, it is possible to use:

- Spectrofluorimeters (SynergyMx, BioTek) and
- the system for the identification of microorganisms using fatty acid methyl ester analysis by gas chromatography (Sherlock Microbial Identification System) that is at the moment located at the Biotechnical Faculty of the University of Ljubljana.

In 2021, the large infrastructural equipment of the IC MBP consisted of:

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

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

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

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 IP 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.

IP NIB je tudi v letu 2021 zagotavljal sodelovanje med raziskovalci različnih raziskovalnih programov, projektov in institucij ter tudi povezovanje raziskovalcev z uporabniki raziskav iz vrst drugih proračunskih uporabnikov in industrije ter stik s pedagoškim procesom. IP NIB je v letu 2021 prav tako pomenil osnovo za sodelovanje pri evropskih in drugih mednarodnih projektih. S sodobno in dobro vzdrževano (skladno s standardom ISO 17025) raziskovalno opremo IP 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.

IC NIB svojo veliko infrastrukturno opremo redno dopolnjuje in posodablja. V letu 2021 je IC Planta svojo opremo dopolnil z visoko pretočnim sistemom za izolacijo, detekcijo in kvantifikacijo nukleinskih kislin, ki omogoča avtomatizirano ekstrakcijo nukleinskih kislin in verižno reakcijo s polimerazo v realnem času in je sestavljena iz dveh modulov, med seboj povezanih v funkcionalno celoto. Prvi modul sistema predstavlja učinkovit avtomatiziran/robotiziran sistem za ekstrakcijo nukleinskih kislin, beljakovin in celic, KingFisher Apex, ki ga lahko upravljamo z zaslonom na dotik. KingFisher Apex je najnovejša izvedba sistemov KingFisher in se odlikuje po preprostejši uporabi, izboljšani zmogljivosti in prilagodljivosti. Sistem temelji na magnetnem ločevanju vezanih tarčnih molekul in je tako primeren za različne tipe vzorcev. Delovanje temelji na prenašanju tarčnih molekul med različnimi raztopinami, kar omogoča dobro čiščenje in ponovljive rezultate. Drugi modul sistema predstavlja aparatura za PCR v realnem času QuantStudio7 Pro, ki omogoča izvajanje verižne reakcije s polimerazo v realnem času (kvantitativni PCR, qPCR) in naknadno PCR-analizo. Za vzbujanje fluorescentnih barvil uporablja močan vir svetlobe, in sicer dolgoživo belo diodo ter dve posebni ločeni optični namizji in posebne polprepustne leče s po šestimi optično ločenimi vzbujevalnimi filtri ter šestimi emisijskimi filtri, kar omogoča natančno razlikovanje med različnimi fluorescentnimi barvili. Za zaznavanje fluorescence uporablja CCD-kamero. Aparatura omogoča eno- ali večbarvno zaznavanje (single ali multiplex kvantitativne reakcije). Sistem je zelo občutljiv in omogoča zaznavanje ene kopije tarčnega zaporedja v reakcijski mešanici. Linearnost je zagotovljena prek desetih logaritemskih redov.

V letu 2021 je IC MBP v okviru projekta RI-SI-2 LifeWatch (MIZŠ in Kohezijski sklad) nadgradil vrstični elektronski mikroskop (SEM) s sistemom za napraševanje in nanašanje kovin, rotacijsko črpalko in uparjalnikom ogljika z indikatorjem LED, ki bo omogočil dehidracijo vzorcev, kar pomeni, da bo mogoča analiza organizmov, ki nimajo trdne zunanje strukture. Raziskovalna oprema je zdaj popolnoma nadgrajena in funkcionalna, kar omogoča celotnemu inštitutu, ki je član konzorcija LifeWatch-SI, da se še bolj vključi v delovanje LifeWatch-ERIC. Kupljeno opremo so uporabljali domači in tuji raziskovalci, tehnično osebje ter številni študenti z Univerze na Primorskem in tujih univerz.

V letu 2021 je IC MBP zagotavljal tehnično pomoč Enoti µPLAST, ki služi kot podpora za izvajanje dejavnosti ciljnega raziskovalnega programa V1-2040 Zagotovimo.si hrano za jutri z naslovom Pirati plastike – dajmo, Evropa; mladi skupnostni znanstveniki z misijo pridobivanja podatkov in širjenja znanja o onesnaženosti rek s plastiko in mikroplastiko. Projekt je vpet v mednarodni prostor, saj so se k izvajanju skupne akcije zavezale države, ki predsedujejo Svetu EU v drugi polovici leta 2020 in v letu 2021 (Nemčija, Portugalska in Slovenija).

In 2021, the IP NIB continued to ensure cooperation among the researchers of various research programmes, projects and institutions as well as the networking of researchers with the research users from among other budget users and the industry and contact with the pedagogical process. The IP NIB continued to serve as the basis for cooperation in European and other international projects in 2021. The modern and well-maintained (pursuant to ISO 17025) IP NIB research equipment was also used to carry out other projects for companies that expect evidence of quality control for the provision of services. IC NIB equipment also served as support for technological development, the development of methods and the performance of specialised analyses.

The IC NIB regularly supplements and updates its large infrastructural equipment. In 2021, IC Planta supplemented its equipment with a new High Throughput System for Nucleic Acid Isolation, Detection and Quantification that enables automated nucleic acid extraction and real-time polymerase chain reaction, and consists of two modules interconnected to form a functional unit. The first module of the system is the KingFisher Apex, an efficient automated/robotic nucleic acid extraction system for nucleic acid, protein and cell extraction. KingFisher Apex is the latest version of the KingFisher systems and is distinguished by its ease of use, improved performance and flexibility. The system is based on magnetic separation of bound target molecules and is therefore suitable for a wide range of sample types. The principle of operation is based on the transfer of target molecules between different solutions, resulting in good cleaning and reproducible results. The second module of the system is real-time PCR instrument QuantStudio7 Pro, which allows real-time polymerase chain reaction (quantitative PCR, qPCR) and post-PCR analysis. It uses a powerful light source for excitation of the fluorescent dyes, namely a long-lived white diode and two special separate optical tables and special semi-transparent lenses with six optically separate excitation filters and six emission filters each, which allow accurate discrimination between the different fluorescent dyes. It uses a CCD camera to detect fluorescence. The instrument allows single or multiplex detection (single or multiplex quantitative reactions). The system is very sensitive, allowing the detection of 1 copy of the target sequence in the reaction mixture. Linearity is guaranteed over 10 logarithmic orders.

In 2021, with financial support from the RI-SI-2 LifeWatch project (MIZŠ and EU Cohesion Fund), the IC MBP upgraded its scanning electron microscope (SEM) with a metal atomisation and deposition system, a rotary pump, and a carbon evaporator with LED indicator to allow dehydration of samples so that organisms without a solid external structure can be analysed. The research equipment has thus been further upgraded and is now fully functional, allowing the entire institute, which is a member of the LifeWatch-SI consortium, to be even more involved in the operation of LifeWatch-ERIC. The acquired equipment has been used by domestic and foreign researchers and students of Slovenian and foreign universities. Among them are numerous domestic and foreign researchers, technical staff and students of the University of Primorska.

In 2021, IC MBP underpin the µPLAST unit, which supports the implementation of the activities of the targeted research programme V1-2040 “Let.us.get.ourselves.food.for.tomorrow” entitled “Plastic Pirates – Go Europe; young Citizen Scientists with a mission to collect data and disseminate knowledge about plastic and microplastic pollution of rivers”. The project is international, as the three countries holding the EU Presidency in the second half of 2020 and in 2021 (Germany, Portugal and Slovenia) have committed to a joint action.

ELIXIR-SI Sistemska biologija je v letu 2021 prevzel naloge, ki jih je do konca leta 2020 opravljalo slovensko vozlišče ISBE.SI, saj je s koncem leta 2020 evropska infrastrukturna mreža ISBE.EU prenehala obstajati. Na evropski ravni se je zato znotraj ELIXIR.eu ustanovila skupnost Systems Biology Community. To je omogočilo, da se bo delo, ki ga je do konca leta 2020 opravljal ISBE, nadaljevalo. Ker sta infrastrukturi ELIXIR in ISBE v veliki meri sorodni, pri čemer je ELIXIR osredotočena na podatke za življenje, ISBE pa na modele za življenje, prehod dejavnosti pod novo okrilje ne predstavlja večjih sprememb. Strateški cilj tako ostaja povezava področij delovanja, orodij in podatkov pri modeliranju in integraciji podatkov različnih virov in področij, skrbništvu podatkov in modelov, razvoju metodologij za pridobivanje kvantitativnih bioloških podatkov, standardizaciji in izobraževanju. Združitev ELIXIR in ISBE bo to še pospešila, saj bo povezovanje podatkov z modeli omogočilo, da se bo iz podatkov dobilo kar največ, medtem ko bo povezovanje modelov s podatki povzročilo, da se bo podatke zbiralo z mislimi na njihovo uporabo v sistemski biologiji, s tem pa močno popravilo moč njenih matematičnih modelov. Na tak način bo od zdaj naprej skupnost za sistemsko biologijo znotraj infrastrukture ELIXIR omogočala znanstvenikom, ki delujejo na področju raziskav ved o življenju in medicine, prehod s klasičnega na celosten pristop, ki omogoča razumevanje in reševanje kompleksnih bioloških problemov na področjih od medicine do pridelave hrane in industrijske biotehnologije. Z vključenostjo v infrastrukturo za sistemsko biologijo bo slovenski znanstveni in tehnološki prostor stalno na vrhuncu znanja, kar bo pripomoglo k večji konkurenčnosti in prebojnosti obeh sektorjev.

In 2021, ELIXIR-SI Systems Biology took over the tasks that were until the end of 2020 performed by the Slovenian node ISBE.SI, because the European Research Infrastructures ISBE.EU does not exist anymore since the end of 2020. Therefore at European level, the Systems Biology Community has been established within ELIXIR.eu. This has allowed the work carried out by ISBE until the end of 2020 to be continued. As the ELIXIR and ISBE infrastructures are largely related, with ELIXIR focusing on data for life and ISBE on models for life, the transition of activities under the new umbrella does not represent a major change. The strategic objectives thus remain the integration of the fields of activity, tools and data in modelling and data integration across sources and domains, data and model curation, development of methodologies for quantitative biological data generation, standardisation and education. The integration of ELIXIR and ISBE will further accelerate this, as integrating data with models will allow to get the most out of data, while integrating models with data will lead to data being collected with their use in systems biology in mind, thus greatly correcting the power of its mathematical models. In this way, the Systems Biology community within ELIXIR will now enable scientists working in life sciences and medical research to move from a classical to an integrated approach, enabling them to understand and solve complex biological problems in fields ranging from medicine to food production and industrial biotechnology. By being part of the systems biology infrastructure, the Slovenian science and technology landscape will be permanently at the cutting edge of knowledge, contributing to the competitiveness and breakthrough of both sectors.

Ilustracija iz Abbildung der inn und auslandischen Baume, Stauden und Sträuche... herausgegeben von Franz Johann Schulz. Zweiter Band. Wien: Sammer, 1792 (Zbirka redkih in dragocenih knjig Biološke knjižnice, foto: Barbara Černač).
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Jata črnikov (*Chromis chromis*) (Foto: Tihomir Makovec).
Flock of damselfish or Mediterranean chromis (*Chromis chromis*) (Photo: Tihomir Makovec).

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

IZVIRNI ZNANSTVENI ČLANEK
ORIGINAL SCIENTIFIC ARTICLE

1. ALIČ, Špela, KRŽIŠNIK, Nikolaj, BEGUŠ, Tadej, ŠTREMFELJ, Andrej, HOSTNIK, Boris. Sistemski pristop ureditve začasnih prostorskih rešitev ob naravnih in drugih nesrečah : primer Zdravstvenega doma Škofja Loka ob epidemiji SARS-CoV-2 = Sistem approach to management of a disaster response : a case study of temporary disaster response facilities for the Škofja Loka Community Health Centre during SARS-CoV-2. *Ujma : revija za vprašanja varstva pred naravnimi in drugimi nesrečami*, ISSN 0353-085X, 2020/2021, št. 34/35, str. 171-179, ilustr. [COBISS.SI-ID 91404547]

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PREGLEDNI ZNANSTVENI ČLANEK
REVIEW ARTICLE

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KRATKI ZNANSTVENI PRISPEVEK
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OBJAVLJENI ZNANSTVENI PRISPEVEK NA KONFERENCI (VABLJENO PREDAVANJE)
PUBLISHED SCIENTIFIC CONFERENCE CONTRIBUTION (INVITED LECTURE)

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

IZVIRNI ZNANSTVENI ČLANEK
ORIGINAL SCIENTIFIC ARTICLE

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ODDELEK ZA RAZISKAVE ORGANIZMOV IN EKOSISTEMOV
DEPARTMENT OF ORGANISMS AND ECOSYSTEMS RESEARCH

IZVIRNI ZNANSTVENI ČLANEK
ORIGINAL SCIENTIFIC ARTICLE

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