2019 ▸▸▸ POROČILO O DELU ANNUAL REPORT

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

2019 POROČILO O DELU

ANNUAL REPORT

Uredili: Barbara Černač, Katja Sinur

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

Ljubljana, 2020

Nacionalni inštitut za biologijo (foto: D. Tome). National Institute of Biology (Photo: D. Tome).

POSLANSTVO

- Ustvarjanje novega znanja s temeljnimi raziskavami na področju biologije in njej sorodnih naravoslovnih ved, varstva okolja, biotehnologije ter biomedicine za razumevanje življenjskih procesov.
- Prenos ustvarjenega novega znanja v uporabo s ciljem izboljševanja kakovosti življenja.
- Prenos ustvarjenega znanja na mlajše generacije z izobraževanjem na dodiplomski in podiplomski ravni.

VIZIJA

- Želimo ustvarjati vrhunsko znanje in tehnologije na področju biologije in spremljajočih ved o življenju in okolju kot mednarodno uveljavljena avtonomna institucija.
- Z dobro organiziranostjo in vrhunsko opremo bomo skrbeli za zadovoljstvo zaposlenih in vzgojo vrhunskih kadrov.
- V tesni povezavi z družbo in poslovnim sektorjem bomo zagotavljali svoj dolgoročni razvoj.

MISSION

- Creating new knowledge through basic research in biology and related natural sciences, environmental protection, biotechnology and biomedicine with the aim of understanding life processes.
- Applying this new knowledge to practice with the intention of improving quality of life.
- Transferring this knowledge to the younger generations through education at the undergraduate and graduate levels.

VISION

- As an internationally renowned autonomous institution we wish to create elite knowledge and technologies in the fields of life and environmental sciences.
- We will strengthen employee satisfaction and the development of top-level staff through great organisation and first-class equipment.
- Working closely with society and the business sector, we will ensure our long-term development.

Fotografija na naslovnici: Travne bilke (foto: D. Dobnik). Cover photo: Leaves of grass (Photo: D. Dobnik).

Preizkušanje učinkovitosti bakterijske filtracije medicinskih zaščitnih mask (foto: A. Rosa).
Testing of bacterial filtration efficiency of medical protective masks (Photo: A. Rosa).

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UVODNA BESEDA DIREKTORJA

V letu 2019 smo na inštitutu vložili veliko truda v stalno izboljševanje delovnega okolja, infrastrukture, raziskovalne opreme, znanstvene odličnosti in prenašanja znanja na mlade. Še naprej pa je bilo naše delovno okolje v ljubljanskem delu inštituta improvizirano, z neustreznimi prostori za raziskovalno dejavnost. Skupaj z našim ustanoviteljem, Ministrstvom za izobraževanje, znanost in šport, smo usmerjali napore k reševanju teh zagat. Odprtje novih bivalnih zabojnikov je bila zgolj začasna rešitev proti temu, da čim prej zaživimo v novem in večjem objektu. O približevanju rešitvi za gradnjo pravih inštitutskih prostorov sva v novembru, na dnevih Miroslava Zeija, govorila oba s svečanim gostom prireditve, ministrom za izobraževanje, znanost in šport, prof. dr. Jernejem Pikalom.

Po drugi strani je delovala Morska biološka postaja Piran, kot edina dislocirana enota NIB-a, v moderni in prostorsko ustrezni zgradbi na Fornačah, kar je nedvomno pripomoglo k znanstveni prodornosti in strokovni nepogrešljivosti te raziskovalne skupine v slovenskem in širšem sredozemskem prostoru. Oktobra 2019 smo svečano obeležili 50. obletnico njenega delovanja. Pogled v naprej je optimističen, kljub temu da sta raziskovanje in varovanje morja polni globalnih izzivov. V tekočem letu je namreč degradiranost svetovnih oceanov že presegla degradiranost celinskih ekosistemov, za katere vemo, da so že sami kritično ogroženi. Proti tem trendom se lahko borimo globalno – z vrhunskim znanjem ter lokalno – s spodbujanjem bolj trajnostnih politik.

Načrtovana investicija Biotehnološko stičišče NIB. Planned investment Biotechnological Hub NIB.

INTRODUCTION BY THE DIRECTOR

In 2019, the Institute invested huge efforts into continuous improvement of the working environment, infrastructure, research equipment, scientific excellence, and the transfer of knowledge to young people. However, our working environment in the Ljubljana part of the institute continued to be improvised, with inadequate infrastructure for research activity. Together with our founder, the Ministry of Education, Science and Sport, we directed efforts to solve these problems. The opening of new living containers was only a temporary solution towards working in a new and larger building as soon as possible. In November, during the days of Miroslav Zei, Prof. Dr Jernej Pikalo, the Minister of Education, Science and Sport, the ceremonial guest of the event, and I both talked about approaching the solution for the construction of modern institute premises.

On the other hand, the Marine Biology Station Piran, as the only dislocated unit of the NIB, operated in a modern and spatially appropriate building in Fornače, which undoubtedly contributed to the scientific excellence and professional indispensability of this research group in Slovenia and the wider Mediterranean. In October 2019, we celebrated the 50th anniversary of the Marine Biology Station's operation. We can look ahead optimistically, despite the fact that exploring and protecting the sea is full of global challenges. In the current year, the degradation of the world's oceans has already exceeded the degradation of continental ecosystems, themselves already critically endangered. We can combat these trends globally – with cutting-edge knowledge, and locally – by promoting more sustainable policies.

Kljub infrastrukturnim omejitvam je NIB v letu 2019 dosegel veliko pomembnih prebojev. Naše kolegice in kolegi so prispevali ključno znanje za razvoj zdravila *Zolgensma*, ki v ZDA že ponuja gensko terapijo pri zdravljenju spinalne mišične atrofije. To zdravilo je verjetno rešilo življenje tudi prvemu slovenskemu otroku, malemu Krisu. Podobne zgodbe smo pisali tudi v sodelovanju s slovenskimi in z evropskimi biotehnološkimi in farmacevtskimi podjetji. Tu je bila ključna podpora naše Pisarne za prenos tehnologij, katere delovanje je omogočilo Ministrstvo za izobraževanje, znanost in šport v okviru Konzorcija za prenos tehnologij iz javnih raziskovalnih organizacij v gospodarstvo. V letu 2019 smo se na NIB-u pridružili evropskim referenčnim laboratorijem za diagnostiko škodljivih organizmov rastlin, in sicer za viruse, viroide, fitoplazme ter bakterije, kjer sodelujemo v konzorcijih z Nizozemsko, Italijo in Belgijo.

Naša znanja v genetski toksikologiji, tumorski biologiji, biotehnologiji, sistemski biologiji, oceanografiji, biotremologiji, ekologiji organizmov in ekosistemov ter filogenetski in evolucijski biologiji so vrhunska, kar potrjujemo z odmevnimi objavami, med drugimi v prepoznavnih revijah kot so *Science Advances, Nature Communications, Molecular Plant, Systematic Biology, Global Change Biology, Bulletin of the American Meteorological Society, Water research* in mnogih drugih. Obenem objavljamo tudi v društvenih revijah nižjih faktorjev vpliva ter monografije, saj smo mnenja, da je, bolj kot samopromocija z visokim faktorjem vpliva, največji prestiž naših objav v tem, da nas kolegi iz stroke berejo, upoštevajo in citirajo.

Za znanstvene in strokovne preboje je nepogrešljiva velika in moderna oprema. Tudi tu smo v letu 2019 stopali naprej z velikimi koraki. S sofinancerjema Biotehniško fakulteto UL in Kemijskim inštitutom smo s pomočjo Paketa 17 ARRS uspeli realizirati investicijo v presevni elektronski mikroskop. Ta investicija v Biološkem središču ni pomembna le za moderno obdelavo vzorcev, ki jih raziskujemo, temveč tudi kot primer dobre prakse souporabe velike raziskovalne opreme med univerzitetnim in inštitutskim okoljem. Prav tako je bil NIB sofinancer krio-elektronskega mikroskopa, ki so ga otvorili na Kemijskem inštitutu.

Dejavnosti NIBa so močno vpete v visokošolsko dejavnost. V letu 2019 smo sodelovali z vsemi visokošolskimi ustanovami v Sloveniji ter nekaj tujimi. Sledimo tudi svetovnim trendom povezovanja in se tako približujemo sporazumu o tesnejšem sodelovanju z Univerzo v Ljubljani, ki je v letu 2019 obeležila svojo 100 obletnico neprekinjenega delovanja.

Nazadnje naj čestitam nagrajenkama, dr. Tanji Dreo in pridr. prof. dr. Nataši Mehle ter nagrajencu, dr. Klemnu Čandku, ki bodo nosili Zeijeva priznanja za izjemne dosežke oziroma izjemno doktorsko delo. Mlada generacija znanstvenikov naj se opremi z odličnim znanjem, saj bo njej zaupano nadaljnje iskanje rešitev človeštva in planeta.

Izr. prof. dr. Matjaž Kuntner, direktor

Despite infrastructural constraints, the NIB achieved many important breakthroughs in 2019. Our colleagues contributed essential knowledge to the development of Zolgensma, a drug that already offers gene therapy for the treatment of spinal muscular atrophy in the USA. This medicine probably also saved the life of the first Slovenian child, little Kris. We also wrote similar stories in cooperation with Slovenian and European biotechnology and pharmaceutical companies. Here, the essential was the support of our Technology Transfer Office, whose operations were made possible by the Ministry of Education, Science and Sport within the Consortium for Technology Transfer from Public Research Organizations to the Economy. In 2019, NIB joined the European reference laboratories for the diagnostics of plant pests, namely for viruses, viroids, phytoplasmas, and bacteria, within consortia with the Netherlands, Italy, and Belgium.

Our knowledge in the genetic toxicology, tumor biology, biotechnology, systems biology, oceanography, biotremology, ecology of organisms and ecosystems, and phylogenetic and evolutionary biology is topmost, which is confirmed by our high-profile publications, among others in recognizable journals, such as Science Advances, Nature Communications, Molecular Plant, Systematic Biology, Global Change Biology, Bulletin of the American Meteorological Society, Water research, and many others. At the same time, we also publish in societal journals of lower impact factors, as well as monographs, because more than self-promotion with a high impact factor, the greatest prestige of our publications is in that that our expert colleagues read us, and cite our work.

Large and modern equipment is indispensable for scientific and professional breakthroughs. Here, too, in 2019, we stepped forward with big steps. With the co-financiers of the Biotechnical Faculty of the University of Ljubljana and the National Institute of Chemistry, we managed to realize an investment in a transmission electron microscope with the help of the 17 ARRS Package. This investment in the Biological Center is important not only for the modern processing of the samples we research but also as an example of good practice in sharing large research equipment between the university and institute environment. NIB was also a co-financier of the cryo-electron microscope which was opened at the National Institute of Chemistry.

NIB's activities are strongly integrated into higher education. In 2019, we cooperated with all higher education institutions in Slovenia and some foreign ones. We also follow the global trends of integration and thus were approaching an agreement on closer cooperation with the University of Ljubljana, which in 2019, celebrated its 100th anniversary of continuous operation.

Finally, let me congratulate the award winners, Dr Tanja Dreo, and Assoc. Prof. Dr Nataša Mehle, and Dr Klemen Čandek, who received Zei's awards for outstanding achievements or an outstanding doctoral dissertation. The young generation of scientists should be equipped with excellent knowledge because it will be entrusted with the further search for solutions for humanity and the planet.

Assoc. Prof. Dr Matjaž Kuntner, director

VODSTVO INŠTITUTA
INSTITUTE'S MANAGEMENT

DIREKTOR
DIRECTOR

izr. prof. dr. Matjaž Kuntner (od from 2018)
Mandat Mandate: 1. 3. 2018 – 28. 2. 2023

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

mag. Franc Potočnik (od from 1999)
Mandat Mandate: 1. 3. 2018 – 28. 2. 2023

POMOČNIK DIREKTORJA ZA PROJEKTNO PODPORO IN PRENOS TEHNOLOGIJ
DEPUTY DIRECTOR FOR TECHNOLOGY TRANSFER

mag. Jure Vindišar (od from 2017)
Mandat Mandate: 1. 3. 2018 – 28. 2. 2023

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prof. dr. Maja Ravnikar, Nacionalni inštitut za biologijo – podpredsednica vice-president
dr. Eva Batista, Ministrstvo za izobraževanje, znanost in šport
dr. Ruth Rupreht, Ministrstvo za okolje in prostor
prof. dr. Uroš Urleb, Biofarmacevtika Mengeš, Novartis

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

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izr. prof. dr. Meta Virant-Doberlet, podpredsednica vice-president
prof. dr. Anton Brancelj
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prof. dr. Metka Filipič
prof. dr. Kristina Gruden
izr. prof. dr. Matjaž Kuntner (direktor director)
izr. prof. dr. Patricija Mozetič
doc. dr. Andreja Ramšak
izr. prof. dr. Jana Žel

Mandat Mandate: 26. 4. 2016 – 25. 4. 2020

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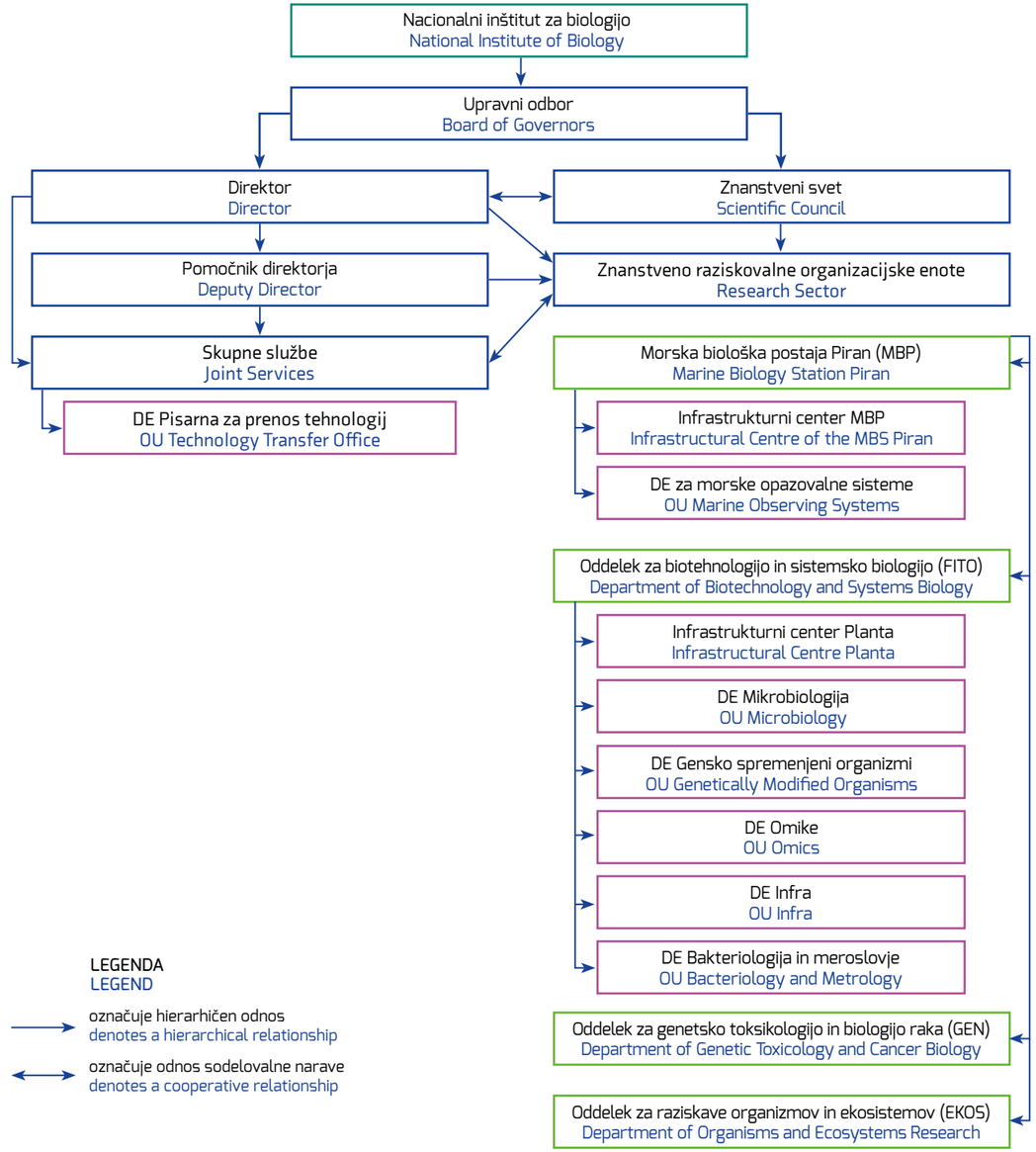
HONORARY MEMBERS

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

ORGANIZACIJSKA SHEMA
ORGANIZATIONAL SCHEME



PREGLED POSLOVANJA NIB V LETU 2019

Poslovno leto 2019 je bilo za NIB eno najbolj uspešnih v njegovem dosedanjem poslovanju.

Najpomembnejši uspeh v letu 2019 je za NIB predstavljal Poziv za oddajo vloge in predložitev investicijske dokumentacije za projekt Biotehnološko stičišče NIB (BTS-NIB), ki ga je Ministrstvo za izobraževanje, znanost in šport posredovalo 9. 12. 2019 in s katerim se je odprla možnost sofinanciranja navedene investicije v višini 20 milijonov EUR iz sredstev evropske kohezijske politike. Navedena investicija je za NIB izjemnega razvojnega pomena, saj bo zagotovila vrhunsko raziskovalno infrastrukturo.

Finančni cilji, opredeljeni v finančnem načrtu za leto 2019, so bili preseženi tako pri prihodkih kot pri poslovnem izidu. Ustvarjeni prihodki v višini 9.492.409 EUR so bili višji od načrtovanih za 635.055 EUR (7,17 %). Ustvarjeni presežek prihodkov nad odhodki (pred obračunom davka od dohodkov pravnih oseb) v višini 408.030 EUR pa je presegel načrtovanega za 403.109 EUR.

V primerjavi z letom 2018 so bili realizirani prihodki NIB-a v letu 2019 višji za 1.709.447 EUR (21,96 %), realizirani odhodki pa za 1.499.503 EUR (19,77 %). Posledično je bil v letu 2019 ustvarjen boljši poslovni izid kot v letu 2018 (za 209.945 EUR oz. 105,99 %). Nominalno največja rast prihodkov v letu 2019 v primerjavi z letom 2018 je bila dosežena pri prihodkih od ARRS. Ti so v 2019 znašali 5.299.559,61 EUR in so bili od primerljivih prihodkov v letu 2017 višji za 744.293 EUR (za 16,34 %). Naslednji po nominalni vrednosti povečanja so bili prihodki od projektov iz različnih evropskih programov (OBZORJE 2020, INTERREG, LIFE ...), ki so v letu 2019 znašali 1.423.306 EUR in so bili višji od primerljivih v letu 2018 za 539.141 EUR (60,98 %). Za 399.849 EUR (45,99 %) so bili v letu 2019 višji kot v letu 2018 tudi prihodki na trgu, še posebej tisti, ustvarjeni na tujem trgu.

PRIHODKI V EUR REVENUES IN EUR	2019	STRUKTURA 2019 (%) STRUCTURE 2019 (%)	2018	INDEKS 2019/18 INDEX 2019/18
Prihodki od ARRS Slovenian Research Agency	5.299.559,61	55,83	4.555.266,88	116,34
Druge javne službe Other public institutions	1.495.311,35	15,75	1.464.324,09	102,12
Evropski skladi EU funds	1.423.305,62	14,99	884.164,47	160,98
Domači trg Domestic market	652.037,18	6,87	546.138,05	119,39
Tuji trg Foreign market	617.246,10	6,50	323.296,17	190,92
Drugi prihodki Other revenues	4.949,21	0,05	9.772,20	50,65
Skupaj prihodki Total revenues	9.492.409,07	100,00	7.782.961,86	121,96

ODHODKI V EUR EXPENSES IN EUR	2019	STRUKTURA 2019 (%) STRUCTURE 2019 (%)	2018	INDEKS 2019/18 INDEX 2019/18
Stroški dela Labour	5.458.698,27	60,09	4.574.279,48	119,33
Stroški amortizacije Amortization	509.506,69	5,61	492.494,04	103,45
Stroški materiala Material	1.196.167,42	13,17	819.329,90	145,99
Stroški storitev Services	1.854.193,79	20,41	1.619.144,21	114,52
Drugi stroški in odhodki Other	65.813,14	0,72	79.629,10	82,65
Skupaj odhodki Total expenditure	9.084.379,31	100,00	7.584.876,73	119,77

REZULTAT POSLOVANJA BUSINESS RESULT	408.029,76		198.085,13	205,99

OVERVIEW OF THE NIB OPERATIONS IN 2019

The 2019 financial year was one of the most successful ones in the institute's history of operations

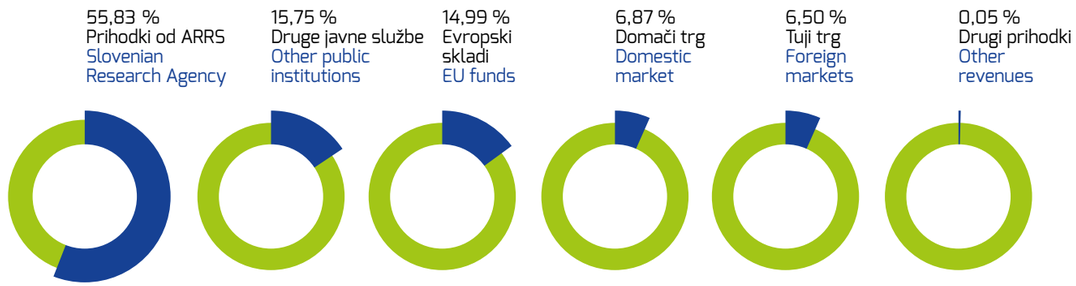
The most important success in 2019 for the NIB was the Call for application and submission of the investment documentation for the NIB Biotechnology Hub (BTS-NIB) project, which was submitted by the Ministry of Education, Science and Sport on 9 December 2019 and which opened the possibility of co-financing that investment of 20 million EUR from the European cohesion policy funds. The stated investment is of exceptional developmental significance for the NIB, as it will provide a state-of-the-art research infrastructure.

The financial objectives set out in the 2019 financial plan were exceeded both in revenues and in profit. We posted revenues of 9,492,409 EUR, which is 635,055 EUR (7.17%) more than planned, while the generated profit of 408,030 EUR (before corporate income tax) exceeded the planned profit by 403,109 EUR.

Compared to 2018, NIB's realized gains and losses in 2019 were 1,709,447 EUR and 1,499,503 EUR (21.96% and 19.77%) higher. As a result, NIB had a better P&L in 2019 than in 2018 (by 209,945 EUR or 105.99%). Nominally, the greatest revenue increase in 2019 compared to 2018 was achieved in relation to revenues from the Slovenian research agency (ARRS). These equaled 5,299,559.61 EUR and were 744,293 EUR (16.34%) higher than comparable revenues in 2018. The next in terms of the nominal amount of increase were revenues generated in projects from various European programs (OBZORJE 2020, INTERREG, LIFE, etc.), which equaled 1,423,306 EUR in 2019 and were by 539,141 EUR (60.98%) higher than comparable revenues in 2018. Revenues on the market were also 399,849 EUR (45.99%) higher in 2019 than in 2018, especially those generated on the foreign market.

STRUKTURA PRIHODKOV NIB V LETU 2019

REVENUE STRUCTURE IN 2019



Leto 2019 je bilo za NIB uspešno tudi na področju izvajanja temeljnega raziskovanja. V tem letu so NIB-ovi raziskovalci objavili 120 znanstvenih člankov v revijah s faktorjem vpliva, od teh 72 v revijah v prvem kvartilu.

Tudi z vidika začetka izvajanja novih projektov je bilo leto 2019 za NIB uspešno. Izvajati je začel trinajst projektov ARRS (sedem kot nosilna organizacija, šest kot sodelujoča), en projekt iz programa Obzorje 2020 na področju zagotavljanja kolaborativnega okolja za digitalno biologijo (dodatno je bil pridobljen še eden v okviru razvoja evropske metrološke infrastrukture na področju prehrane, ki se začne izvajati v 2020), dva projekta iz programa INTERREG (INTERREG MED strateška projekta na področju okolja in nadzora morja). Tudi v okviru programa INTERREG ITA - SLO sta bila pridobljena še dva projekta, ki se začneta izvajati v letu 2020. V okviru sheme European Metrology Programme for innovation and Research EMPIR se je začel izvajati en projekt.

Konec leta 2019 je bila podpisana pogodba z MIZŠ (NIB kot konzorcijski partner) za izvedbo operacije »Razvoj raziskovalne infrastrukture za mednarodno konkurenčnost slovenskega RRI prostora – RI-SI Lifewatch« – Evropska infrastruktura za e-znanost in tehnologijo za raziskave biotske raznovrstnosti in ekosistemov.

Leto 2019 je bilo zaznamovano tudi z NIB-ovim intenzivnim sodelovanjem pri prijavah projektov na različne razpise. Med drugim je sodeloval pri 25 prijavah predlogov projektov na razpisih v okviru programa Obzorje 2020 in pri 26 prijavah predlogov projektov drugih različnih mednarodnih razpisov.

Sodelovanje Nacionalnega inštituta za biologijo na Znanstivalu 2019 (foto: arhiv NIB).

2019 was also a successful year for the NIB in terms of the implementation of basic research. In this year, NIB's researchers published 120 scientific articles in journals with impact factors, of these 72 in journals in the first quartile.

NIB also had a successful 2019 in terms of the launch of new projects. NIB launched thirteen projects of the Slovenian research agency (seven as the leading and six as a participating organization), one project from the Horizon 2020 program, i.e. in the field of ensuring a collaborative environment for digital biology, (one was acquired subsequently and is set to commence in 2020, i.e. in the field of the development of the European merological structure in the field of nutrition), two projects from the INTERREG program, i.e. INTERREG MED strategic projects in the field of environment and the control of the sea. In the process, two additional programs within the framework of the INTERREG ITA SLO were acquired which are set to commence in 2020. Within the framework of the scheme of the European Metrology Programme for Innovation and Research EMPIR one project has started.

At the end of 2019, a contract was signed with the Ministry of Science, Education and Sports (NIB as a consortium partner) for the operation "Development of research infrastructure for the international competitiveness of Slovenian RDI space – RI-SI Lifewatch" – e-Science and Technology European Infrastructure for Biodiversity and Ecosystem Research.

2019 was also marked by NIB's intensive collaboration in project applications for various calls for proposals. Among others, NIB participated in 25 project proposal applications for calls for proposals within the Horizon 2020 program and 26 project proposal applications in various other international calls for proposals.

Dan odprtih vrat NIB (foto: A. Štern). Open day of NIB (Photo: A. Štern).

IZVAJANJE RAZISKOVALNIH PROGRAMOV IN PROJEKTOV

Kot nosilec je NIB v 2019 izvajal naslednje raziskovalne programe:

- **P1-0237: »Raziskave obalnega morja«,** ki se izvaja v organizacijski enoti MBP (7,78 FTE, 16 raziskovalcev, eden upokojeni raziskovalec, dva raziskovalca na začetku kariere, eden tehnični sodelavec, šest MR-jev, vodja izr. prof. dr. Patricija Mozetič), obdobje financiranja 2015–2019;
- **P4-0165: »Biotehnologija in sistemska biologija rastlin«**, ki se izvaja v organizacijski enoti FITO (5,40 FTE, 17 raziskovalcev, dva raziskovalca na začetku kariere, trije tehnični sodelavci, šest MR-jev, vodja prof. dr. Maja Ravnikar), obdobje financiranja 2015–2020;
- **P1-0255: »Združbe, interakcije in komunikacije v ekosistemih«**, ki se izvaja v organizacijski enoti EKOS (6,40 FTE, 15 raziskovalcev, eden upokojeni raziskovalec, trije tehnični sodelavci, pet MR-jev, vodja izr. prof. dr. Meta Virant-Doberlet) ter v soizvajalski organizaciji Prirodoslovni muzej Slovenije (0,19 FTE, 2 raziskovalca), obdobje financiranja 2017–2022;
- **P1-0245: »Ekotoksikologija, toksikološka genomika in karcinogeneza«,** ki se izvaja v organizacijski enoti GEN (3,83 FTE, 11 raziskovalcev, eden tehnični sodelavec, trije MR-ji, vodja prof. dr. Tamara Lah Turnšek), obdobje financiranja 2019–2024;
- **P4-0407: »Okoljska in aplikativna virologija: virusi, prijatelji in sovražniki«,** ki se izvaja v organizacijski enoti FITO (1,59 FTE, sedem raziskovalcev, eden tehnični sodelavec, trije MR-ji, vodja izr. prof. dr. Jana Žel), obdobje financiranja 2019–2024.

Poleg zgoraj navedenih petih 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 Inštitut Jožef Stefan, vodja prof. dr. Milena Horvat, obseg FTE za NIB 0,33.

NIB je v letu 2019 izvajal tudi infrastrukturni program v obsegu 6 FTE.

Poleg programov je NIB v letu 2019 izvajal tudi 30 projektov ARRS (16 kot nosilec in 14 kot sodelujoča organizacija) v skupnem obsegu 14,80 FTE ter tri projekte v okviru CRP programov (dva v programu »Zagotovimo.si hrano za jutri« in enega v programu »CRP 2019«, vse tri kot nosilec) v skupnem letnem obsegu 0,28 FTE.

Obseg financiranja projektov s strani ARRS je bil v letu 2018 za 1,87 FTE oz. 14,67 % večji kot v preteklem letu.

V 2019 je NIB izvajal enajst projektov iz programa Obzorje 2020. Od teh se je v tem letu en projekt zaključil, dva pa sta se v tem letu začela izvajati. Višina ustvarjenih prihodkov v okviru teh projektov je znašala 492.407 EUR in je predstavljala 5,19 % vseh prihodkov NIB-a.

Poleg teh je NIB v letu 2019 izvajal še dva projekta iz programa ARIMNet2, ki sodi v 7. Okvirni program EU, dva projekta iz programa EMPIR in dva projekta iz programa ERA CoBio Tech (oba programa sta sestavni del programa Obzorje 2020). Višina prihodkov iz teh šestih projektov je v letu 2019 znašala 215.779 EUR in je predstavljala 2,27 % vseh prihodkov.

V 2019 je NIB izvajal še 14 projektov iz drugih mednarodnih programov financiranja (LIFE, INTERREG Italija – Slovenija, INTERREG Slovenija – Hrvaška, INTERREG Europe itn.).

Poleg teh je izvajal še šest projektov, sofinanciranih s strani evropskih kohezijskih in investicijskih skladov prek slovenskih ministrstev: dva projekta z razpisa MIZŠ »RRI v verigah in mrežah vrednosti«, tri projekte z razpisa MIZŠ za spodbujanje raziskovalcev na začetku kariere in enega z razpisa »Spodbujanje dejavnosti prenosa znanja prek delovanja pisarn za prenos tehnologij«.

Višina ustvarjenih prihodkov v okviru teh projektov je znašala 1.102.406 EUR in je predstavljala 11,61 % vseh prihodkov v letu 2019.

IMPLEMENTATION OF RESEARCH PROGRAMS AND PROJECTS

NIB carried out the following research programs as the leader in 2019:

- **P1-0237 – Coastal Sea Research**, running in the MBP organizational unit (7.78 FTE, 16 researchers, one retired researcher, two researchers at the beginning of their career, one technical assistant, six YRs, and the head Assoc. Prof. Dr Patricija Mozetič), funding period 2015–2019;
- **P4-0165 – Biotechnology and Plant Systems Biology**, running in the Fito organizational unit (5.4 FTE, 17 researchers, two researchers at the beginning of their career, three technical assistants, six YRs, and the head Prof. Dr Maja Ravnikar), funding period 2015–2020;
- **P1-0255 – Communities, Interactions and Communications in Ecosystems**, running in the eKoS organizational unit (6.4 FTE, 15 researchers, one retired researcher, three researchers at the beginning of their career, three technical assistants, five YRs, and the head Assoc. Prof. Dr Meta Virant-Doberlet) and co-implemented by the Slovenian Museum of Natural History (0.19 FTE, 2 researchers), funding period 2017–2022;
- **P1-0245 – Ecotoxicology, Toxicogenomics, and Carcinogenesis**, running in the Gen organizational unit (3.83 FTE, 11 researchers, one technical assistant, three YRs, and the head Prof. Dr Tamara Lah Turnšek), funding period 2019–2024;
- **P4-0407: Environmental and applicative virology: viruses – friends or foes**, running in the FITO organizational unit (1,59 FTE, 7 researchers, one technical assistant, three YRs, and the head Assoc. Prof. Dr Jana Žel), funding period 2019–2024.

In addition to these four research programs, the MBP organizational unit also collaborated in the implementation of program **P1-0143 – Cycling of substances in the environment, mass balances, modeling of environmental processes and risk assessment,** with Jožef Stefan institute as the project leader, the head Prof. Dr Milena Horvat, in the amount of 0.33 FTE for NIB

In 2019, NIB implemented an infrastructural program equaling 6 FTE.

In addition to the programs, NIB also carried out 30 ARRS projects in 2019 (16 as the leader and 14 as a participating organization) in the total amount of 14.80 FTE and three projects within the CRP programs (two in the program “Let us assure food for tomorrow” and one in the “CRP 2019” program, all three as the leader) in a total annual scope of 0.28 FTE.

The amount of project funding provided by the Slovenian Research Agency in 2019 was 2.25 FTE or 18% higher than in the year before.

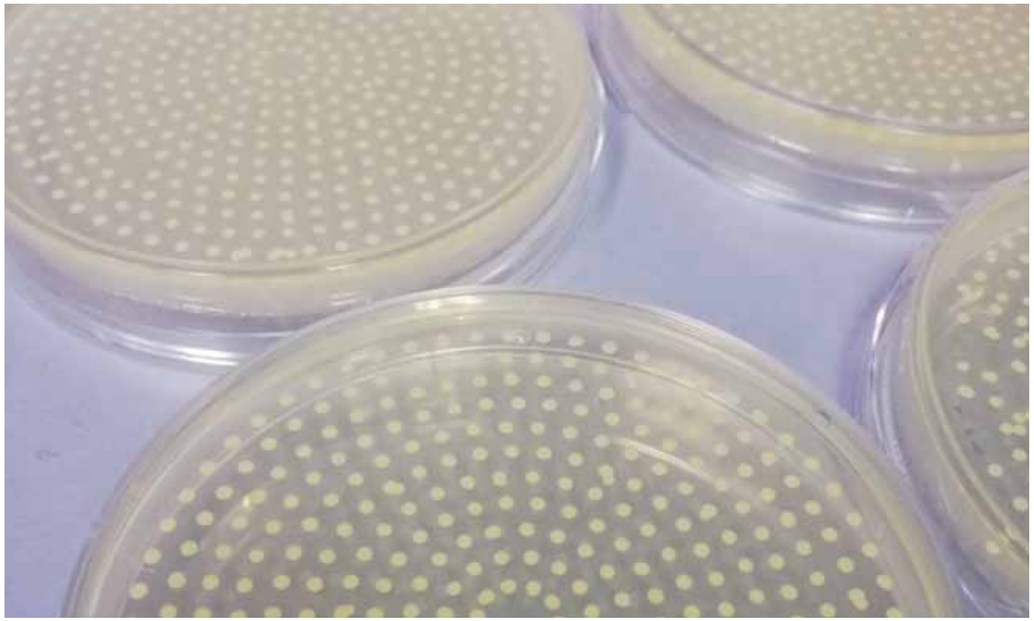
NIB carried out eleven Horizon 2020 projects in 2019. Of these, one project was completed and two were started this year. These projects generated 492,407 EUR of revenues or 5.19% of NIB’s total revenues.

Additionally, in 2019, NIB carried out two projects from the ARIMNet2 program, which is a part of the EU’s Seventh Framework Programme, as well as one project from the EMPIR program and two projects from the era CoBio Tech program, which are integral parts of the Horizon 2020 program. These six projects generated 215,779 EUR of revenues in 2019, or 2.27% of total revenues.

In 2019, NIB implemented additional 14 projects from other international funding programs (LIFE, INTERREG Italy – Slovenia, INTERREG Slovenia – Croatia, INTERREG Europe, etc.).

It also ran six projects that were co-funded by European cohesion and investment funds via the Slovenian ministries: two projects from the Ministry of Education, Science and Sport’s call for proposals “RDI in value chains and networks”, three projects from the Ministry of Education, Science and Sport’s call for proposals for support to researchers in at the beginning of their careers and one project from the call for proposals “Promoting knowledge transfer through the operation of technology transfer offices”.

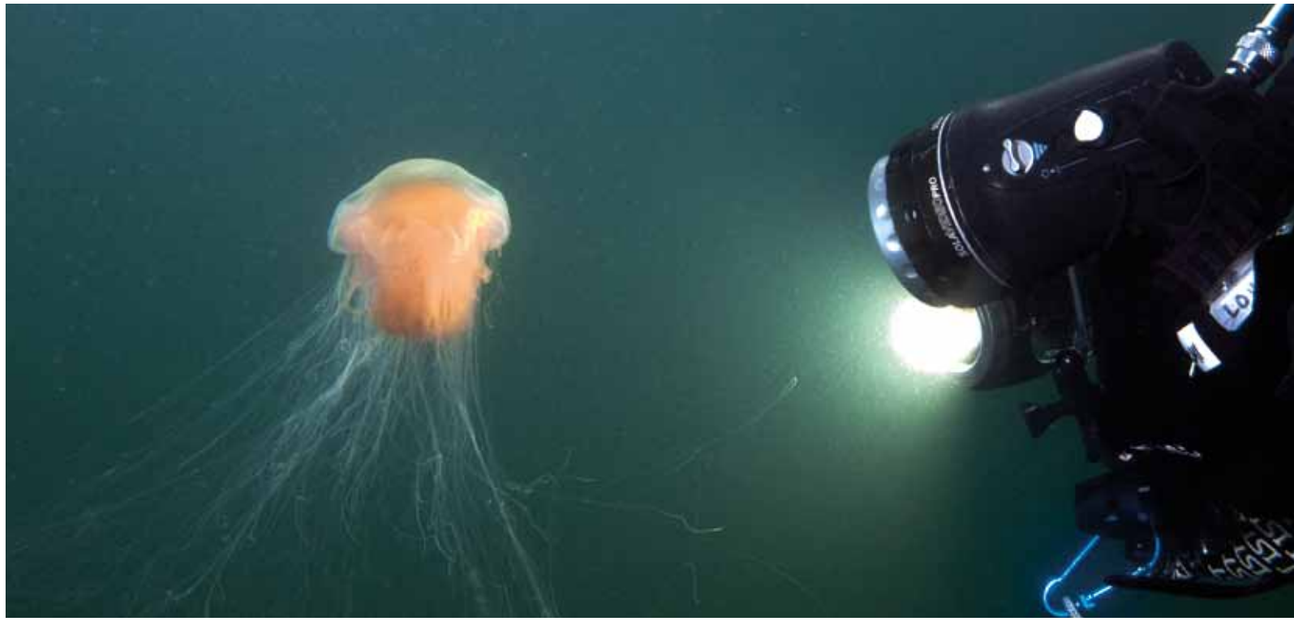
These projects generated 1,102,406 EUR of revenues or 11.61% of NIB’s total revenues in 2019.



Kolonije bakterije *Staphylococcus aureus* vzorčene s 6-stopenjskim vzorčevalnikom zraka Andersen (foto: P. Kogovšek).
Staphylococcus aureus colonies sampled with Andersen 6-stage air sampler (Photo: P. Kogovšek).

INVESTICIJE

NIB je v letu 2019 realiziral investicijska vlaganja v višini 1.541.277 EUR, od tega aktivirano v višini 1.534.081,45 EUR in v pridobivanju v višini 7.295,74 EUR. Viri nabav so neporabljena amortizacija preteklih let v višini 517.444,52 EUR in obračunana amortizacija tekočega leta v višini 509.506,69 EUR, prejeti investicijski transfer s strani MIZŠ (prenova laboratorija za celične kulture – GOI dela in raziskovalna oprema) v višini 290.000,00 EUR, prejeta sredstva od ARRS za TEM v višini 168.179,17 EUR, prejeti investicijski transfer od MO v višini 24.000,00 EUR, sredstva prejeta iz projektnega financiranja (LIFE IP, NAT2CARE) v višini 31.332,64 EUR in iz razporejenih presežkov prihodkov preteklih let za investicije v višini 914,17 EUR. S ciljem rešitve prostorske stiske je bilo v letu 2019 iz sredstev neporabljene amortizacije preteklih let v okviru zgoraj navedenega zneska porabljenih 398.136,20 EUR za postavitev 13 novih kontejnerjev (z zunanjo ureditvijo in pohištvom).



Podvodna foto in video dokumentacija je izjemnega pomena pri proučevanju morskega okolja, še toliko bolj pa, ko imamo opravka z občutljivimi organizmi, kot so tudi klobučnjaške meduze (foto: B. Mavrič). Underwater photo- and videodocumentation is very important in observations of marine environment, even more so when we are dealing with sensitive and fragile organisms like jellyfish in the picture (Photo: B. Mavrič).

INVESTMENTS

In 2019, the NIB realized investments in the amount of 1,541,277 EUR of which 1,534,081.45 EUR were activated and 7,295.74 EUR in acquisitions. The sources of supply include unused depreciation from past years in the amount of 517,444.52 EUR and a depreciation expense for the current year of 509,506.69 EUR, an investment transfer received from the Ministry of Education, Science and Sport, (renovation of the laboratory for cell cultures – construction and craft works and research equipment) in the amount of 290,000.00 EUR, funds received from ARRS for TEM in the amount of 168,179.17 EUR, investment transfer received from the Ministry of Defence in the amount of 24,000.00 EUR, funds received from project financing (LIFE IP, NAT2CARE) in the amount of 31,332.64 EUR and from the allocated surplus revenues from previous years for investments in the amount of EUR 914.17. With the aim of resolving the space shortage, 398,136.20 EUR was spent in 2019 from the funds of unused depreciation of previous years within the above-mentioned amount for the installation of 13 new containers (with external landscaping and furniture).

ZAPOSLENI V LETU 2019

Inštitut je bil v letu 2019 sestavljen iz štirih raziskovalnih enot in Skupnih služb. Zaposleni v največjih dveh enotah predstavljajo 62 % vseh zaposlenih na NIB-u. Oddelek za biotehnologijo in sistemsko biologijo je na 31. 12. 2019 zaposloval 60 sodelavcev, enota Morska biološka postaja Piran 36 sodelavcev, Oddelek za genetsko toksikologijo in biologijo raka 16 sodelavcev, Oddelek za raziskave organizmov in ekosistemov 27, Skupne službe pa 15 sodelavcev.

Na NIB-u je bilo tako na dan 31. 12. 2019 154 zaposlenih, od tega 81 raziskovalcev, 19 mladih raziskovalcev ter 54 strokovno-tehničnih in administrativnih sodelavcev.

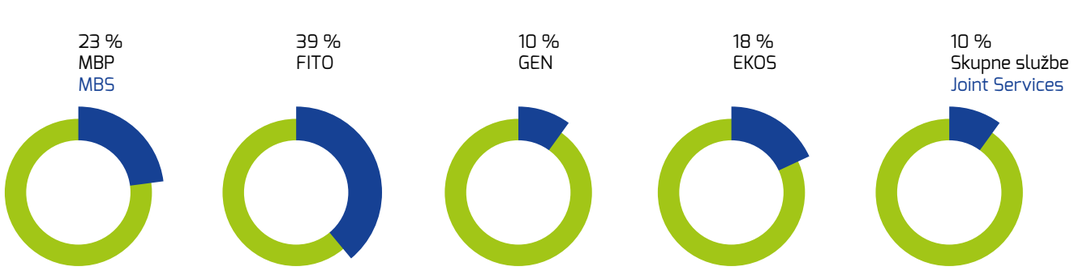
V letu 2019 se je na novo zaposlilo 27 sodelavcev, devetim je delovno razmerje na NIB-u prenehalo.

V letu 2019 se je na NIB usposabljalo 24 mladih raziskovalcev. S strani ARRS so bila raziskovalnim programom dodeljena 4 mentorska mesta za mlade raziskovalce. V letu 2019 so doktorirali štirje mladi raziskovalci.

Na dan 31. 12. 2019 je bilo na inštitutu zaposlenih 51 % delavcev z doktoratom znanosti, 4 % z magisterijem znanosti, 33 % s VII. stopnjo izobrazbe, 12 % zaposlenih je imelo nižjo izobrazbo od VII. stopnje.

STANJE PO ORGANIZACIJSKIH ENOTAH NA DAN 31. 12. 2019

NUMBER OF STAFF BY UNITS ON 31. 12. 2019



EMPLOYEES IN 2019

In 2019, the Institute was comprised of four research units and Joint Services. The employees in the biggest two units represent 62% of all NIB employees. On 31 December 2019, the Department of Biotechnology and Systems Biology had 60 employees, the Marine Biology Station Piran unit had 36, the Department of Genetic Toxicology and Cancer Biology had 16, the Department of Organisms and Ecosystems Research had 27 and Joint Services had 15.

On 31 December 2019, NIB had 154 employees of which 81 were researchers, 19 were young researchers, and 54 were the professional-technical and administrative staff.

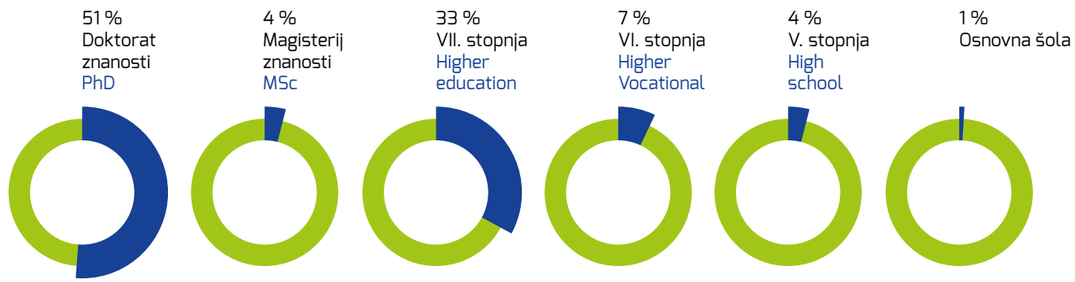
In 2019, 27 new employees were hired and nine employment relationships at NIB were terminated.

In 2019, 24 young researchers were trained at the NIB. The ARRS allocated 4 mentoring positions to research programs for young researchers. In 2019, four young researchers received their doctorates.

On 31 December 2019, 51% of the Institute's employees had doctoral degrees, 4% had master's degrees, 33% had a level of education of VII, and 12% had a level of education lower than VII.

IZOBRAZBENA STRUKTURA NA DAN 31. 12. 2019

EDUCATIONAL STRUCTURE ON 31. 12. 2019



DOKTORATI, MAGISTERIJI IN DIPLOME V LETU 2019

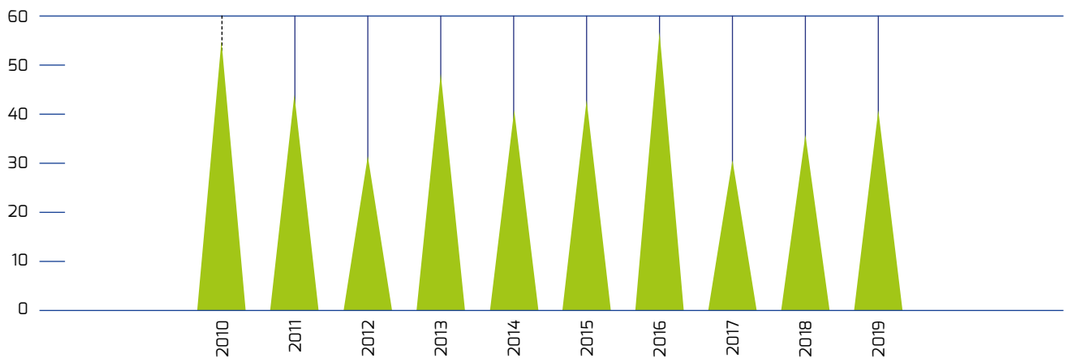
Svojo doktorsko disertacijo so pripravili pod (so)mentorstvom raziskovalcev z NIB in jo zagovarjali v letu 2019:

DOCTORAL DISSERTATIONS, MASTER'S THESES AND UNDERGRADUATE THESES IN 2019

Doctoral dissertations under the (co)supervision of NIB researchers in 2019:

ŠTUDENT/ STUDENT	(SO) MENTOR/ (CO)SUPERVISOR
dr. Kos Kramar, Maja	Mentorica izr. prof. dr. Valentina Turk (MBP)
dr. Križnik, Maja (FITO)	Mentorica prof. dr. Kristina Gruden (FITO), somentorica doc. dr. Špela Baebler (FITO)
dr. Neves Oliveira, Mona	Mentorica prof. dr. Tamara Lah Turnšek (GEN)
dr. Opalički Slabe, Maja (EKOS)	Mentor prof. dr. Anton Brancelj (EKOS)
dr. Rozina, Tinkara	Mentorica doc. dr. Tina Eleršek (GEN), somentor prof. dr. Domen Leštan
dr. Schug, Hannah Inka	Mentorja prof. dr. Kristin Schirmer, dr. Anže Županič (FITO)
dr. Tomc, Jana	Mentorica prof. dr. Metka Filipič (GEN), somentorica doc. dr. Bojana Žegura (GEN)

- ŠTEVILO DIPLOMSKIH, MAGISTRSKIH IN DOKTORSKIH NALOG POD (SO)MENTORSTVOM RAZISKOVALCEV Z NACIONALNEGA INŠTITUTA ZA BIOLOGIJO V OBDOBJU 2010-2019
- NUMBER OF UNDERGRADUATE THESES, MASTER'S THESES AND DOCTORAL DISSERTATIONS UNDER (CO)SUPERVISION OF NIB RESEARCHERS IN YEARS 2010-2019



- ŠTEVILO ZAGOVARJANIH MAGISTRSKIH IN DOKTORSKIH NALOG TER MENTORSTEV IN SOMENTORSTEV S STRANI ZAPOSLENIH NA NIB V LETU 2019
- NUMBER OF MASTER'S THESES, DOCTORAL DISSERTATIONS, SUPERVISIONS AND CO-SUPERVISIONS BY NIB EMPLOYEES IN YEAR 2019

doktorska disertacija Doctoral Dissertation	2
mentor pri doktorskih disertacijah Supervisor for Doctoral Dissertations	7
mentor pri magistrskih delih Supervisor for Master's Theses	15
mentor pri diplomskih delih Supervisor for Undergraduate Theses	4
somentor pri doktorskih disertacijah Co-Supervisor for Doctoral Dissertations	2
somentor pri magistrskih delih Co-Supervisor for Master's Theses	17
somentor pri diplomskih delih Co-Supervisor for Undergraduate Theses	6

OBJAVE IN CITIRANOST V LETU 2019

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 2019

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
2015	98	2,604	2	2363
2016	98	2,908	2	2468
2017	113	2,899	2	2421
2018	109	3,148	2	3505
2019	119	3,887	2	4186

NAJVPLIVNEJŠI ČLANKI V LETU 2019

THE MOST INFLUENTIAL ARTICLES IN 2019

KEŽAR, Andreja, KAVČIČ, Luka, PÓLAK, Martin, NOVÁČEK, Jiři, GUTIÉRREZ-AGUIRRE, Ion, TUŠEK-ŽNIDARIČ, Magda, COLL RIUS, Anna, STARE, Katja, GRUDEN, Kristina, RAVNIKAR, Maja, PAHOVNIK, David, ŽAGAR, Ema, MERZEL, Franci, ANDERLUH, Gregor, PODOBNIK, Marjetka. Structural basis for the multitasking nature of the potato virus Y coat protein. *Science advances*, ISSN 2375-2548, 2019, vol. 5, no. 7, str. 1-13, ilustr. doi: 10.1126/sciadv.aaw3808. [COBISS.SI-ID 5135183]

IF (JCR)=12.804

GARCIA-PORTA, Joan, IRISARRI, Iker, KIRCHNER, Martin, RODRÍGUEZ, Ariel, KIRCHHOF, Sebastian, BROWN, Jason L., MACLEOD, Amy, TURNER, Alexander P., AHMADZADEH, Faraham, ALBALADEJO, Gonzalo, ŽAGAR, Anamarija, et al. Environmental temperatures shape thermal physiology as well as diversification and genome-wide substitution rates in lizards. *Nature communications*, ISSN 2041-1723, 2019, vol. 10, str. 1-12. doi: 10.1038/s41467-019-11943-x. [COBISS.SI-ID 5159503]

IF (JCR)=11.878

SCHWACKE, Rainer, PONCE-SOTO, Gabriel Y., KRAUSE, Kirsten, BOLGER, Anthony M., ARSOVA, Borjana, HALLAB, Asis, GRUDEN, Kristina, STITT, Mark, BOLGER, Marie E., USADEL, Björn. MapMan4 : a refined protein classification and annotation framework applicable to multi-omics data analysis. *Molecular Plant*, ISSN 1674-2052, 2019, vol. 12, iss. 6, str. 879-892, doi: 10.1016/j.molp.2019.01.003. [COBISS.SI-ID 4958799],

IF (JCR)=10.812

KUNTNER, Matjaž, HAMILTON, Christopher A., CHENG, Ren-Chung, GREGORIČ, Matjaž, LUPŠE, Nik, LOKOVŠEK, Tjaša, LEMMON, Emily Moriarty, LEMMON, Alan R., AGNARSSON, Ingi, CODDINGTON, Jonathan A., BOND, Jason E. Golden orbweavers ignore biological rules : phylogenomic and comparative analyses unravel a complex evolution of sexual size dimorphism. *Systematic biology : a journal of the Society of Systematic Biologists*, ISSN 1063-5157. [Print ed.], 2019, vol. 68, iss. 4, str. 555-572, ilustr., doi: 10.1093/sysbio/syy082. [COBISS.SI-ID 44009773]

IF (JCR)= 10.266

AZZURRO, Ernesto, SBRAGAGLIA, Valerio, CERRI, Jacopo, BARICHE, Michel, BOLOGNINI, Luca, BEN SOUISSI, Jamila, BUSONI, Giulio, COCO, Salvatore, CHRYSSANTHI, Antoniadou, FANELLI, Emanuela, LIPEJ, Lovrenc, et al. Climate change, biological invasions, and the shifting distribution of Mediterranean fishes : a large-scale survey based on local ecological knowledge. ***Global change biology***, ISSN 1354-1013. Print ed., 2019, vol. 25, iss. 8, str. 2779-2792, ilustr., doi: 10.1111/gcb.14670. [COBISS.SI-ID 5075279]

IF 8.800

MALAČIČ, Vlado, ŽAGAR, Nedjeljka. Seawater icicles of the Adriatic Sea. *Bulletin of the American Meteorological Society*, ISSN 0003-0007, 2019, vol. 100, no. 6, str. 987-994. doi: 10.1175/BAMS-D-18-0118.1. [COBISS.SI-ID 4973391]

IF 8.166

MORI, Nataša, DEBELJAK, Barbara, ŠKERJANEC, Mateja, SIMČIČ, Tatjana, KANDUČ, Tjaša, BRANCELJ, Anton. Modelling the effects of multiple stressors on respiration and microbial biomass in the hyporheic zone using decision trees. *Water research*, ISSN 0043-1354. [Print ed.], 2019, vol. 149, str. 9-20. doi: 10.1016/j.watres.2018.10.093. [COBISS.SI-ID 4885071]

IF 7.913

MIŠÍK, Miroslav, FILIPIČ, Metka, NERSESYAN, Armen, KUNDI, Michael, ISIDORI, Marina, KNASMÜELLER, Siegfried. Environmental risk assessment of widely used anticancer drugs (5-fluorouracil, cisplatin, etoposide, imatinib mesylate). *Water research*, ISSN 0043-1354. [Print ed.], 2019, vol. 164, 1-10 str., doi: 10.1016/j.watres.2019.114953. [COBISS.SI-ID 5139535]

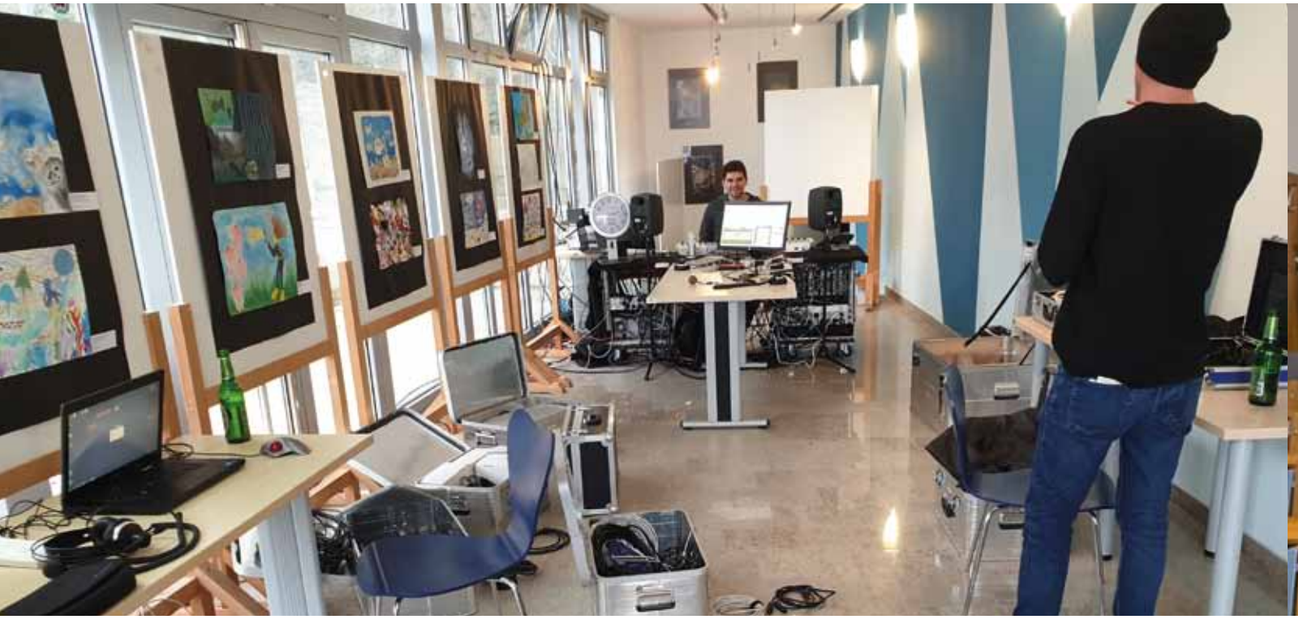
IF 7.913

BIBLIOGRAFIJA INŠTITUTA V LETIH 2010 – 2019 (ANALITIČNI PODATKI)

INSTITUTE'S BIBLIOGRAPHY IN 2010 – 2019 (ANALYTICAL DATA)

ZVRST DOKUMENTA TYPE OF DOCUMENT	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	SKUPAJ TOTAL
znanstveni članki z IF scientific papers with IF	58	72	86	83	79	80	82	97	91	99	**827**
znanstveni članki brez IF other scientific papers	21	9	16	7	13	18	16	16	18	20	**154**
strokovni in poljudni članki professional and popular articles	56	69	66	62	45	43	62	58	49	44	**554**
objavljeni prispevki s kongresov published conference papers	40	39	18	24	16	17	16	24	17	11	**222**
povzetki s kongresov published conference paper abstracts	145	159	101	166	166	156	149	159	178	178	**1557**
poglavja v knjigah book chapters	13	10	14	28	11	9	7	18	8	30	**148**
knjige books	3	4	4	3	6	1	6	5	1	2	**35**
poročila reports	30	27	28	34	23	35	38	51	51	40	**357**
doktorska dela doctoral dissertations	7	8	7	9	8	4	4	2	6	2	**57**
magistrska dela master's theses		1	1		2	1	2	1	5		**13**
patenti patents	2	4	3	2	2	2		1	1	2	**19**
razno other	93	128	121	207	138	161	151	217	250	198	**1664**
SKUPAJ TOTAL	**468**	**530**	**465**	**625**	**509**	**527**	**533**	**649**	**675**	**626**	**5607**

PRISPEVKI SOAVTORJEV IZ RAZLIČNIH ODDELKOV NIB SO ŠTETI ENKRAT.
PAPERS OF CO-AUTHORS FROM DIFFERENT NIB DEPARTMENTS ARE COUNTED ONCE.



Val 202 je v počastitev 50. obletnice delovanja MBP oddajal iz njenih prostorov (foto: T. Turk Dermastia).

USPEHI, NAGRADE IN PRIZNANJA V LETU 2019

NAGRADE MIROSLAVA ZEIA IN PRIZNANJA NACIONALNEGA INŠTITUTA ZA BIOLOGIJO

Ljubljana, 11. 11. 2019

Nacionalni inštitut za biologijo (NIB) je ob 59. letnici obstoja že desetič podelil nagrade in priznanja Nacionalnega inštituta za biologijo, poimenovana po prof. dr. Miroslavu Zeiu, ki je bil eden njegovih ustanoviteljev. Nagrade Miroslava Zeia so bile podeljene posameznikom za njihove izjemne dosežke na področju osnovnih in uporabnih raziskav ved o življenju ter uresničevanja vizij in poslanstva NIB. Slavnostni dogodek je potekal v ponedeljek 11. 11. 2019 v Biološkem središču na Večni poti 111 v Ljubljani. Zbrane goste sta slavnostno nagovorila direktor NIB, izr. prof. dr. Matjaž Kuntner, in častni gost, minister za izobraževanje, znanost in šport, prof. dr. Jernej Pikalo.

Nagrado prof. Miroslava Zeia za izjemne dosežke na področju dejavnosti Nacionalnega inštituta za biologijo za leto 2019 sta prejeli dr. Tanja Dreo in pridr. prof. dr. Nataša Mehle.

Nagrado za izjemno doktorsko delo na področju dejavnosti Nacionalnega inštituta za biologijo je prejel dr. Klemen Čandek. Na prireditvi so priznanja NIB-a prejeli tudi štirje mladi sodelavci NIB-a, ki so v obdobju od 1. oktobra 2018 do 30. septembra 2019 pridobili doktorske nazive.

PRIZNANJE PROMETEJ ZNANOSTI ZA ODLIČNOST V KOMUNICIRANJU V ZNANOSTI

Slovenska znanstvena fundacija je podelila slovensko priznanje Prometej znanosti za odličnost v komuniciranju v znanosti uredniškemu odboru publikacije Pol stoletja dolga pot Morske biološke postaje Piran 1969-2019 Nacionalnega inštituta za biologijo. Prejeli so priznanje za izjemno usklajeno znanstveno sporočilo z vizualno komunikacijo v publikaciji.

Podelitev Nagrad Miroslava Zeia in priznanj Nacionalnega inštituta za biologijo (foto: M. Arandjelovic).

SUCCESSES, AWARDS, AND RECOGNITIONS IN THE YEAR 2019

THE AWARD OF MIROSLAV ZEI AND THE RECOGNITIONS OF THE NATIONAL INSTITUTE OF BIOLOGY

Ljubljana, 11th November 2019

The National Institute of Biology (NIB) presented awards and recognitions at the 59th anniversary of its existence for the tenth time already. The awards and recognitions are named after Prof. Dr Miroslav Zei, who was one of its founders. The Miroslav Zei awards were presented to individuals for their exceptional achievements in the field of basic and useful research sciences on life and fulfilling the visions and missions of the NIB. The formal event took place on Monday, the 11th of November 2019, at the Biological Centre at Večna pot 111 in Ljubljana. The Director of the NIB, Assoc. Prof. Dr Matjaž Kuntner, and a guest of honor, the Minister for Education, Science and Sport, Prof. Dr Jernej Pikalo, formally addressed the assembled guests.

The Miroslav Zei Award for Exceptional Achievements in the Field of Activities of the National Institute of Biology for the year 2019 was presented to Dr Tanja Dreo, and Assoc. Prof. Dr Nataša Mehle.

The Award for an Exceptional Doctoral Dissertation in the Field of Activities of the National Institute of Biology was presented to Dr Klemen Čandek. At the ceremony, the recognitions of the National Institute of Biology were presented also to all young coworkers of the NIB, who obtained doctoral degrees from the 1st of October 2018 to the 30th of September 2019.

PROMETHEUS OF SCIENCE FOR EXCELLENCE IN SCIENCE COMMUNICATION

The Slovenian Science Foundation presented the Slovenian Prometheus of Science for Excellence in Science Communication Award to the editorial board of the publication Half a Century Long Path of the Marine Biology Station Piran 1969-2019 of the National Institute of Biology. They received recognition for an exceptionally coordinated scientific message with visual communication in the publication.

MORSKA BIOLOŠKA POSTAJA PIRAN PRAZNOVALA 50-LETNICO OBSTOJA

Za enoto MBP je bilo leto 2019 zelo pomembno, saj je praznovala 50-letnico delovanja v okviru Nacionalnega inštituta za biologijo. Ta častitljiva obletnica je bila skozi leto obeležena na več načinov: s predavanji različnemu krogu poslušalcev, številnimi nastopi v medijih (časopis, radio, TV, internet) ter izdajo priložnostne znamke in publikacije »Pol stoletja dolga pot Morske biološke postaje Piran, 1969 – 2019«. Vse skupaj je zaokrožila proslava, ki je potekala 10. 10. 2019 v Avditoriju Portorož. Častni gost je bil predsednik Državnega zbora, mag. Dejan Židan. Osrednje predavanje o navidezni nespremenljivosti morja, a prav zato pomembnosti raziskav MBP in drugih, je podal mag. Robert Turk iz Zavoda Republike Slovenije za varstvo narave.

NACIONALNI INŠTITUT ZA BIOLOGIJO JE BIL URADNO IMENOVAN ZA DVA EVROPSKA REFERENČNA LABORATORIJA ZA POVZROČITELJE BOLEZNI RASTLIN.

Gre za prvo imenovanje evropskih referenčnih laboratorijev (EURL) za škodljive organizme rastlin, in sicer eden za viruse, viroide, fitoplazme, in drugi za bakterije, v katerem NIB sodeluje z Nizozemsko (NVWA), Italijo (CREA) in v primeru bakterij še z Belgijo (ILVO). V okviru obeh EURL je NIB uspešno organiziral prva testa preizkušanja usposobljenosti uradnih EU laboratorijev.

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

- Mlada raziskovalka Špela Tomaž je prejela fakultetno (FKKT) Prešernovo nagrado pod mentorstvom prof. dr. Kristine Gruden in somentorstvom prof. dr. Dušana Turka.
- 19. 3. 2019 je Društvo mlada akademija na slavnostni prireditvi v Predsedniški palači že desetič podelilo nagrado Mentor leta. Društvo Mlada akademija je predstavilo pet finalistov, poleg zmagovalke Barbare Korouši Seljak še Meto Virant – Doberlet z Nacionalnega inštituta za biologijo.
- Mladi raziskovalec Borut Umer je pridobil Fulbrightovo štipendijo za devet mesecev študija v ZDA na Texas A&M University, fizikalna oceanografija.
- Timotej Turk Dermastia, mladi raziskovalec, je zmagal na Znanstvenem slamu 2019 – Cutting Edge.
- Inženirska akademija (IAS) je na letni skupščini izvolila nove redne, izredne, dopisne in častne člane. Prof. dr. Tamara Lah Turnšek je postala redna članica.
- Arijana Filipić je dobila nagrado za najboljše predavanje na konferenci »9th International Young Water Professionals Conference, 23–27 junij 2019, Toronto, Kanada«, ki je gostila približno 300 udeležencev s celega sveta. Prejela je tudi tretjo nagrado za najboljše predavanje, dodeljeno s strani publike na 11. študentski konferenco Mednarodne podiplomske šole Jožefa Stefana in 13. dnevu mladih raziskovalcev (Konferenca KMBO), 15. in 16. april 2019, Planica, Slovenija.
- Mojca Juteršek je na 11. študentski konferenci Mednarodne podiplomske šole Jožefa Stefana prejela nagrado za predstavitev raziskovalnega dosežka.

MARINE BIOLOGY STATION PIRAN CELEBRATED ITS 50TH ANNIVERSARY

The year 2019 was very important for the MBS unit, as it celebrated its 50th anniversary within the National Institute of Biology. This venerable anniversary was marked in several ways throughout the year – by lectures to different circles of listeners, by numerous performances in the media (newspaper, radio, TV, and internet) and the publication of a commemorative stamp and publications »Half a Century Long Path of the Marine Biological Station Piran, 1969-2019«. The peak was a celebration, which took place on 10 October 2019 in the Auditorium Portorož. The guest of honor was the president of the National Assembly, MSc Dejan Židan. The central lecture on an apparent changelessness of the sea and the importance of research by MBS and others precisely because of this matter was performed by MSc Robert Turk, from the Institute of the Republic of Slovenia for Nature Conservation.

THE NATIONAL INSTITUTE OF BIOLOGY HAS BEEN OFFICIALLY DESIGNATED FOR THE TWO EUROPEAN REFERENCE LABORATORIES FOR PLANT PATHOGENS.

It is the first designation of European Reference Laboratories (EURL) for plant pests, one for viruses, viroids, phytoplasmas and the other for bacteria, in which the NIB cooperates with the Netherlands (NVWA), Italy (CREA) and with Belgium (ILVO) in the case of bacteria. Within both EURLs, the NIB successfully organized the first proficiency testing of official EU laboratories.

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

- A young researcher Špela Tomaž received the Faculty (FKKT) Prešeren Prize under the mentorship of Prof. Dr Kristina Gruden, and co-mentorship of Prof. Dr Dušan Turk.
- On 19 March 2019, the Young Academy Society awarded the Mentor of the Year award at a gala event at the Presidential Palace for the tenth time already. The Young Academy Society presented five finalists, in addition to the winner Barbara Koroušić Seljak also Meta Virant – Doberlet from the National Institute of Biology.
- A young researcher Borut Umer received a Fulbright scholarship for a nine-month study in the USA at Texas A&M University, physical oceanography.
- Timotej Turk Dermastia, a young researcher, won the Science Slam 2019 – Cutting Edge.
- The Academy of Engineering (IAS) elected new regular, associate, correspondent, and honorary members at the annual general meeting. Prof. Dr Tamara Lah Turnšek, became a regular member.
- Arijana Filipić received an award for the best lecture at the conference "The 9th International Young Water Professionals Conference, June 23-27, 2019, Toronto, Canada", which hosted about 300 participants from around the world. She also received the third prize for the best lecture awarded by the audience at the 11th Student Conference of the Jožef Stefan International Postgraduate School and the 13th day of young researchers (KMBO Conference), 15 and 16 April 2019, Planica, Slovenia.
- At the 11th student conference of the Jožef Stefan International Postgraduate School, Mojca Juteršek received an award for presenting her research achievement.

IZUMI IN INOVACIJE

V letu 2019 je bil NIB s strani Evropskega patentnega urada (EPO) podeljen patent prof. dr. Bojana Sedmaka s partnerji Arhel, d. o. o., Biotehniško fakulteto Univerze v Ljubljani in Envito, d. o. o. za izum »Metoda in sistem za sočasno zaznavanje koncentracije mikrodelcev v suspenziji in njihovih morfoloških in fizioloških značilnosti«. Pisarna za prenos tehnologij na NIB je pristopila k postopkom za zaščito in trženje predmetnega izuma.

Tudi izumi in inovacije za NIB pomenijo odsev rezultatov raziskovalnega dela in potencial za sodelovanje z industrijskimi partnerji. Na NIB je področje izumov in inovacij v domeni Komisije za izume, sestavljene iz raziskovalcev, ki jih predlagajo oddelki NIB, ter predstavnikov Pisarne za prenos tehnologij.

Dodatno je NIB skupaj z industrijskim partnerjem na področju čiščenja virusnih vektorjev in cepiv vložil PCT patentno prijavo pri WIPO (International Bureau of the World Intellectual Property Organisation).

Sodelavci v Pisarni za prenos tehnologij so se v letu 2019 z namenom krepitve znanj in kompetenc s področja upravljanja izumov in prenosa tehnologij kot udeleženci ali soorganizatorji udeleževali posvetov in izobraževanj s področja upravljanja intelektualne lastnine (tako v okviru konzorcija KTT kot dogodkov Evropske komisije – European Research and Innovation Days).

Za interno promocijo pomena inovacij in upravljanja z intelektualno lastnino je bil izdelan in objavljen priročnik Pospešujemo inovacije (Podpora raziskovalcem pri prenosu tehnologij).

PRENOS ZNANJA V GOSPODARSTVO

Upravljanje trženja izdelkov in storitev na NIB je sistemsko v domeni v letu 2010 ustanovljene Pisarne za prenos tehnologij. V okviru leta 2017 ustanovljenega Konzorcija za prenos tehnologij iz JRO v gospodarstvo tudi pisarna na NIB izvaja različne dejavnosti in podporo raziskovalcem z namenom pospešitve prenosa znanj v gospodarstvo oziroma povečanja deleža tržnih prihodkov v celotnih prihodkih NIB.

Tu gre za izvedbo izobraževanj, usposabljanj in svetovanj na področju izdelave poslovnih načrtov, trženja izdelkov in storitev ter upravljanja intelektualne lastnine.

Te aktivnosti 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 okviru in tudi s podporo razpoložljivih sredstev projekta je bila v letu 2019 za raziskovalce na pobudo oddelka FITO med drugim izvedena Delavnica o trženju RR dosežkov ter predstavitev NIB v okviru dogodka Dan inovativnosti (GZS) ter na Razstavi dosežkov slovenske industrije in institucij znanja – Future Food (GZS).

V letu 2019 se je na področju prenosa znanj v gospodarstvo v sodelovanju z domačimi in tujimi inovativnim podjetji na NIB dodatno še okrepilo področje razvoja in izvajanja molekularnih metod za kvantifikacijo virusov za gensko terapijo. Poleg tega se je nadaljevalo že vzpostavljeno sodelovanje s partnerji iz gospodarstva tudi na področju raziskav monitoringa morja, biodiverzitete in ekosistemskih storitev ter na področju raziskav tumorskih biomarkerjev.

INVENTIONS AND INNOVATIONS

In 2019, the NIB was granted a patent by the European Patent Office (EPO) of Prof. Dr Bojan Sedmak, and the partners Arhel, d.o.o., the Biotechnical Faculty of the University of Ljubljana, and Envita, d.o.o. for the invention entitled “Method and system for simultaneous detection of microparticle concentration in suspension and their morphological and physiological traits”. The Technology Transfer Office at the NIB started the procedures for the protection and marketing of the applicable innovation.

For NIB, inventions and innovations also represent a reflection of the results of its research work and the potential to establish quality cooperation with the industrial partners. The field of inventions and innovations at the NIB is managed by the Inventions Commission comprised of researchers put forward by the various NIB departments and representatives of the Technology Transfer Office.

Besides, the NIB filed a PCT patent application at the WIPO (International Bureau of the World Intellectual Property Organization) together with an industrial partner in the field of cleaning viral vectors and vaccines.

To strengthen knowledge and competencies in the field of invention management and technology transfer, the co-workers in the Technology Transfer Office participated in consultations and pieces of training in the field of intellectual property management as participants or co-organizers in 2019 (both within the KTT consortium and the European Commission events – the European Research and Innovation Days).

To promote the importance of innovation and intellectual property management internally, the manual Accelerating Innovation (Supporting Researchers in Technology Transfer) was written and published.

TRANSFER OF KNOWLEDGE TO THE ECONOMY

The management of the marketing of products and services at the NIB is systemically in the domain of the Technology Transfer Office established in 2010. 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 and supports researchers intending to accelerate the transfer of knowledge to the economy or increase the share of market revenues in total NIB revenues.

This includes the implementation of education, training, and consulting in the field of business planning, marketing of products and services, and intellectual property management.

These activities are performed within the five-year project KTT (2017-2022) – the Consortium for Technology Transfer from Public Research Agencies to the Economy, funded by the Ministry of Science, Education and Sports, which aims to encourage strengthening links and cooperation between public research organizations and the economy and strengthening technology transfer offices, researchers, and companies.

Within the framework of and also with the support of available project funds, in 2019, a Workshop on Marketing R&D Achievements and a presentation of the NIB within the Innovation Day (the Chamber of Commerce and Industry of Slovenia) event and at the Exhibition of Achievements of Slovenian Industry and Knowledge Institutions – Future Food (the Chamber of Commerce and Industry of Slovenia) were performed for researchers in 2019 at the initiative of the FITO department.

In 2019, the field of the development and implementation of molecular methods for the quantification of viruses for gene therapy was further strengthened in cooperation with domestic and foreign innovative companies at the NIB in the field of knowledge transfer to the economy. Besides, the already established cooperation with business partners continued in the field of marine monitoring research, biodiversity, and ecosystem services, as well as in the field of research on tumor biomarkers.

1.0 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.

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2.0)

MORSKA BIOLOŠKA POSTAJA PIRAN
MARINE BIOLOGY STATION PIRAN

Spremenljivost in odzivnost morskih ekosistemov.
Variability and resilience of marine ecosystems.

Morska lilija (*Antedon mediterranea*), nekoč tudi del favne slovenskega morja, je pri nas izginila med obsežnimi anoksijami konec 70. in 80. letih 20. stol. in se do danes še ni vrnila nazaj (foto: T. Makovec).

The Mediterranean feather star (*Antedon mediterranea*), once also a part of the fauna of the Slovenian sea, disappeared in Slovenia during extensive anoxia in the late 1970s and 1980s and has not returned to this day (Photo: T. Makovec).

MORSKA BIOLOŠKA POSTAJA PIRAN
MARINE BIOLOGY STATION PIRAN

VODJA: izr. prof. dr. Patricija Mozetič
HEAD: Assoc. Prof. Dr Patricija Mozetič

Izr. prof. dr. Patricija Mozetič je od marca 2018 vodja enote Morska biološka postaja Piran in hkrati tudi vodja raziskovalnega programa ARRS »Raziskave obalnega morja« ter izredna profesorica za področje ekologije na Univerzi na Primorskem. Njeno raziskovalno delo je osredotočeno na ekologijo in ekofiziologijo fitoplanktona obalnih morij, kar vključuje raziskave dolgoročnih sprememb fitoplanktonske združbe, 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).

As of March 2018, Marine Biology Station Piran is headed by Assoc. Prof. Dr Patricija Mozetič. At the same time, she manages the ARRS research programme “Coastal Sea Research” and serves as Associate Professor in the field of ecology at the University of Primorska. Her research work is focused on the ecology and eco-physiology of the phytoplankton in coastal seas, which includes research into long-term changes in phytoplankton communities, 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).

Polip trdoživnjaka morska narcisa (*Corymorpha nutans*) se v najhladnejšem obdobju leta občasno pojavi na blatno peščenem morskem dnu (foto: T. Makovec). The polyp of *Corymorpha nutans* appears on the muddy sandy seabed occasionally during the coldest period of the year (Photo: T. Makovec).

RAZISKAVE OBALNEGA MORJA

KLJUČNE DEJAVNOSTI

Morska biološka postaja Piran (MBP) je kot vodilna enota za raziskave morskih ekosistemov v Sloveniji tudi v letu 2019 nadaljevala s temeljnimi in uporabnimi raziskavami v okviru dveh raziskovalnih programov (P1-0237 in v manjši meri P1-0143) ter več nacionalnih in mednarodnih projektov. Interdisciplinarne programske raziskave zagotavljajo temeljna znanja o zgradbi in delovanju ekosistemov ter biogeokemičnih procesih v obalnem morju, kjer so organizmi in ekosistemi izpostavljeni kombinaciji številnih dejavnikov, ki delujejo v različnih prostorskih in časovnih skalah. V tem letu smo pridobili en temeljni in en podoktorski ARRS projekt; kot partnerska organizacija smo bili vključeni še v štiri ARRS projekte, ki dopolnjujejo temeljne in aplikativne raziskave. Potekajoči CRP projekt omogoča prenos znanja do uporabnikov na področju ribištva in kmetijstva ter povezovanje s sorodnimi institucijami. Z izvajanjem strokovnih nalog za različne uporabnike smo tudi v letu 2019 nudili podporo tako državnim institucijam, javnim zavodom kot gospodarskim družbam pri trajnostno usmerjenem gospodarskem in družbenem razvoju obalnega prostora in morja.

PODROČJA RAZISKAV

- Raziskujemo različne ravni biološke raznovrstnosti – od genoma do vrstne sestave in raznovrstnosti življenjskih združb in okolij (plankton, bentoški nevretenčarji, makroalge, obrežne ribje združbe, podvodni travniki, biogene formacije). V raziskave vključujemo pristope primerjalne genomike in evolucijske vidike ter poleg strukture proučujemo tudi procese.
- Raziskujemo vlogo fitoplanktona pri kroženju ogljika, analiziramo časovne serije za razumevanje vpliva podnebnih sprememb in evtrofikacije. Raziskujemo raznovrstnost morskih mikrobnih združb ter interakcije mikroorganizmov z organskimi in anorganskimi spojinami. Proučujemo množično pojavljanje želatinoznega planktona in iščemo rešitve za blaženje negativnih vplivov tega pojava na ekosistem.
- Raziskujemo vplive na organizme in okolje, ki so posledica podnebnih sprememb in človekovih dejavnosti v morju. Osredotočeni smo na kroženje in razgradnjo onesnažil, na oksidacijske procese v odpadnih vodah in v morskem okolju, ki so pomembni za razgradnjo. Učinke onesnažil v organizmih preučujemo predvsem na subcelični ravni.

Sredozemska barakuda (*Sphyraena sphyraena*) je termofilna vrsta, ki je vse pogostejša v Jadranskem morju, tudi njegovem severnem delu (foto: L. Lipej). The Mediterranean barracuda (*Sphyraena sphyraena*) is a thermophilic species that is becoming more common in the Adriatic Sea, including its northern part (Photo: L. Lipej).

COASTAL SEA RESEARCH

BASIC ACTIVITIES

As the leading unit for research of marine ecosystems in Slovenia, the Marine Biology Station Piran (MBS) continued with basic and applied research within the framework of two research programs (P1-0237, as well as P1-0143 to a lesser extent) and several national and international projects in 2019. Interdisciplinary program research provides basic knowledge about the structure and functioning of ecosystems and biogeochemical processes in the coastal sea where organisms and ecosystems are exposed to a combination of many factors operating in different spatial and temporal scales. This year, we acquired one basic and one postdoctoral ARRS project. As a partner organization, we were involved also in four more ARRS projects that complement basic and applicative research. The ongoing CRP project enables the transfer of knowledge to users in the field of fisheries and agriculture and networking with related institutions. By performing professional expertises for various users, in 2019, we also offered support to state institutions, public institutions, and companies in the sustainable economic and social development of the coastal area and the sea.

FIELDS OF RESEARCH

- We investigate different levels of biological diversity – from the genome to the species composition and diversity of living communities and environments (plankton, benthic invertebrates, macroalgae, riparian fish communities, underwater meadows, biogenic formations). We include comparative genomics approaches and evolutionary aspects in our research, and we also study processes in addition to the structure.
- We investigate the role of phytoplankton in carbon cycle, analyze time series to understand the impact of climate change and eutrophication. We investigate the diversity of marine microbial communities and the interactions of microorganisms with organic and inorganic compounds. We study the mass occurrence of gelatinous plankton and look for solutions to mitigate the negative impacts of this phenomenon on the ecosystem.
- We research the impacts on organisms and the environment resulting from climate change and human activities at sea. We focus on the circulation and decomposition of pollutants, on oxidation processes in wastewater and in the marine environment that are important for decomposition. The effects of pollutants in organisms are studied mainly on the subcellular level.

- Raziskujemo dinamiko vodnih mas in modeliranje v obalnem morju, razvijamo avtomatizirano obdelavo podatkov in krepimo razvoj infrastrukture na morju. S svojim znanjem in izkušnjami lahko ponudimo rešitve za različne gospodarske subjekte in dejavnosti na morju ter v obalnem pasu ter razvijamo inovacije na področju opazovanja morja.
- Na podlagi javnega pooblastila Agencije RS za okolje izvajamo programe monitoringa morja za vrednotenje ekološkega in okoljskega stanja z biološkimi elementi ter fizikalnimi in kemičnimi parametri v skladu z državno in evropsko okoljsko zakonodajo (ODMS 2008/56/ES in ODV 2000/60/ES) in sodelujemo pri oblikovanju mednarodnih okoljskih politik.
- Povezujemo se v mrežo evropskih morskih bioloških postaj (MARS), smo člani združenja EuroMarine in EuroGOOS ter partner v slovenskem konzorciju LifeWatch Slovenija, preko katerega vstopamo v evropsko raziskovalno infrastrukturo LifeWatch-ERIC za biodiveriziteto in ekosisteme. 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 in napredne možnosti izobraževanja. Zainteresiranim raziskovalcem in študentom ponujamo bivanje v dormitoriju ter delo v laboratorijih in na morju.
- Z različnimi stalnimi dejavnostmi, kot so Dan odprtih vrat Morske biološke postaje Piran, objavljanje prispevkov v poljudnih in strokovnih revijah in izvajanje predavanj za različne starostne skupine ter sodelovanje na drugih dogodkih (npr. Dan biotske raznovrstnosti, Znanstival, Dan očarljivih rastlin, Evropska noč raziskovalcev), močno prispevamo k širjenju znanja o morju in dvigu morske pismenosti pri strokovni in laični javnosti.

Gosti grozdi dagenj (*Mytilus galloprovincialis*) na verigah boje Vide so živahno zbirališče organizmov na odprtem morju in tako zanimiv objekt proučevanja (foto: T. Makovec). The dense clusters of mussels *(Mytilus galloprovincialis*) on the chains of the Vida buoy are a lively gathering place of organisms on the high seas and thus an interesting object of study (Photo: T. Makovec).

- We research the dynamics of water masses and modeling in the coastal sea, develop automated data processing, and strengthen the development of infrastructure at sea. With our knowledge and experiences, we can offer solutions for various economic entities and activities at sea and in the coastal zone. We develop innovations in the field of sea observation.
- Based on the public authorization of the Slovenia Environment Agency, we implement marine monitoring programs for the assessment of ecological and environmental status with biological elements and physical and chemical parameters following national and European environmental legislation (ODMS 2008/56/EC and ODV 2000/60/EC) and we participate in the planning of international environmental policies.
- We are part of the European Network of Marine Stations (MARS). We are members of the associations EuroMarine and EuroGOOS and a partner in the Slovenian consortium LifeWatch Slovenia through which we enter the European research infrastructure LifeWatch-ERIC for biodiversity and ecosystems. Within the framework of these links and European projects, we develop innovative research methodologies and research concepts and provide access to biological sources and historical data from observations, state-of-the-art experimental and analytical capabilities, and advanced educational opportunities. We offer interested researchers and students living in a dormitory and working in laboratories and at sea.
- Through various ongoing activities, such as the Piran Marine Biology Station Open Day, publishing articles in popular and professional journals, lecturing for different age groups, and participating in other events (e.g. Biodiversity Day, Science Festival (Znanstival), Enchanting Plants Day, European Researchers' Night), we make a strong contribution to spreading knowledge about the sea and raising maritime literacy among the professional and lay public.

Jata zlatih cipeljev (*Liza aurata*) se gosti z izločki velikega leščurja (*Pinna nobilis*) (foto: T. Makovec).
A flock of golden grey mullets (*Liza aurata*) is hosted with secretions of the noble pen shell (*Pinna nobilis*) (Photo: T. Makovec).

V letu 2019 je Morska biološka postaja Piran NIB praznovala svojo 50-letnico obstoja, ki smo jo obeležili tudi s slovesnostjo v Avditoriju Portorož (foto: M. Alpner). In 2019, the Marine Biology Station Piran NIB celebrated its 50th anniversary of existence which was also celebrated with a ceremony in the Auditorium Portorož (Photo: M. Alpner).

GLAVNI DOSEŽKI V LETU 2019

V letu 2019 je bilo MBP odobreno podaljšanje raziskovalnega programa P1-0237, Raziskave obalnega morja, za obdobje 6 let (2020-2025).

Največji in najbolj odmeven dogodek enote v letu 2019 je bilo obeleženje 50-letnice delovanja Morske biološke postaje Piran, edine slovenske raziskovalne enote, ki se ukvarja izključno z raziskavami morskih ekosistemov. Vztrajanje dolgo pet desetletij v zelo različnih in turbulentnih pogojih raziskovalnega delovanja smo prepoznali kot zelo pomemben dosežek.

Z vstopom v konzorcije štirih Interreg projektov smo utrdili svojo vlogo v regiji pri iskanju okoljskih rešitev z uporabo zelenih tehnologij in ohranjanju biotske raznovrstnosti ter pri strategijah upravljanja Sredozemlja s krepitvijo zmogljivosti in izmenjavo znanj. Preko COST akcije (CA18238), ki se je začela oktobra 2019 in v kateri je MBP vodilni partner, vstopamo v evropsko transdisciplinarno mrežo za morsko biotehnologijo.

23. decembra 2019 je s sprostitvijo finančnih sredstev s strani SVRK dejansko zaživel projekt LifeWatch Slovenija, ki bo partnerjem konzorcija, v katerega je vključen NIB z MBP Piran, omogočil nakup opreme za podporo izvajanju mednarodnih raziskovalnih projektov pri spremljanju in napovedovanju vplivov globalnih sprememb na biotsko raznovrstnost. Projekt RI-SI-LifeWatch izpolnjuje nacionalno prednostno nalogo v okviru Raziskovalne in inovacijske strategije Slovenije 2011–2020.

Slavnostna prireditev ob 50-letnici Morske biološke postaje Piran Nacionalnega inštituta za biologijo je bila 10. 10. 2019 v Avditoriju Portorož. Na sliki stojijo od leve proti desni: mag. Robert Turk (Zavod RS za varstvo narave), prof. dr. Tamara Lah Turnšek (nekdanja direktorica NIB), mag. Dejan Židan (predsednik Državnega zbora), prof. dr. Alenka Malej (nekdanja vodja MBP Piran), izr. prof. dr. Matjaž Kuntner (direktor NIB), izr. prof. dr. Patricija Mozetič (vodja MBP Piran) (foto: M. Alpner). A festive event on the occasion of the 50th anniversary of the Marine Biology Station Piran of the National Institute of Biology was held on 10 October 2019 in the Auditorium Portorož. In the picture, standing from left to right: MSc Robert Turk, (Institute of the Republic of Slovenia for Nature Conservation), Prof. Dr Tamara Lah Turnšek, (former director of the NIB), MSc Dejan Židan, (President of the National Assembly), Prof. Dr Alenka Malej, (former head of the MBS Piran), Assoc. Prof. Dr Matjaž Kuntner, (Director of the NIB), Assoc. Prof. Dr Patricija Mozetič (head of the MBS Piran) (Photo: M. Alpner).

MAJOR ACHIEVEMENTS IN 2019

In 2019, MBS was granted a prolongation of the research program P1-0237, Coastal Sea Research, for 6 years (2020-2025).

The largest and most attention-grabbing event of the unit in 2019 was the celebration of the 50th anniversary of the Marine Biology Station Piran, the only Slovenian research unit that deals exclusively with the research on marine ecosystems. Persistence for five decades in very different and turbulent conditions of research activity was recognized as a very important achievement.

By entering consortia of four Interreg projects, we consolidated our role in the region in finding environmental solutions by using green technologies and preserving biodiversity, and in Mediterranean management strategies through capacity building and knowledge sharing. Through the COST action (CA18238), which started in October 2019 and in which MBS is the leading partner, we are entering the European transdisciplinary network for marine biotechnology.

On 23 December 2019, the LifeWatch Slovenia project was launched with the release of funds from SVRK, which will enable the partners of the consortium which includes the NIB with the MBS Piran to purchase equipment for the support of international research projects in monitoring and forecasting the effects of global changes on biotic diversity. The RI-SI-LifeWatch project fulfills a national priority task within the framework of the Research and Innovation Strategy of Slovenia 2011–2020.

ZNANSTVENA ODLIČNOST

V letu 2019 smo objavili 39 izvirnih in 3 pregledne znanstvene članke. Od skupno 42 znanstvenih člankov jih je bilo 28 kategorije A1/2, večina kategorije A1 (25), od tega 21 A' in 4 A''.

Kot največja dosežka predstavljamo dva članka iz kategorije A'' s faktorjem vpliva > 8. Raziskovalec MBP je bil del številne sredozemske raziskovalne skupine, v katero so bile vključene pomembne organizacije, kot so CIESM in FAO. Skupina je z analizo znanja ribičev ali t. i. lokalnega ekološkega poznavanja (Local Ecological Knowledge – LEK) uspela rekonstruirati recentne spremembe v razširjenosti 75 vrst rib in izsledke objaviti v prestižni reviji *Global Change Biology* (IF = 8,880). Članek [COBISS.SI-ID 5075279] je kmalu po objavi dosegel odmevnost v medijih in v znanstveni sferi (CI Scopus = 5).

V reviji *Bulletin of the American Meteorological Society* (IF = 8,166) je raziskovalec MBP opisal neznačilen pojav vdora hladnega zraka iz polarnega območja februarja 2018, ki je povzročil nastanek ledenih morskih sveč [COBISS.SI-ID 4973391]. Navkljub potrjenemu naraščanju temperature zraka in morja lahko do takih pojavov izjemoma pride tudi v obalnih območjih Sredozemskega morja.

Omeniti velja tudi članek »Ten inconvenient questions about plastics in the sea« avtorjev Giuseppeja Bonanna in Martine Orlando-Bonaca [COBISS.SI-ID 4682063], ki obravnava nekaj najbolj perečih težav zaradi vse večje prisotnosti plastike v Sredozemskem morju in je bil izbran za dosežek ARRS »Odlični v znanosti 2019« na področju naravoslovja.

PRISPEVEK K POPULARIZACIJI IN PROMOCIJI ZNANOSTI

50-obletnica MBP Piran je bil pospremljena z izdajo publikacije »Pol stoletja dolga pot Morske biološke postaje Piran, 1969–2019« (Francé, J., Kovač, N., Mozetič, P. (ur.)).

Zaradi praznovanja 50-letnice MBP so se njeni zaposleni še bolj kot sicer pojavljali v medijih. V COBISS-u so zavedeni nastopi v televizijskih in radijskih oddajah ter objave v tiskanih medijih in na spletnih portalih (18); prav poseben dogodek se je zgodil 16. 11. 2019, ko so se prostori Morske biološke postaje Piran za en dan spremenili v terenski studio 2. programa Radia Televizije Val 202.

Konec leta 2019 je izšla knjiga »Ocean v malem« (avtorji Lovrenc Lipej, Manja Rogelja, Borut Mavrič), ki je rezultat skupnega istoimenskega projekta MBP in Gimnazije, elektro in pomorske šole Piran za uresničevanje ciljev Strategije lokalnega razvoja. Projekt in izdaja knjige sta bila financirana iz Javnega poziva LAS Istre.

Borut Mavrič in Tihomir Makovec sta kot avtorja sodelovala pri izdaji knjige »Knights, Ballerinas and Invisibles«, ki opisuje rake deseteronožce iz zaščitenega morskega področja Nacionalnega parka Brioni. Knjiga je plod večletnega sodelovanja MBP in Prirodoslovnega muzeja Münchna, ki je organiziral ekspedicije na Brione.

SCIENTIFIC EXCELLENCE

In 2019, we published 39 original and 3 review scientific articles. Out of a total of 42 scientific articles, 28 were of category A1/2, most of them of category A1 (25) of which 21 A' and 4 A''.

As the greatest achievements, we present two articles from category A'' with an impact factor > 8. The MBS researcher was only a part of a numerous Mediterranean research group that included important organisations, such as CIESM and FAO. By analyzing the knowledge of fishermen or the so-called Local Ecological Knowledge (LEK) succeeded in reconstructing recent changes in the distribution of 75 fish species and in publishing the results in the prestigious journal Global Change Biology (IF = 8,880). The article [COBISS.SI-ID 5075279] soon received publicity in the media and the scientific sphere (CI Scopus = 5).

In the Bulletin of the American Meteorological Society (IF = 8,166), the MBS researcher described an uncharacteristic occurrence of cold air intrusion from the polar region in February 2018 which caused the formation of sea icicles [COBISS.SI-ID 4973391]. Despite the confirmed rise in air and sea temperatures, such phenomena can occur in the coastal areas of the Mediterranean exceptionally.

The article »Ten inconvenient questions about plastics in the sea« by Giuseppe Bonann and Martina Orlando-Bonac [COBISS.SI-ID 4682063] is also worth mentioning. It deals with some of the problems related to the growing presence of plastics in the Mediterranean and was selected for the ARRS achievement “Excellent in Science 2019” in the field of natural sciences.

CONTRIBUTION TO THE POPULARIZATION AND PROMOTION OF SCIENCE

The 50th anniversary of MBS Piran was accompanied by the publication »Half a Century Long Journey of the Marine Biology Station Piran, 1969-2019« (Francé, J., Kovač, N., Mozetič, P. (eds.)).

Due to the celebration of the 50th anniversary of the MBS, its employees appeared in the media even more than usual. COBISS includes appearances in television and radio broadcasts, as well as publications in the print media and on web portals (18). A very special event took place on 16 November 2019, when the premises of the Marine Biology Station Piran were transformed into the field studio of the 2nd program of the Slovenian national radio and television Val 202 for one day.

At the end of 2019, the book »Ocean in a Nutshell« was published (authors Lovrenc Lipej, Manja Rogelja, and Borut Mavrič), which is the result of a joint project of the same name of the MBS and the Gymnasium, Electro and Maritime School Piran to achieve the goals of the Local Development Strategy. The project and the publication of the book were financed from the Public Call of the LAS of Istria.

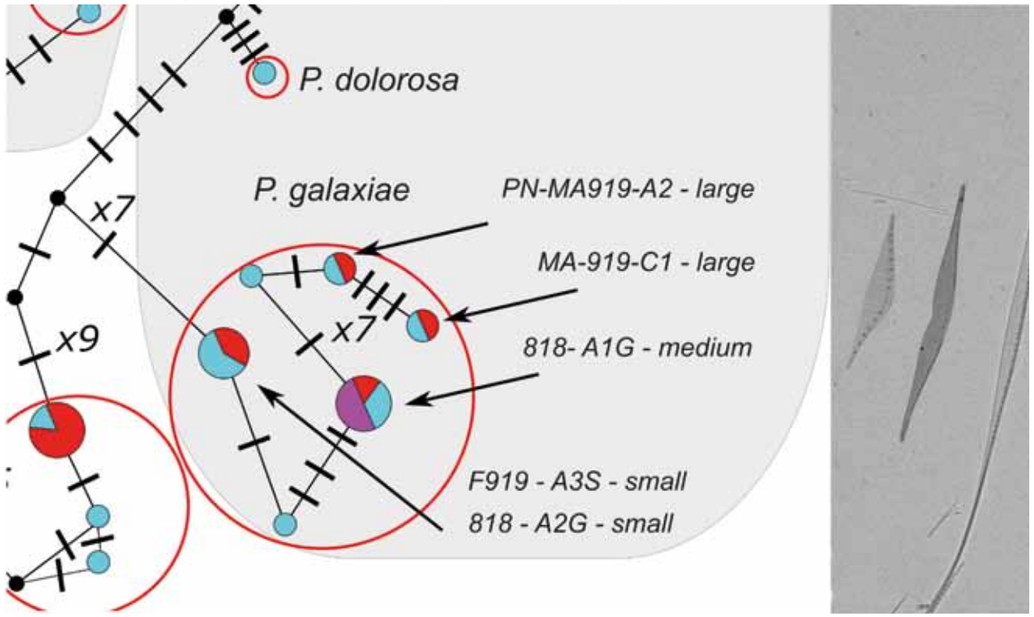
Borut Mavrič and Tihomir Makovec participated as authors in the publication of the book »Knights, Ballerinas and Invisibles«, which describes ten-legged crustaceans from the protected marine area of the Brijuni National Park. The book is the result of many years of cooperation between the MBS Piran and the Natural History Museum of Munich, which organized expeditions to Brijuni.

ORGANIZACIJA DELOVNIH SREČANJ IN SESTANKOV

Organizirali smo več sestankov in delavnic mednarodnih projektov, pri katerih sodelujemo kot partner, ter strokovnih srečanj.

- V okviru dni Latinsko ameriških in Karibskih držav (LAC Days 2019), ki jih je organiziral MZZ, je 23. 5. 2019 na MBP potekala delavnica, na kateri so se predstavnikom LAC in Evropske skupnosti predstavili primorski inštituti in univerze, med njimi tudi NIB in še posebej MBP s tremi predstavitvami.
- Predstavitev rezultatov projekta »Pregled stanja, ovrednotenje vpliva na okolje ter pregled možnih ukrepov za obvladovanje populacij tujerodne vrste rebrače *Mnemiopsis leidyi* v slovenskem morju« za različne deležnike, 18. 11. 2019. Projekt je financiral MKGP iz kohezijskih sredstev Evropskega sklada za pomorstvo in ribištvo 2014-2020.
- Redno letno srečanje partnerjev projekta GoJelly (H2020-BG), 19. – 21. 11. 2019. Snemalna ekipa televizije Euronews je med srečanjem posnela reportažo o raziskovalnih dosežkih projekta in projektni skupini. Prispevek je bil objavljen januarja 2020 v sklopu programa Futuris.
- Četrta mednarodna konferenca COST projekta OceanGov – *Trajnostno upravljanje oceanov – izzivi, možnosti in vloga znanosti* (CA15217), 25. – 27. 11. 2019. 55 udeležencev iz 29 držav, ki zastopajo različna področja znanosti in tudi politike, je razpravljalo o trajnostni prihodnosti oceanov in morij. Poleg plenarnih predavanj je bilo na dnevnem redu konference več znanstvenih delavnic oz. okroglih miz. Koordinator COST projekta je Leibniz Center za tropske morske raziskave iz Bremna.

Z molekularnimi analizami lahko potrdimo, da so pripadniki iste vrste diatomej *Pseudo-nitzschia galaxiae*, ki so si morfološko precej različni (desno), tudi sicer drugačni (levo). Na ta način lahko odkrijemo nove vrste (foto: T. Turk Dermastia).
Molecular analyzes can confirm that members of the same diatom species *Pseudo-nitzschia galaxiae*, which are morphologically quite different (right) are also genetically different (left). In this way, we can discover new species (Photo: T. Turk Dermastia).



ORGANIZATION OF WORKING MEETINGS AND GATHERINGS

We organized several meetings and workshops of international projects in which we participate as a partner and professional meetings.

- As part of the Latin American and Caribbean Days (LAC Days 2019) organized by the Ministry of Foreign Affairs, a workshop was held at the MBS on 23 May 2019, at which the representatives of LAC and the European Community were introduced to coastal institutes and universities, including NIB and especially MBS with three presentations.
- Presentation of the results of the project "Review of the status, evaluation of the impact on the environment, and review of possible measures for the management of populations of the alien species of the warty comb jelly *Mnemiopsis leidyi* in the Slovenian sea" for various stakeholders, 18 November 2019. The project was finnanced by the MKGP through the Cohesion Fund and the European Maritime and Fisheries Fund, programme 2014-2020.
- A regular annual meeting of GoJelly project partners (H2020-BG), 19-21 November 2019. During the meeting, the Euronews TV crew recorded a report on the research achievements of the project and the project team. The show was broadcasted in January 2020 as part of the Futuris program.
- The fourth International COST Conference of the OceanGov Project – *Sustainable Ocean Management – Challenges, Opportunities, and the Role of Science* (CA15217), 25-27 November 2019. 55 participants from 29 countries representing various fields of science and politics discussed a sustainable future of oceans and seas. In addition to plenary lectures, the conference agenda included several scientific workshops and round tables. The COST project coordinator is the Leibniz Center for Tropical Marine Research in Bremen.

Kozica *Palaemon adspersus* je ena pogostejših predstavnikov rakov deseteronožcev obalnega morja (foto: B. Mavrič).
Prawn *Palaemon adspersus* is one of the most common representatives of coastal ten-legged crustaceans (Photo: B. Mavrič).

Ledeni zobje zime na slovenski obali (foto: T. Makovec). The harshness of winter on the Slovenian coast (Photo: T. Makovec).

BIBLIOGRAFIJA
BIBLIOGRAPHY

39	Izvirni znanstveni članek Original Scientific Article
3	Pregledni znanstveni članek Review Article
3	Strokovni članek Professional Article
8	Poljudni članek Popular Article
1	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)
30	Objavljeni povzetek znanstvenega prispevka na konferenci Published Scientific Conference Contribution Abstract
1	Objavljeni povzetek strokovnega prispevka na konferenci Published Professional Conference Contribution Abstract
16	Samostojni strokovni sestavek ali poglavje v monografski publikaciji Independent Professional Component Part or a Chapter in a Monograph
1	Recenzija, prikaz knjige, kritika Review, Book Review, Critique
1	Polemika, diskusijski prispevek, komentar Polemic, Discussion, Commentary
5	Intervju Interview
6	Drugi sestavni deli Other Component Parts
2	Znanstvena monografija Scientific Monograph
12	Končno poročilo o rezultatih raziskav Final Research Report
2	Elaborat, predštudija, študija Treatise, Preliminary Study, Study
8	Radijska ali televizijska oddaja Radio or Television Broadcast
2	Druge monografije in druga zaključena dela Other Monographs and Other Completed Works
10	Radijski ali TV dogodek Radio or Television Event
1	Razstava Exhibition
2	Predavanje na tuji univerzi Invited Lecture at Foreign University
4	Prispevek na konferenci brez natisa Unpublished Conference Contribution
12	Druga izvedena dela Other Performed Works
13	Uredništvo Editorship

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3.0

ODDELEK ZA BIOTEHNOLOGIJO IN SISTEMSKO BIOLOGIJO

DEPARTMENT OF BIOTECHNOLOGY AND SYSTEMS BIOLOGY

Začeli smo pri koreninah,
a tudi nebo ni naša meja.

We have started at the roots
but even the sky is not our limit.

Utrinek z Dneva očarljivih rastlin, ki so ga 24. maja 2019 že osmič po vrsti so-organizirali člani FITO (foto: arhiv NIB).

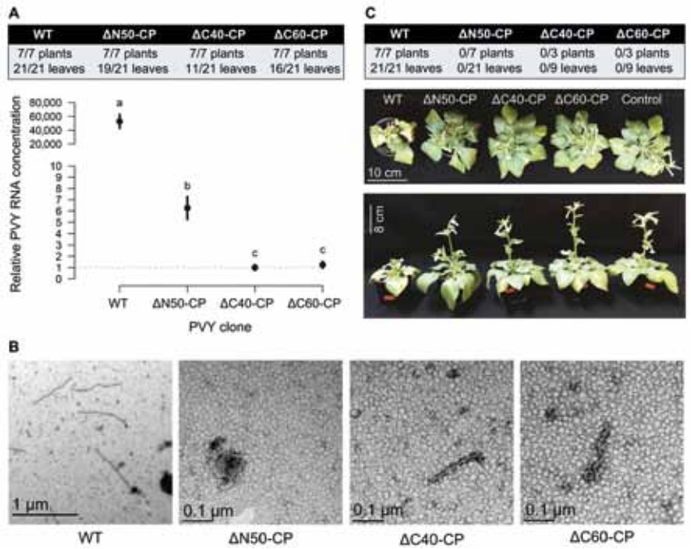
An impression from the Fascination of Plants Day, which was co-organized by members of FITO for the eighth consecutive time on May 24, 2019 (Photo: NIB archive).

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

VODJA: prof. dr. Maja Ravnikar
HEAD: Prof. Dr Maja Ravnikar

Prof. dr. Maja Ravnikar, znanstvena svetnica, je vodja oddelka za biotehnologijo in sistemsko biologijo ter redna profesorica na Univerzi Nova Gorica. Njene raziskave so odmevne predvsem na področjih virologije in sicer proučevanja raznolikosti in diagnostike ter epidemiologije virusov ter razvoja metod za nekemično eliminacijo mikrobov in določitev lastnosti virusov za različne biotehnološke aplikacije.

Prof. Dr Maja Ravnikar, scientific councillor, is the head of the Department of Biotechnology and Systems Biology and professor at the University Nova Gorica. Her research met high response in the field of virology, especially in virus diversity, diagnostics and epidemiology studies and in development of nonchemical methods for microbe elimination and characterisation of viruses, developed for different biotechnological applications.

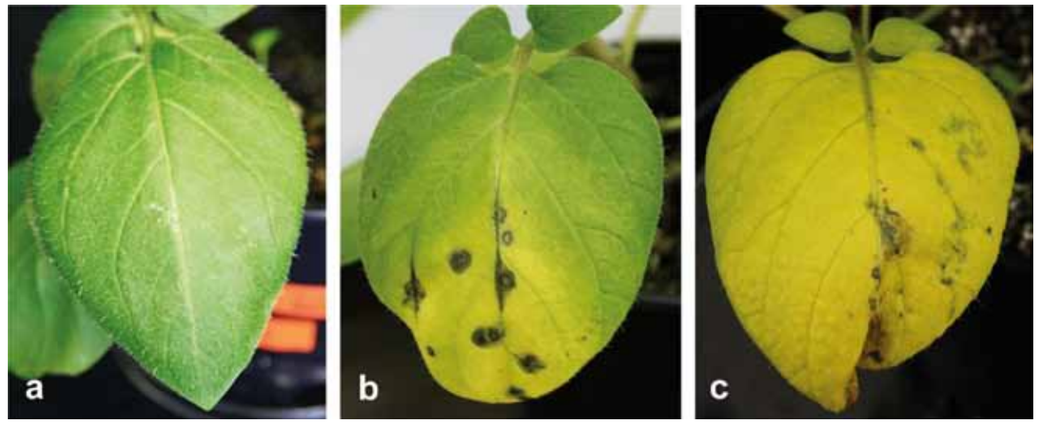


Funkcionalna analiza delecij na N- in C- terminalu plaščnega proteina v rastlini. Vir: Copyright © 2019 The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. Distributed under a Creative Commons Attribution NonCommercial License 4.0 (CC BY-NC). Functional analysis of PVY CP N- and C-terminal deletions in planta. Source: Copyright © 2019 The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. Distributed under a Creative Commons Attribution NonCommercial License 4.0 (CC BY-NC).

KLJUČNE DEJAVNOSTI

Glavne raziskovalne usmeritve FITO so:

- s pristopi sistemske biologije pridobivati novo znanje o mehanizmih rastlinskih odgovorov na stres;
- raziskovati biologijo mikrobov v različnih okoljih (zrak, voda, tla) za boljše razumevanje raznolikosti, patogenosti in epidemiologije teh mikrobov ter s tem njihove vloge v rastlinskih gostiteljih in pomena za zdravje ljudi;
- na osnovi pridobljenih rezultatov razvijati učinkovite in trajnostne metode za biotehnološki in biološki nadzor mikrobov;
- določati molekularne in morfološke lastnosti virusov z metodami, ki omogočajo celosten vpogled v viruse in s katerimi lahko določimo in odstranimo šibke točke pri sledenju virusov v biomedicinskih proizvodnih procesih, kot sta proizvodnja cepiv in virusnih vektorjev za genske terapije;
- razvijati nove strategije za zaščito rastlin ter za varno hrano in vodo;
- graditi tehnološko platformo, ki podpira raziskave sistemske biologije rastlin;
- razvijati bioinformatska orodja, ki olajšajo interpretacijo ogromnih količin podatkov (»big data«), pridobljenih s pristopi sistemske biologije;
- razvijati in vzdrževati meroslovno naravnane tehnološke podpore za učinkovitejšo identifikacijo in detekcijo mikrobov in gensko spremenjenih organizmov, ki bi bile uporabne tudi na področjih kmetijstva, farmacije, zdravja ljudi in varovanja okolja;
- partnersko sodelovanje z drugimi raziskovalnimi skupinami na NIB-u 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.

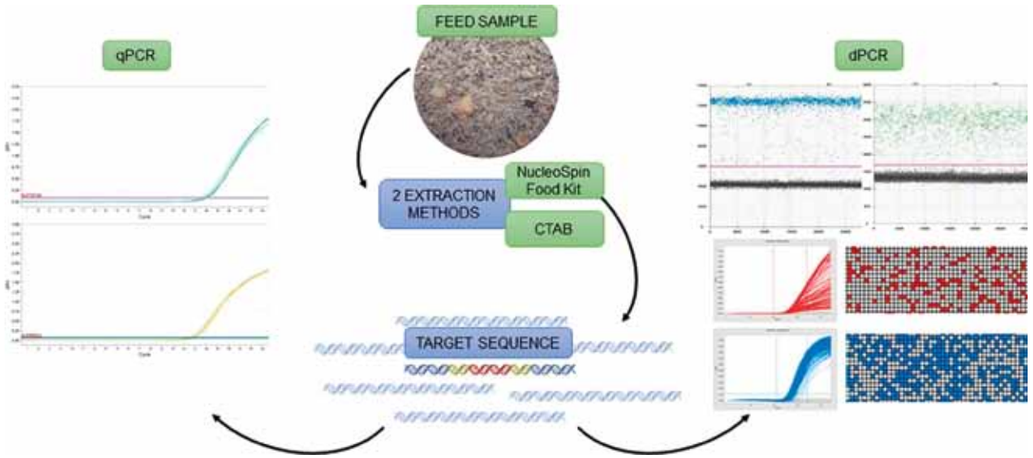


Primeri opaženih fenotipov v interakciji krompirja sorte Desiree s PVY^{NTN}. (a) List z manjšimi mehanskimi poškodbami; (b) list z lisami, venskimi nekrozami in rumenenjem; (c) list z rumenenjem. Vir: *Scientific Data* 2019; 6, 250 (2019).
Examples of observed phenotypes in potato cv. Desiree-PVY^{NTN} interaction during the course of the experiment. (a) Leaf with slight mechanical damage. (b) Leaf exhibiting spot and vein necrosis and yellowing. (c) Leaf exhibiting yellowing. Source: *Scientific Data* 2019; 6, 250 (2019).

KEY ACTIVITIES

Creating state-of-the-art knowledge about mechanisms of plant stress responses with the systems biology approaches.

- Research of microbe biology in different environments (water, air, and soil) for a comprehensive understanding of diversity, pathogenicity, and epidemiology of microbes and, thus, the role of microbes in plant hosts and the microbe association with human health.
- Developing more efficient and sustainable methods for biotechnological and biological control of microbes based on new knowledge.
- Molecular and morphological characterization of viruses with methods that allow a holistic view into viruses and, thus, provide a basis for the elimination of critical points associated with virus tracking in the biomedical processes, i.e. vaccine and gene therapy viruses production.
- Developing new strategies for plant protection and safe food and water.
- Upgrading a technology platform that supports plant systems biology.
- Developing bioinformatics tools for interpretation of »big data« obtained by systems biology approaches.
- Developing and maintaining metrology-oriented technological support for more effective identification and detection of microbes and genetically modified organisms that would be also suitable in the fields of agriculture, pharmacy, human health, and environmental protection.
- 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, higher education organizations, and the industry for a common contribution to solving current problems in the department's fields of activity.



Prenos in združitev dveh metod za detekcijo GSO s PCR v realnem času na kapljični digitalni PCR. Vir: ***Food Chemistry*** 2019; 294: 73-78.
Transfer and combination of two methods for GMO from qPCR to ddPCR. Source: *Food Chemistry* 2019; 294: 73-78.

GLAVNI DOSEŽKI V LETU 2019

NAŠI REZULTATI SO DEL SVETOVNE ZAKLADNICE ZNANJA

Še tako spreten tat ne more ukrasti znanja in zato je znanje najboljši in najvarnejši zaklad.

L. Frank Baum (1856–1919), ameriški pisatelj, najbolj znan po knjigi Čarovnik iz Oza

V okviru raziskav krompirjevega virusa Y (PVY), ki je med rastlinskimi virusi peti gospodarsko najpomembnejši, smo v letu 2 019 objavili rezultate v dveh člankih v revijah, ki sta v bazi SICRIS uvrščeni v kategorijo najvplivnejših znanstvenih dosežkov (A''). V sodelovanju s Kemijskim inštitutom in CEITEC iz Brna v Češki republiki smo razvozlali strukturne osnove delovanja PVY. Raziskovalci FITO so k raziskavi prispevali svoje biološko znanje o PVY, sistemski biologiji in interakcijah virusov z gostitelji. Pripravili so tudi poskuse z elektronskim mikroskopom. Rezultati raziskave so bili objavljeni v *Science Advances* z visokim dejavnikom vpliva 12,8. Z različnimi pristopi sistemske biologije smo raziskali tolerantni odziv krompirja na okužbo s PVY.

Do sedaj smo za določanje gensko spremenjenih organizmov (GSO) ali virusnih vektorjev za genske terapije največkrat uporabljali metodo kvantitativnega PCR v realnem času. V obeh primerih se pojavlja težava pri kvantifikaciji, saj se z uvajanjem novih GSO povečuje kompleksnost sestave hrane in krme, ki GSO vsebujejo, oziroma je količina različnih sestav virusnih vektorjev izjemno velika. Da bi prešli te omejitve smo za kvantifikacijo sojinega referenčnega gena za lektin in gena 'Roundup Ready' posamezna obstoječa testa, pripravljena za kvantitativni PCR v realnem času, prenesli in združili v en test s kapljičnim digitalnim PCR. Nova metoda se je izkazala kot učinkovita in potencialno zanimiva za testiranje vsebnosti GSO v hrani. Kapljični digitalni PCR se je kot metoda, uspešnejša od kvantitativnega PCR v realnem času, pokazala tudi pri določanju lastnosti in kvantifikaciji terapevtskih virusov, pridruženih adeno virusom (AAV).

Dolgoletne uspešne raziskave najmanjših znanih patogenih bakterij – fitoplazem smo nadgradili z odkritjem, da fitoplazme povzročajo tudi propadanje lesk in z vabljenim preglednim znanstvenim člankom o povezavi fitoplazem hormonskim sistemom rastlin.

Leska, okužena s fitoplazmami (foto: N. Mehle). Hazelnut infected with phytoplasma (Photo: N. Mehle).

MAJOR ACHIEVEMENTS IN 2019

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

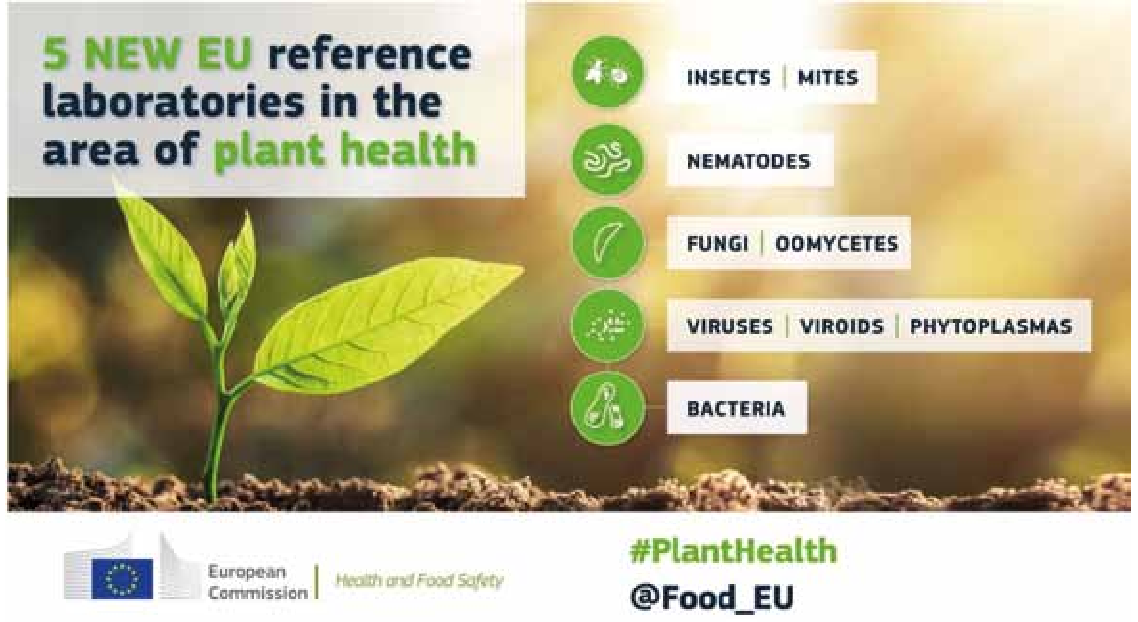
No thief, however skillful, can rob one of knowledge, and that is why knowledge is the best and safest treasure to acquire.

L. Frank Baum (1856-1919), American author, chiefly famous for his book, The Wizard of Oz

In the framework of our research associated with the potato virus Y (PVY), which is the 5th most economically important plant virus, we published our results in 2019 in two scientific articles, which are categorized in a database SICRIS among the most influential scientific achievements. Researchers from the NIB contributed to the research with their expertise of the potato virus Y, transmission electron microscopy, and knowledge of systemic biology in virus-host interactions. The results were published in the journal *Science Advances* with high impact factor IF= 12.8. In the additional article, we presented a tolerant potato response to PVY which was investigated with different tools of systems biology.

The most common approach for GMO detection and quantification or analytical characterization of the gene therapy viral vectors is quantitative real-time PCR. In both cases, there are limitations in quantification, since the increased use of genetically modified organisms is accompanied by the increased complexity of the matrices that contain GMOs. There is a plethora of viral vector formulations. To overcome these limitations, we transferred two simplex quantitative real-time PCR assays for quantification of soybean reference lectin gene and 'Roundup Ready' soybean to droplet digital PCR. A new method showed great potential to improve measurements in GMO testing and monitoring of food authenticity. Digital droplet PCR proved to perform better than quantitative real-time PCR also in measurements of identity and purity for adeno-associated viral vectors (AAV).

In 2019 we upgraded our almost two-decades-long research of the smallest known pathogenic bacteria – phytoplasmas with a discovery that phytoplasmas also cause a decline of hazelnuts and with an invited scientific review on hormones in phytoplasma infected plants.



Vir: @Food_EU Source: @Food_EU

Z NAŠIM ZNANJEM OBLIKUJEM
BOLJŠI SVET ZA VSE

▸▸▸ *Vsak mora poskušati biti boljši in sočasno deliti odgovornost do vseh. Še posebej moramo pomagati tam, kjer mislimo, da smo lahko najbolj koristni.*

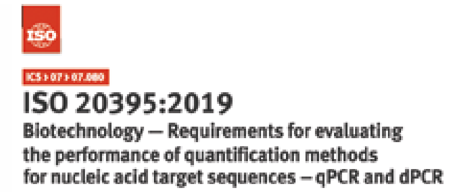
Marie Skłodowska-Curie (1867–1934), poljsko-francoska fizičarka in kemičarka, dobitnica dveh Nobelovih nagrad, za fiziko in kemijo

V letu 2019 je Evropska komisija dva laboratorija FITO (NIB) imenovala kot partnerja v konzorcijih Referenčnih laboratorijev Evropske unije za škodljive organizme rastlin za področji virusov, viroidov in fitoplazem ter bakterij na rastlinah. Na tem področju so bili to prvi imenovani referenčni laboratoriji v Evropski uniji.

Oddelek FITO je sodeloval pri razvoju zdravila Zolgensma®, pripravljenega na osnovi terapevtskih virusov, ki ga izdeluje podjetje AveXis iz skupine Novartis. Zdravilo se uporablja za zdravljenje manj kot dve leti starih otrok s spinalno mišično atrofijo. FITO je sodeloval s specifičnimi analitskimi tehnikami, ki so nujne za natančno določitev lastnosti zdravila (digitalni PCR, qPCR).

Pet objavljenih raziskav oddelka FITO je bilo vključenih v pripravo standarda SIST EN ISO 20395:2019(E) Biotechnology – Requirements for evaluating the performance of quantification methods for nucleic acid target sequences – qPCR and dPCR, ki ga je objavila Mednarodna organizacija za standardizacijo (ISO).

Mlada raziskovalka Mojca Juteršek je na 11. študentski konferenci Mednarodne podiplomske šole Jožefa Stefana 15. in 16. aprila 2019 v Planici prejela nagrado strokovne komisije in prvo nagrado publike (foto: arhiv NIB). Our young researcher Mojca Juteršek was a recipient of the award of professional committee of the 11th Student Conference of the Postgraduate School Jožef Stefan, which was organized in Planica from May 15th to 16th 2019. Besides, the audience awarded her with the best prize at the same conference (Photo: NIB archive).



Zolgensma® za zdravljenje spinalne mišične atrofije je trenutno najdražje zdravilo na svetu. Vir: https://www.fiercepharma.com/pharma/novartis-sma-gene-therapy-zolgensma-could-struggle-to-hit-blockbuster-territory-report Zolgensma® for curing spinal muscular atrophy is the world's most expensive drug at the moment. Source: https://www.fiercepharma.com/pharma/novartis-sma-gene-therapy-zolgensma-could-struggle-to-hit-blockbuster-territory-report

Naša mlada raziskovalka Arijana Filipić je na 9. mednarodni konferenci Young Water Professionals od 23. do 27. junija 2019 v Torontu v Kanadi, ki je gostila približno 300 udeležencev s celega sveta, prejela nagrado za najboljše predavanje. Soorganizirala je tudi 11. konferenco Eastern European Young Water Professionals, ki je potekala od 1. do 5. oktobra v Pragi, Češka Republika. Na konferenci je imela predavanje in je vodila delavnico »How to present« (foto: arhiv NIB). Our young researcher Arijana Filipić was a recipient of the best presentation award at the 9th International Young Water Professionals Conference with 300 participants which took place in Toronto, Canada, from June 23rd to 27th 2019. Besides, she was a co-organizer of the 11th Eastern European Young Water Professionals Conference, which took place from October 1st to 5th 2019 in Prague, Czech Republic. At the conference, she gave a talk and chair a workshop on »How to present« (Photo: NIB archive).

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

▸▸▸ *Each of us must work for his own improvement and, at the same time, share a general responsibility for all humanity, our particular duty being to aid those to whom we think we can be most useful.*

Marie Skłodowska-Curie (1867–1934), Polish and French physicist and chemist, the winner of Nobel prize for physics and chemistry.

In 2019, the EU Commission designated two laboratories of FITO (NIB) as partners in consortiums of the European Union Reference Laboratory for pests of plants on viruses, viroids, phytoplasmas, and pests of plants on bacteria. This is the first designation of EU reference laboratories in this field.

FITO participated as a technical supplier to AveXis from the Novartis Group at the development of Zolgensma®, the first and only gene therapy for pediatric patients less than 2 years of age with spinal muscular atrophy. FITO serves as a contract lab for AveXis providing time-effective support of downstream process development and consultation on specific analytical techniques, such as droplet digital polymerase chain reaction or real-time PCR required for accurate characterization of the drug product.

The International Organization for Standardization (ISO) has published a new standard: "SIST EN ISO 20395:2019(E) Biotechnology – Requirements for evaluating the performance of quantification methods for nucleic acid target sequences – qPCR and dPCR", for which five references of FITO researchers were used.

Utrinek z Dneva očarljivih rastlin 2019 (foto: A. Kladnik). A highlight from the Fascination of Plants Day 2019. (Photo: A. Kladnik).

BIBLIOGRAFIJA
BIBLIOGRAPHY

24	Izvirni znanstveni članek Original Scientific Article
2	Pregledni znanstveni članek Review Article
4	Kratki znanstveni prispevek Short Scientific Article
3	Strokovni članek Professional Article
12	Poljudni članek Popular Article
6	Objavljeni znanstveni prispevek na konferenci Published Scientific Conference Contribution
6	Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje) Published Scientific Conference Contribution Abstract (invited lecture)
86	Objavljeni povzetek znanstvenega prispevka na konferenci Published Scientific Conference Contribution Abstract
3	Samostojni znanstveni sestavek ali poglavje v monografski publikaciji Independent Scientific Component Part or a Chapter in a Monograph
3	Drugi sestavni deli Other Component Parts
1	Srednješolski, osnovnošolski ali drugi učbenik z recenzijo Reviewed Secondary and Primary School Textbook or Other Textbook
2	Drugo učno gradivo Other Educational Material
1	Doktorska disertacija Doctoral Dissertation

8	Končno poročilo o rezultatih raziskav Final Research Report
13	Elaborat, predštudija, študija Treatise, Preliminary Study, Study
6	Radijska ali televizijska oddaja Radio or Television Broadcast
2	Patentna prijava Patent Application
3	Druge monografije in druga zaključena dela Other Monographs and Other Completed Works
2	Radijski ali TV dogodek Radio or Television Event
2	Razstava Exhibition
1	Predavanje na tuji univerzi Invited Lecture at Foreign University
19	Prispevek na konferenci brez natisa Unpublished Conference Contribution
2	Vabljeno predavanje na konferenci brez natisa Unpublished Invited Conference Lecture
1	Druga izvedena dela Other Performed Works
9	Uredništvo Editorship

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4.0

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.

Priprava celičnih agregatov za sferoide (foto: M. Štampar).

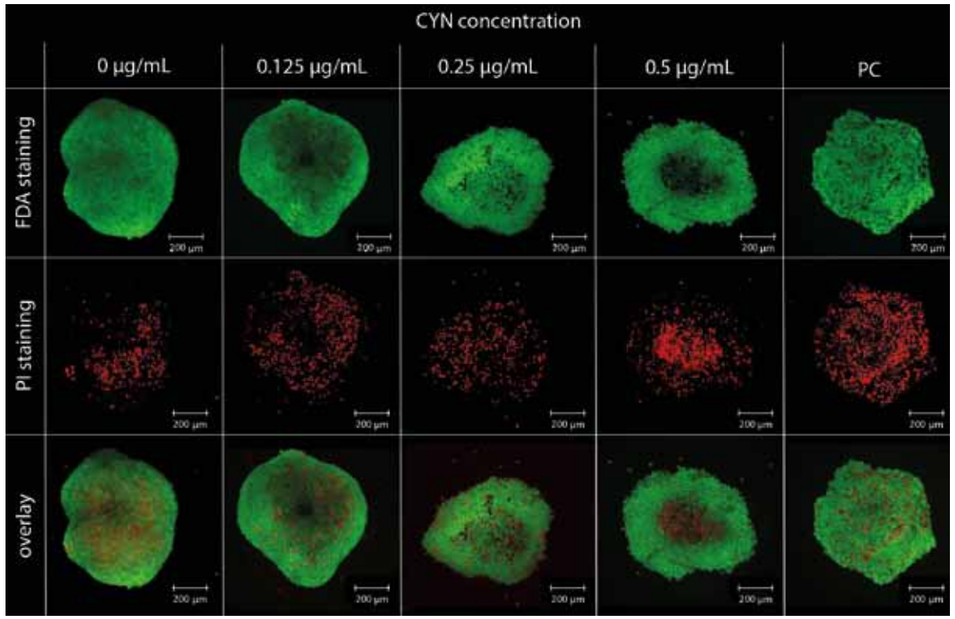
Preparation of cellular aggregates for spheroides (Photo: M. Štampar).

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

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.



Sferoidi tretirani s clindrospermopsinom (foto: M. Štampar). Spheroids treated with Cylindrospermopsin (Photo: M. Štampar)

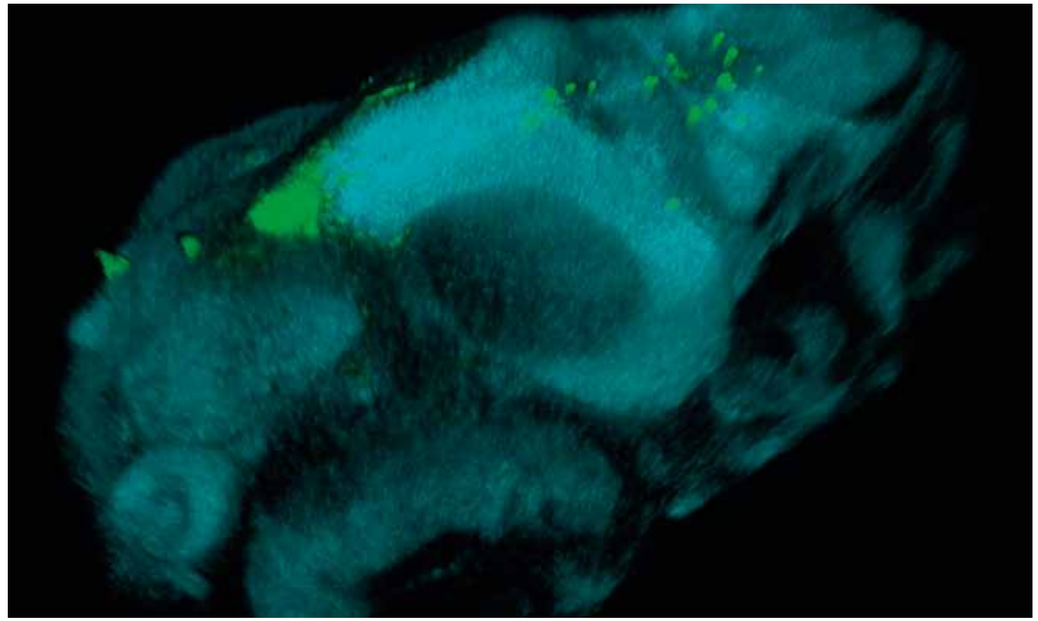
KLJUČNE DEJAVNOSTI

Raziskovalno delo na Oddelku za genetsko toksikologijo in biologijo raka poteka v okviru raiskovalnega programa ARRS (P1–0245) z naslovom »Ekotoksiologija, toksikološka genomika in karcinogeneza" in več domačih in mednarodnih raziskovalnih projektov in je usmerjeno 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 proučevanje potencialnih škodljivih učinkov tako posameznih onesnažil (bisfenoli, cianobakterijski toksini, ostanki zdravil ...) kot tudi njihovih zmesi na zdravje ljudi in vodne organizme.
- Raziskave napredovanja možganskih tumorjev – gliomov, glioblastomskih matičnih celic in njihove vloge pri napredovanju in odpornosti proti zdravljenju. Raziskave osredotočamo na proučevanje vloge 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* testnih sistemov za nadomeščanje uporabe poskusnih živali v genetski toksikologiji in raziskavah raka. Razvijamo tridimenzionalne (3D) celične modele in obetavne modele z zarodki rib cebric (*Danio rerio*).
- Ekološki monitoring kakovosti površinskih voda in razvoj novih metodologij ekološkega vrednotenja kakovosti voda na osnovi analiz okolijske DNK v vodnih telesih.

Na vseh področjih partnersko sodelujemo z raziskovalnimi skupinami v Sloveniji in tujini. Za potrebe državnih institucij ter partnerje iz gospodarstva izvajamo naročniške raziskovalne projekte in svetovanje. Izvajamo testiranja varnosti proizvodov za potrebe registracij (testiranje mutagenosti v skladu z OECD načeli dobre laboratorijske prakse (DLP), testiranje biokompatibilnosti medicinskih pripomočkov v skladu z ISO-standardi).



Širjenje možganskega tumorja v zarodkih rib cebric (foto: M. Vittori, B. Breznik).
Proliferation of brain tumor in zebrafish embrios (Photo: M. Vittori, B. Breznik).

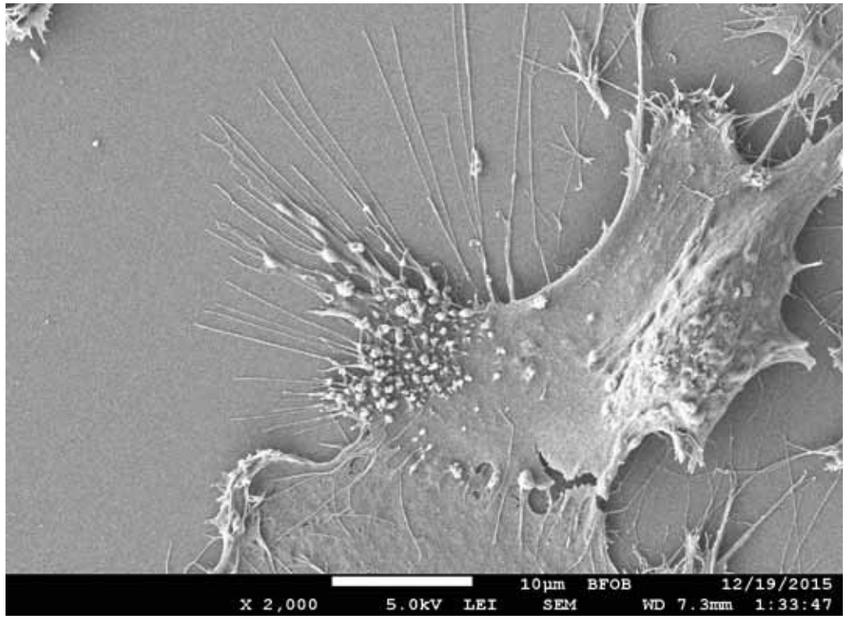
KEY ACTIVITIES

Research work at the Department of Genetic Toxicology and Cancer Biology 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:

- Research into the molecular mechanisms of toxic and genotoxic action of environmental contaminants. We focus on investigating the potential adverse effects of individual contaminants (bisphenols, cyanobacterial toxins, unused medicinal products, etc.) and their mixtures on human health and aquatic organisms.
- Research on the development of brain tumors – gliomas, glioblastoma stem cells, and their role in tumor progression and therapeutic resistance. Our research focuses on the study of the role of cancer stem cells and the tumor microenvironment in chemo- and radioresistance, 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 all areas, we work in partnership with research groups in Slovenia and abroad. For the needs of state institutions and industrial partners, we carry out contract research projects and consulting. We perform product safety testing for registration purposes (mutagenicity testing following the OECD standards of Good Laboratory Practice (GLP), biocompatibility testing of medical devices following ISO standards).



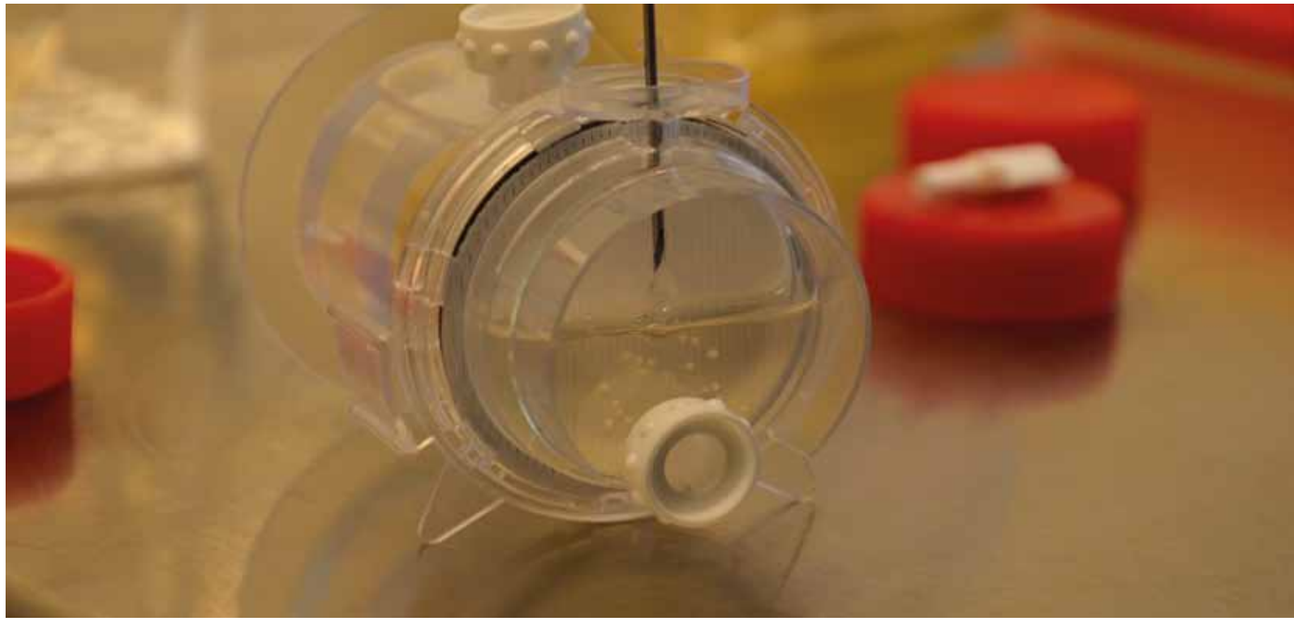
Celice možganskega tumorja glioblastoma (foto: M.Vittori, B. Breznik). Glioblastoma brain tumor cells (Photo: M.Vittori, B. Breznik).

GLAVNI RAZISKOVALNI DOSEŽKI V LETU 2019

V okviru razvoja novih alternativnih testnih sistemov za nadomeščanje laboratorijskih živali za proučevanje in testiranje genotoksičnosti smo razvili nov tridimenzionalni (3D) eksperimentalni model s celicami hepatocelularnega karcinoma (HepG2). Pokazali smo večjo občutljivost 3D sferoidov za zaznavanja genotoksičnih spojin v primerjavi z enoplastnimi 2D kulturami HepG2 celic. Ta nov eksperimentalni model lahko prispeva k zanesljivejši oceni genotoksičnosti kemikalij in s tem k zmanjšanju potrebe po testiranjih na živalih. Članek je bil objavljen v prestižni reviji na področju toksikologije *Archives of Toxicology*. (doi: 10.1007/s00204-019-02576-6)

V okviru raziskav potencialnih škodljivih učinkov zdravil na vodno okolje smo v reviji *Water Reserach* (doi: 10.1016/j.watres.2019.114953) objavili oceno tveganja zaradi ostankov protirakavih zdravil (5-fluotouracil, cis-platin, eteopozid in imatinib mesilat) v vodnem okolju, ki temeljijo na ekotoksikoloških podatkih, pridobljenih v okviru evropskega projekta EU Cytothreat. Rezultati ocene tveganja so pokazali, da so akutni, subakutni in kronični toksični učinki teh zdravil v vodnem okolju malo verjetni, vendar lahko do njih pride, kadar spojin ne odstranimo z učinkovitim čiščenjem odpadnih vod iz predvsem bolnišnic. Poleg tega so rezultati pokazali, da so nekatere vrste (npr. nižji raki) zelo občutljive na indukcijo genotoksičnih učinkov pri za okolje relevantnih koncentracijah, kar pomeni, da je pri teh vrstah možen pojav posledic prek več generacij.

Glioblastom (GBM) je najagresivnejši in najpogostejši možganski tumor; sedanji pristopi zdravljenja niso uspešni. Mikrookolje tumorjev, še posebej tkivne niše, kjer so rakave matične celice, je izrednega pomena pri vzdrževanju malignosti teh celic, saj so izjemno odporne proti terapiji in povzročijo ponovno razrast tumorja. Glioablastom sodi med redke tumorje, a medtem daleč največ rakavih bolnikov umre zaradi metastaz v možganih. Oba procesa napredovanja in usodnega širjenja rakavih celic v možganih sta sorodna v tem, da se rakave matične in metastaske celice s podobnimi lastnostmi zasidrajo v tkivnih nišah, ki jih ne le ščitijo pred terapijo, ampak omogočajo, da se tam namnožijo v napadalne celice, ki uničijo možgansko tkivo. Najnovejše raziskave in pristope zdravljenja smo objavili v ugledni reviji *Seminars in cancer Biology* (DOI: 10.1016/j.semcancer.2019.10.010.) z visokim faktorjem vpliva.



Gojenje celičnih sferoidov v bioreaktorju (foto: M. Štampar). Cell spheroid cultured in bioreactor (Photo: M. Štampar).

MAJOR RESEARCH ACHIEVEMENTS IN 2019

Related to the development of new alternative testing systems for the replacement of laboratory animals for the study and testing of genotoxicity, we developed a new three-dimensional (3D) experimental model with hepatocellular carcinoma (HepG2) cells. We demonstrated a higher sensitivity of 3D spheroids for the detection of genotoxic compounds compared to monolayer 2D cultures of HepG2 cells. This new experimental model can contribute to a more reliable assessment of the genotoxicity of chemicals and, thus, reduce the need for animal testing. The article was published in the prestigious journal in the field of toxicology *Archives of Toxicology*.

Related to the research of potential adverse effects of the residues of pharmaceuticals on the aquatic environment, in the journal *Water Research*, we published risk assessment for the aquatic environment for residues of anticancer medicines (5-fluorouracil, cis-platinum, etoposide, and imatinib mesylate) which is based on ecotoxicological data generated in EU Cytothreat project. The results demonstrated that the acute, subacute, and chronic toxic effects of these drugs in the aquatic environment are unlikely but may occur when the compounds are not removed by effective wastewater treatment, primarily from hospitals. Besides, the results showed that some species (e.g. crustacea) are very sensitive to the induction of genotoxic effects at environmentally relevant concentrations, which means that transgenerational consequences are possible in these species.

Glioblastoma (GBM) is the most aggressive and frequent brain tumor although current treatment protocols are not successful. The tumor microenvironment (TME), especially at the tissue niches where cancer stem cells are located, is of paramount importance in maintaining their malignancy, as these cells are extremely resistant to therapy and cause tumor regrowth. Glioblastoma is a rare tumor. However, many more cancer patients die from brain metastases. Both, the processes of progression and the fatal spread of cancer cells in the brain are related as cancer stem and metastatic cells have rather similar properties that allow them to anchor themselves in tissue niches. These not only protect them from therapy but also allow them to multiply there resulting in aggressive cells that destroy brain tissue. We published the latest research and therapy protocols on this in the prestigious journal *Seminars in Cancer Biology* with the high factor DOI: 10.1016 / j.semcancer.2019.10.010.)

Skupaj z raziskovalci z Univerze v Amsterdamu smo dokazali, da so rakave matične celice v hipoksičnih nišah v GBM ob velikih žilah arteriolah, ki so zelo podobne nišam hematopoetskih matičnih celic v kostnem mozgu (*Journal of Histochemistry and Cytochemistry*; DOI: 10.1369/0022155419878416). Prav tako smo ugotovili, da so v teh nišah v GBM mezenhimske matične celice, ki izražajo močan tropizem proti GBM in lahko vplivajo na malignost rakavih matičnih celic, zato so pomembne pri odzivu glioblastomov na terapijo (*Cancer microenvironment. 2019, DOI: 10.1007/s12307-019-00229.*) Slednje proučujemo tudi na živalskem modelu z zarodki rib cebric.

V tem letu smo začeli z raziskavami na področju imunoterapije z naravnimi celicami ubijalkami (NK) v sodelovanju s prof. Anahid Jewett iz Univerze v Kaliforniji Los Angeles (UCLA). NK celice so namreč edine imunske celice, ki prepoznajo in ubijejo rakave matične celice in so tako zelo obetaven pristop za zdravljenje glioblastoma. Pridobili smo bilateralni projekt ARRS Slovenija-ZDA, v sklopu katerega preučujemo protirakave učinke NK celic v modelih GBM *in vitro* ter v miškah .

V letu 2019 smo pridobili večji v raziskovalni projekt »Diagnostična platforma za precizno zdravljenje bolnikov z rakom s kanabinoidi« z multinacionalnim 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.

Vodna telesa so ponudniki mnogih ekosistemskih storitev. Soočajo se z vse več dejavniki, kot npr. podnebne spremembe, ki ogrožajo njihovo delovanje. Prekomerna razrast škodljivih cianobakterij, ki je posledica obremenjevanja s hranili, je vse bolj pogosta zaradi razsežnejših podnebnih sprememb in predstavlja globalni problem. Raziskovalci GEN (dr. Tina Eleršek) so se preko vključenosti v mrežo DNAqaNet COST in projekt Interreg Alpski prostor (2018–2021) Eco-AlpsWater ukvarjali z inovativnim ekološkim vrednotenjem in strategijo upravljanja voda za zaščito ekosistemskih storitev v jezerih in rekah. Novi pristop ekološkega vrednotenja temelji na analizi okolijske DNK v vodnih telesih (od bakterij do rib), na osnovi sekvenciranja naslednje generacije (NGS) ter pametnih tehnologij pri obdelavi in shranjevanju velikih podatkovnih baz. Poleg tega so za specifično skupino toksičnih cianobakterij začeli optimizirat molekularna orodja, kot je kvantitativni PCR, ki omogoča hitro, specifično in cenovno ugodno identifikacijo potencialno toksičnih vrst cianobakterij. Te metode imajo velik potencial za izboljšanje upravljanja z vodnimi viri, vendar jih je pred njihovo implementacijo potrebno testirati na realnih okoljskih vzorcih in optimizirati.

PATENTI:

V letu 2019 je bil Oddelku za genetsko toksikologijo in biologijo raka Nacionalnega instituta za biologijo podeljen prvi evropski patent, ki opisuje »Napravo in metodo za hkratno ne-invazivno razlikovanje sestave, zgradbe in oblik mikroskopsko majhnih organizmov in njihovih združb ter sprememb in fizioloških stanj s pomočjo pulzno inducirane osvetlitve«. Opisana fluorometrična metoda omogoča odkrivanje in spremljanje agregiranih majhnih delcev, ki so sposobni absorbirati in/ali oddajati sevanje določenih valovnih dolžin (npr. mikro-organizmi ter organski in anorganski delci v suspenziji), pri čemer je pomembno, da ostanejo lastnosti posameznih elementov in celovite populacije delcev v suspenziji ohranjene. Patent ima široke možnosti uporabe na področjih okolijskih tehnologij, farmacevtike in kozmetike za sledenje procesov v bioreaktorjih, v proizvodnji materialov za nadzor kvalitete, kakor tudi v okoljskih meritvah, kot je sledenje kakovosti zraka.

Together with researchers from the University of Amsterdam, we have shown that cancer stem cells are located in hypoxic niches in GBM along arterioles and niches are very similar to hematopoietic stem cell niches in bone marrow (DOI: 10.1369 / 0022155419878416 *Journal of Histochemistry and Cytochemistry*). We also found that mesenchymal stem cells express strong tropism against GBM. Being present in these niches, they can affect cancer stem cell malignancy, as well as glioblastoma response to therapy (Cancer microenvironment. 2019, DOI: 10.1007 / s12307- 019-00229.) These phenomena are also studied in a model with zebrafish embryos.

This year we started research in the field of immunotherapy using natural killer cells (NK) in collaboration with prof. Anahid Jewett from the University of California Los Angeles (UCLA). NK cells are the only immune cells that can recognize and kill cancer stem cells and are thus considered as a very promising approach for glioblastoma treatment. We obtained the ARRS bilateral project Slovenia-USA, in which we study the anti-cancer effects of NK cells in GBM models *in vitro* and in mice.

In 2019, we started a new research project »Diagnostic platform for precision cannabinoids treatment of cancer patients« with a European biopharma company MGC Pharmaceuticals Ltd. The general aim of the project is to develop formulations and to define the protocols for the treatment of high-grade brain tumors (glioblastoma) with cannabinoids alone or as adjuvant therapeutics in vitro with the goal of translation to clinics.

Water bodies provide many ecosystem services. They face more and more stressors, e.g. climate change, which threaten their functioning. Blooming of harmful cyanobacteria, which is a consequence of excess nutrient loads, is increased because of more extensive climate change and presents a global problem. Researchers from the GEN unit (Dr Tina Eleršek) has been involved in the DNAqaNet COST network and the project Interreg Alpine Space (2018–2021) Eco-AlpsWater, a project dealing with innovative ecological assessment and water management strategy for the protection of ecosystem services in lakes and rivers. The new approach will make use of Next Generation Sequencing (NGS) to analyze environmental DNA in water bodies (from bacteria to fish) and smart technologies to process and store large databases. Besides, molecular tools, such as quantitative PCR, have begun to be optimized for a specific group of toxic cyanobacteria allowing rapid, specific, and cost-effective identification of potentially toxic cyanobacterial species. These methods have great potential for improving water resource management but need to be tested on real environmental samples and optimized before they can be implemented.

PATENTS:

In 2019, the Department of Genetic Toxicology and Cancer Biology of the National Institute of Biology was granted a first European patent describing “a device and method for simultaneously non-invasive differentiation of the composition, structure, and shapes of microscopically small organisms and their communities and changes and physiological conditions utilizing pulsed induced lighting”. The described fluorometric method enables the detection and monitoring of aggregated small particles capable of absorbing and/or emitting radiation of certain wavelengths (i.e. microorganisms, organic and inorganic particles in suspensions) while the properties of individual elements and the entire population of particles in suspension are preserved. The patent has a wide range of applications in the fields of environmental technologies, in pharmacy, and cosmetics for monitoring processes in bioreactors, in the production materials for quality control, as well as in environmental measurements such as air quality monitoring.

Cianobakterijska gošča v naravi (foto: T. Eleršek). Cyanobacerial bloom (Photo: T. Eleršek).

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12	Izvirni znanstveni članek Original Scientific Article
5	Pregledni znanstveni članek Review Article
1	Strokovni članek Professional Article
2	Poljudni članek Popular Article
3	Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje) Published Scientific Conference Contribution Abstract (invited lecture)
27	Objavljeni povzetek znanstvenega prispevka na konferenci Published Scientific Conference Contribution Abstract
1	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
1	Intervju Interview
1	Drugi sestavni deli Other Component Parts
3	Končno poročilo o rezultatih raziskav Final Research Report
2	Raziskovalni ali dokumentarni film, zvočna ali video publikacija Scientific or Documentary Film, Sound or Video Publication
3	Radijska ali televizijska oddaja Radio or Television Broadcast

1	Patent Patent
2	Druge monografije in druga zaključena dela Other Monographs and Other Completed Works
6	Radijski ali TV dogodek Radio or Television Event
4	Prispevek na konferenci brez natisa Unpublished Conference Contribution
2	Druga izvedena dela Other Performed Works
10	Uredništvo Editorship

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

Neokrnjeni naravni ekosistemi so naše bogastvo

Intact natural ecosystems are our wealth

Grintovci so eno od pilotnih območij večletnega naravovarstvenega projekta »*LIFE integrirani projekt za okrepljeno upravljanje Nature 2000 v Sloveniji*«, v katerem kot partner sodeluje tudi NIB. Pogled s Podolševe proti Logarski dolini. (foto: M. Bedjanič)

Grintovci is one of the pilot areas of the multi-year nature conservation project »*LIFE Integrated Project for Enhanced Management of Natura 2000 in Slovenia*". The NIB is one of the project partners. View from Podolševa towards Logarska dolina. (Photo: M. Bedjanič)

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

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 in njeno raziskovalno delo je usmerjeno na procese, ki so ključnega pomena ne-le za evolucijo vibracijske komunikacije temveč tudi za razumevanje splošnih osnovnih procesov sporazumevanja. Ima tudi pomembno vlogo pri razvoju in uporabi vibracijskih signalov kot novega, okolju prijaznega pristopa za nadzor žuželčjih škodljivcev. Kot priznanje za njene prelomne raziskave je prejela mednarodno nagrado 'Insect Drummer Lifetime Achievement Award' ter nagrado Miroslava Zeia za izjemne znanstvene dosežke na področju dejavnosti NIB.

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

KLJUČNE DEJAVNOSTI ODDELKA

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

Specifična področja raziskav so naslednja:

- biodiverziteta kopenskih in sladkovodnih ekosistemov vključno s podzemnimi ekosistemi;
- filogenija, taksonomija in biogeografija izbranih skupin pajkov;
- evolucija ekstremnih fenotipov;
- vibracijska komunikacija, v sklopu katere analiziramo naravno vibracijsko zvočno krajino, proučujemo komunikacijska omrežja, raziskujemo mehanizme produkcije vibracijskih signalov, analiziramo vedenjske odzive ter izvajamo nevrobiološke in ekofiziološke študije;
- prilagojenost izbranih vrst na spremembe dejavnikov v okolju na osnovi ekofizioloških študij;
- odnosi med tuje- in domorodnimi vrstami s podobnimi ekološkimi nišami;
- biologija in ekologija hroščev s seznama vrst evropskega varstvenega pomena;
- ekosistemske storitve, v sklopu katerih raziskujemo procese v vodonosnikih in ekologijo opraševanja s poudarkom na divjih opraševalcih;
- vpliv rabe prostora na ekosistemske procese v vodotokih;
- interakcije človeka z okoljem v travniškem in mestnem okolju;
- razvoj alternativnih pristopov za nadzor žuželčjih škodljivcev in monitoring ogroženih vrst.

Hrapavi krešič (*Carabus caelatus*). Gozdna združba krešičev (Carabidae) se je v raziskavi višinske razširjenosti različnih živalskih skupin v dinarskem gozdu izkazala za najbolj občutljivo na višinske spremembe, saj je med temi ektotermnimi talnimi hrošči največ višinskih specialistov (iz članka v reviji *Nature Conservation*) (foto: A.Vrezec). *Carabus caelatus*. In the study of altitudinal distribution patterns in different animal groups in the Dinaric forest, the ground beetles (Carabidae) appeared to be the most sensitive assemblage to altitudinal changes (Photo: A. Vrezec).

KEY ACTIVITIES OF THE DEPARTMENT:

Through basic and applied research, the Department of Organisms and Ecosystems Research creates top-level knowledge necessary for a 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 leverage our interdisciplinary know-how to devise proposals for more effective and more sustainable interventions affecting the environment.

Our specific areas of research include:

- biodiversity of terrestrial and freshwater ecosystems, including underground ecosystems;
- phylogeny, taxonomy, and biogeography of the selected groups of spiders;
- evolution of extreme phenotypes;
- vibrational communication where we analyze the natural vibrational soundscape, study communication networks, explore the generation mechanisms of vibration signals, analyze behavioral responses and perform neurobiological and eco-physiological studies;
- adaptation of the selected species to changes in environmental factors based on eco-physiological studies;
- relationships between non-native and indigenous species with similar ecological niches;
- biology and ecology of beetles from the list of species of the European conservation importance;
- ecosystem services in which we explore the processes in aquifers and the ecology of pollination with an emphasis on wild pollinators;
- impact of the use of space on ecosystem processes in watercourses;
- human interaction with the environment in grassland and urban environments;
- development of alternative approaches for the control of insect pests and the monitoring of endangered species.

Navadna čigra (*Sterna hirundo*) je ribojeda ptica. Med raziskavami gnezditvene kolonije na Ptujskem jezeru smo s pomočjo GPS sprejemnikov ugotavljali, v katerih predelih Drave najpogosteje lovijo hrano (foto: D. Tome). Common tern (*Sterna hirundo*) is a piscivorous bird. During the research of breeding colony on Ptujsko jezero we were using GPS tags to determine the most commonly used hunting areas within the Drava river (Photo: D. Tome).

Vzorčenje mikroplastike v rečnih sedimentih (foto: N. Medvešček). Microplastics sampling in riverbed sediments (Photo: N. Medvešček).

GLAVNI DOSEŽKI V LETU 2019

V januarju smo organiziral mednarodno delavnico ob zaključku prve faze evropskega Interreg projekta BID-REX, katerega cilj je izboljšati dostopnost in uporabo podatkov o biodiverziteti na področju varstva narave in s tem prispevati k izboljšanju upravljanja z zavarovanimi območji. Delavnice so se udeležili partnerji in deležniki iz šestih evropskih držav, med njimi tudi slovenski predstavniki Sektorja za ohranjanje narave z Ministrstva za okolje in prostor, direktor Krajinskega parka Ljubljansko barje in direktor Zavoda RS za varstvo narave. Namen delavnice je bil izmenjati izkušnje in znanja pri oblikovanju akcijskih načrtov za sedem pilotnih zavarovanih območij. V Sloveniji je to Krajinski park Ljubljansko barje.

Projekt »Sadjarji za opraševalce in opraševalci za sadjarje« je bil predstavljen na Mednarodni ministrski konferenci evropskih kmetijskih ministrov »Krepitev oblikovanja in prenosa znanja za napredek kmetijstva in podeželja«, ki je bila 23. 8. 2019 na Ptuju. Projekt je bil izbran kot eden štirih primerov dobre prakse prenosa znanja v kmetijstvu. Je primer »Evropskega partnerstva za inovacije« (European Innovation Partnership, EIP) in poteka v okviru »Programa razvoja podeželja 2014–2020«. Cilj projekta je izboljšati prenos znanja za izboljšanje razmer za opraševalce v sadovnjakih in s tem povečanje zanesljivosti opraševanja. Je del naših prizadevanj, da Slovenija postane model za trajnostno upravljanje pestrosti opraševalcev za zanesljivo pridelavo hrane in varovanje biodiverzitete.

V septembru smo v okviru COST projekta ERBFacility (European Raptor Biomonitoring Facility) organizirali mednarodno ornitološko delavnico. Cilj projekta je povezovanje kapacitet biomonitoringa okoljskih onesnažil prek roparskih ptic s povezovanjem laboratorijev, zbirk vzorcev (zlasti muzejev) in shem monitoringa roparskih ptic. Delavnica, ki so se je udeležili terenski ornitologi, muzejski kustosi in laboratorijski analitiki iz 14 evropskih držav, je med drugim zasnovala tudi panevropsko študija izbranih onesnažil pri lesni sovi (*Strix aluco*) in kanji (*Buteo buteo*), ki bo posredovala prve podatke o razširjenosti nekaterih onesnažil, kot so težke kovine in organokloridi, v populacijah roparskih ptic po Evropi ter pokazala tudi na relevantne vplive onesnaženosti okolja za ljudi.

Sodelavci Oddelka za raziskave organizmov in ekosistemov smo sodelovali pri zasnovi knjige Biotremology: Studying Vibrational Behavior, ki je izšla pri založbi Springer. Knjiga, pri kateri smo sodelovali kot uredniki ter prispevali 8 od 25 poglavij, predstavlja pregled najnovejših raziskav in novih konceptov v raziskavah biotremologije, vede, ki proučuje interakcije, ki temeljijo na zaznavanju vibracij podlage.

»Rosalium« – skladovnica bukovih debel, postavljena v Trenti v okviru projekta NAT2CARE (Interreg Italija – Slovenija 2014–2020). Skladovnica prispeva k povečanju količine odmrle lesne mase v gozdu, od katere so odvisne saproksilne vrste, kot je npr. alpski kozliček (*Rosalia alpina*). (foto: A. Kapla) "Rosalium" – a pile of beech logs set up in Trenta in the scope of NAT2CARE project (Interreg Italy – Slovenia 2014-2020). The piles contribute to the amount of deadwood in the forest providing important habitat for saproxylic species, such as the Alpine longicorn (*Rosalia alpina*). (Photo: A. Kapla)

MAJOR ACHIEVEMENTS IN 2019

On completion of the first phase of the European Interreg project BID-REX in January, we organized an international workshop which was attended by partners and stakeholders from six European countries, including Slovenian representatives of the Nature Conservation Department from the Ministry of the Environment and Spatial Planning, the director of the Ljubljana Marsh Nature Park and the director of the Institute of the Republic of Slovenia for Nature Protection. The project aims to improve the availability and use of biodiversity data in the field of nature protection and improve the management of protected areas. The workshop was dedicated to the exchange of experience and knowledge in the development of 7 Action Plans for individual pilot areas.

The project "Fruit growers for pollinators and pollinators for fruit growers" was presented at the international ministerial conference under the title Strengthening the Formation and Transfer of Knowledge for the Advancement of Agriculture and the Countryside (Ptuj, 23 August 2019). The project was selected as one of the four examples of good practice in knowledge transfer in agriculture. It is an example of the European Innovation Partnership (EIP) and takes place within the Rural Development Program 2014-2020. The project aims to improve the transfer of knowledge to improve the conditions for pollinators in orchards and, thus, increase the reliability of pollination. It is part of our efforts to make Slovenia a model for the sustainable management of pollinator diversity for reliable food production and protection of biodiversity.

In the frame of the European COST action ERBFacility (European Raptor Biomonitoring Facility), we organized an international ornithological workshop. The goals of the action are to connect the capacities of biomonitoring of environmental pollutants with raptors by connecting laboratories, sample collections (especially museums), and monitoring schemes for raptors. The workshop was attended by field ornithologists, museum curators, and laboratory analysts with representatives from 14 European countries. The participants also prepared a pan-European study of the selected pollutants in the Tawny Owl (*Strix aluco*) and the Common Buzzard (*Buteo buteo*) that will provide the first data on the prevalence of certain pollutants, such as heavy metals and organochlorines, in raptor populations across Europe and which will serve as an assessment of dangerous chemicals in the environment for human health as well.

As editors, we collaborated on the development of the book Biotremology: Studying Vibrational Behavior published by Springer. We also contributed eight of 25 chapters.

Rjavi čmrlj (*Bombus pascuorum*). Divji opraševalci v kmetijstvu oprašijo vsaj polovico. Pestrost opraševalcev je ključna za zanesljivo opraševanje pridelavo hrane in biotsko pestrost (foto: J. Polajnar). Common carder bee (*Bombus pascuorum*). Wild pollinators account for at least half of pollination in agriculture. Diversity in pollinators is crucial for reliable food production and biodiversity (Photo: J. Polajnar).

V članku, objavljenem v reviji *Systematic Biology*, smo objavili študijo evolucije skupine pajkov družine Nephilidae, ki so modelni organizmi za mnoge biološke raziskave. V prispevku smo podali novo filogenijo, ki temelji na modernih filogenomskih analizah z uporabo 367 genetskih markerjev ter novo fosilno časovno kalibracijo. Delo je podlaga za razumevanje evolucijske zgodovine te skupine s poudarkom na spolnem velikostnem dimorfizmu.

V članku, objavljenem v reviji *Nature Communications*, smo uporabili najnovejše visoko-ločljive metode sekveniranja DNA in analize fosilnih primerkov kuščaric, da smo rekonstruirali življenjsko drevo 262 vrst kuščaric, ki poseljujejo Evropo, Azijo in Afriko. Dokazali smo, da se je večina današnjih vrst kuščaric pojavila v preteklih toplih podnebjih, vendar so se nato postopno prilagajale ohlajanju ozračja in se do danes razširile tudi v zelo hladna območja na Zemlji. Ti rezultati nam omogočajo razumeti, kakšne so možnosti, da se bodo vrste uspele prilagajati na spremembe v prihodnosti, ki jih prinašata globalno segrevanje podnebja in spremenjeni režimi padavin.

V članku, objavljenem v reviji *Water Research*, smo s pomočjo strojnega učenja raziskovali interakcije med stresorji in njihovim vplivom na biološke procese v rečnih sedimentih obraslih z biofilmom. Pokazali smo, da so odnosi med stresorji in okoljskimi dejavniki ter biološkim odzivom odvisni predvsem od tega, v katerem temperaturnem rangu jih opazujemo. Dosežek je del širšega raziskovalnega področja, kjer programska skupina poskuša pridobiti poglobljeno razumevanje vpliva prepletenih ekoloških dejavnikov in okoljskih stresorjev v rečnih ekosistemih predvsem na območjih prehoda med površinsko in podzemno vodo, v plitvem hiporeiku oziroma v sedimentih rečnega dna. Ekosistemski procesi, ki potekajo na teh območjih so ključni tako za kakovost površinskih kot tudi podzemnih voda in predstavljajo pomembne ekosistemske storitve celinskih voda.

Izr. prof. dr. Meta Virant-Doberlet je za svoje pionirsko delo na področju uporabe vibracijskih signalov pri nadzoru žuželk, prejela IOBC (International Organisation for Biological and Integrated Control) Exceptional Merrit Award za svoj prispevek pri razvoju novih trajnostnih metod nadzora škodljivcev.

Izr. prof. dr. Meta Virant-Doberlet je bila ena od petih finalistov izbora za nagrado Mentor leta, ki jo podeljuje društvo Mlada akademija.

Živorodna kuščarica (*Zootoca vivipara*). Globalne podnebne spremembe bodo imele še posebej močne negativne vplive na ektotermne organizme, kakor so tudi kuščarice. Naše raziskave so pokazale, da bodo med njimi najbolj prizadete tropske vrste in vrste specializirane na gorske habitate (foto: M. Krofel). Viviparous lizard (*Zootoca vivipara*). Under future climate changes the global warming might have an especially strong negative impact on ectotherm organisms, such as small lizards. Our studies confirmed that among them the most vulnerable will be tropical species and mountain specialists (Photo: M. Krofel).

The book presents an up-to-date state-of-the-art overview of the research and developing concepts in the field of biotremology, a discipline, which studies interactions guided by substrate-borne vibrations.

We published an evolutionary paper on a group of spiders of the family Nephilidae which are model organisms for many biological studies. In the paper published in the journal *Systematic Biology*, we presented a new phylogeny based on modern phylogenomic approaches using 367 genetic markers and a new fossil time calibration. The work is the basis for understanding the evolutionary history of this group with a focus on sexual size dimorphism.

In the study published in the journal *Nature Communications*, we used state-of-the-art DNA sequencing methods and analyses of fossils to reconstruct the evolution of 262 species of lacertid lizards, a group that is widespread in Europe, Asia, and Africa. We discovered that many of the recent species originated in warm past climates. Since then, however, they have adapted as the Earth cooled down and spread into very cold regions in the process. These results provide us with a better understanding of what is the potential that these species have for adapting to future changes expected under global climate warming and disrupted precipitation regimes.

In the article published in the journal Water Research, we used machine learning tools to investigate the interactions between stressors and their impact on biological processes in river sediments overgrown with biofilm. We have shown that the relationships between stressors and environmental factors and the biological response depend primarily on the temperature range in which they are observed. This achievement is a part of a broader research area where the program research group aims to gain an in-depth understanding of the impact of intertwined ecological factors and environmental stressors in river ecosystems, especially at surface-groundwater ecotones, such as shallow hyporheic zones, i.e. riverbed sediments below and laterally from the river channel. The ecosystem processes taking place in these areas are crucial for both surface and groundwater quality and represent important freshwater ecosystem services.

For her pioneering work in applied biotremology, Assoc. Prof. Dr Meta Virant-Doberlet received the IOBC (International Organisation for Biological and Integrated Control) Exceptional Merrit Award for her contribution to developing the exploitation of vibrational signals as a new, alternative environmentally-friendly approach for managing insect pests.

Assoc. Prof. Dr Meta Virant-Doberlet was one of the five finalists in the selection for 'Ph.D. Supervisor of the Year'.

Cilj projekta »Sadjarji za opraševalce in opraševalci za sadjarje« je izboljšati prenos znanja za izboljšanje razmer za opraševalce v sadovnjakih in s tem povečanje zanesljivosti opraševanja (foto: B. Koderman). The aim of the project »Fruit growers for pollinators and pollinators for fruit growers« is to improve the transfer of knowledge to improve the conditions for pollinators in orchards and thus increase the reliability of pollination (Photo: B. Koderman).

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1	Samostojni strokovni sestavek ali poglavje v monografski publikaciji Independent Professional Component Part or a Chapter in a Monograph
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2	Drugo učno gradivo Other Educational Material
1	Doktorska disertacija Doctoral Dissertation
3	Končno poročilo o rezultatih raziskav Final Research Report
1	Elaborat, predštudija, študija Treatise, Preliminary Study, Study
7	Radijska ali televizijska oddaja Radio or Television Broadcast
8	Druge monografije in druga zaključena dela Other Monographs and Other Completed Works
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6.0 INFRASTRUKTURNI CENTER NIB
NIB INFRASTRUCTURAL CENTRE

Boja »Vida« (foto: T. Makovec).
Buoy »Vida« (Photo: T. Makovec).

INFRASTRUKTURNI CENTER NIB
NIB INFRASTRUCTURAL CENTRE

VODJA: izr. prof. dr. Maruša Pompe Novak
HEAD: Assoc. 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 od leta 2018 poleg IC Planta in IC MBP vključeno tudi Slovensko vozlišče evropske infrastrukture za sistemsko biologijo (ISBE.SI). Vsak del IC NIB ponuja uporabo opreme ter storitve javnemu in zasebnemu sektorju.

The NIB Infrastructural Centre (IC NIB) consists of two distinct centers in terms of programs and organization: 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 as of 2018 also includes the Slovenian Node of Infrastructure for Systems Biology Europe (ISBE.SI) in addition to IC Planta and the IC MBP. Each part of the IC NIB offers services and equipment to the public and private sectors.

Terensko delo za izvedbo kartografije gozdičev rjavih alg iz rodu *Cystoseira*, ki rastejo v zgornjem infralitoralnem pasu (foto: B. Mavrič).

Veliko infrastrukturno opremo IC Planta so v letu 2019 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 in ABI QuantStudio7),
- aparature za digitalni PCR (Biorad QX100, Biorad QX200 in Fluidigm BioMark HD),
- robot za pipetiranje (Hamilton Microlab STARlet),
- komore za gojenje rastlin in tkivnih kultur (Kambič),
- komore za ločeno gojenje rastlin (Kambič) ter
- 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 lociran na Biotehniški fakulteti (BF) Univerze v Ljubljani (UL).

Veliko infrastrukturno opremo IC MBP so v letu 2019 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 in
- visokofrekvenčni radar Wera.

Dostava novega presevnega elektronskega mikroskopa Talos L120C (foto: M. Tušek Žnidarič).

The large infrastructural equipment of IC Planta consists 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 and ABI QuantStudio7);
- Digital PCR instruments (Biorad QX100, Biorad QX200, and Fluidigm BioMark HD);
- Robot for pipetting (Hamilton Microlab STARlet);

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 located at the Biotechnical Faculty of the University of Ljubljana at the moment.

The large infrastructural equipment of the IC MBP consists 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;
- a smaller vessel, and
- the Wera high-frequency radar.

IC NIB svojo veliko infrastrukturno opremo redno dopolnjuje in posodablja. V letu 2019 je IC Planta svojo opremo dopolnil z novim presevnim elektronskim mikroskopom (Talos L120C), ki je bil nabavljen z združevanjem sredstev Nacionalnega inštituta za biologijo, Javne agencije za raziskovalno dejavnost Republike Slovenije preko Paketa 17, Oddelka za biologijo Biotehniške fakultete Univerze v Ljubljani in Kemijskega inštituta. Novi presevni elektronski mikroskop Talos L120C omogoča nemoteno nadaljevanje tekočih raziskav, ki so do sedaj potekale z uporabo presevnega elektronskega mikroskopa Philips CM100; hkrati omogoča nadaljnji razvoj in dostopnost modernih tehnik elektronske mikroskopije, saj dodatna opremo omogoča raziskave 3D zgradbe vzorcev z elektronsko tomografijo. Novi presevni elektronski mikroskop Talos L120C je specializiran za opazovanje bioloških vzorcev, čemur so optimalno prilagojene njegove karakteristike: velik kontrast, visoka ločljivosti pri širokem razponu povečav, hitro pregledovanje slike preparata na zaslonu ter zajem in obdelava slik z visoko ločljivostjo. Integriran vakuumski sistem omogoča optimalne pogoje za hitro vzpostavitev visokega vakuuma za analizo in slikanje vzorcev in s tem kratek časovni interval med različnimi vzorci. Navedene karakteristike omogočajo vizualizacijo izredno širokega spektra bioloških vzorcev, to je vse od izoliranih makromolekul, virusov in bakterij do notranje zgradbe celic gliv, rastlin, živali in človeka z nanometrsko ločljivostjo, zaradi česar bodo novi presevni elektronski mikroskop uporabljali raziskovalci iz različnih inštitucij za izvajanje velikega števila izjemno raznolikih projektov. Informacije o strukturi bioloških vzorcev in o lokaciji izbranih molekul na subcelični nivoju, pridobljene s presevno elektronsko mikroskopijo, so namreč nujno potrebne za razumevanje delovanja bioloških sistemov in omogočajo aplikacije pridobljenega znanja na različnih področjih znanosti o življenju, biotehnologije in zdravja, kot na primer za gensko zdravljenje in razvoj zdravil, kakršno je Zolgensma, za sledenje kakovosti surovin za živila ter za razvoj tehnik za identifikacijo, odstranjevanje in uničevanje škodljivih mikroorganizmov v rastlinah in okolju.

Presevni elektronski mikroskop Talos L120C (foto: Jože Suhadolnik, Delo).
Transmission electron microscope Talos L120C (Photo: Jože Suhadolnik, Delo).

The IC NIB regularly supplements and updates its large infrastructural equipment. In 2019, IC Planta supplemented its equipment with a new transmission electron microscope (Talos L120C) which was purchased by pooling the funds of the National Institute of Biology, Slovenian Research Agency through Package 17, Department of Biology at Biotechnical Faculty of University of Ljubljana and the National Institute of Chemistry. The new Talos L120C Electron Microscope enables a continuation of the ongoing research for which up till transmission electron microscope Philips CM100 was used. At the same time, it also ensures further development and availability of modern electron microscopy techniques, such as 3D tomography. The new transmission electron microscope Talos L120C is specialized for the observation of biological samples, as its characteristics are high contrast, high resolution at a wide magnification range, rapid scanning of the image on the screen, and capture and processing of high-resolution images. The integrated vacuum system provides optimal conditions for the rapid establishment of a high vacuum, and thus, a short time interval between different samples. These features allow visualization of an extremely wide range of biological samples ranging from isolated macromolecules, viruses, and bacteria to the ultrastructure of fungi, plants, animals, and humans at nanometre resolution. Therefore, researchers from various institutions will use the new microscope to perform a large number of extremely diverse projects. Information on the structure of biological samples and on the localization of the selected molecules on the subcellular level obtained by screening electron microscopy is crucial for understanding the functioning of biological systems and enables the application of acquired knowledge in various fields of life sciences, biotechnology, and health, such as genetic treatment and development of new medicines, such as Zolgensma, to track the quality of food and to develop techniques for the identification, removal, and destruction of harmful micro-organisms in plants and the environment.

Presevni elektronski mikroskop Talos L120C (foto: Jože Suhadolnik, Delo).
Transmission electron microscope Talos L120C (Photo: Jože Suhadolnik, Delo).

IC MBP je v letu 2019 zaključil petletni remont oceanografske boje Vida. Ta je vključeval barvanje notranjosti in trupa boje, postavitev treh baterijskih sklopov, prenovo energetske omarice in montaža anten ter testiranje merilnih inštrumentov na kopnem, po prevozu oceanografske boje na morsko pozicijo in še priklop ter testiranje vseh merilnih inštrumentov na in pod bojo (tokomer, merilci morske temperature in slanosti, kisika itd.). Zamenjane so bile tudi vse nadzorne kamere. Poleg obnovljenega trupa ima boja Vida tudi posodobljen in v celoti krmiljen energetski sistem z okolju mnogo bolj prijaznimi baterijami in tri nove solarne panele. Oceanografska boja Vida je nadgrajena tudi z novo strojno in programsko opremo. Primarni prenos podatkov sedaj poteka preko GSM sistema, ki je energetsko občutno manj potraten, medtem ko prenos preko radijskih frekvenc poteka le v primeru, če GSM ne deluje. Tako je bila oceanografska boja v letu 2019 v celoti obnovljena in nadgrajena.

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 je tudi uporaba opreme 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.

V letu 2019 je veliko infrastrukturno opremo IP NIB uporabljalo 120 različnih uporabnikov, s čimer je IP NIB uspel ohraniti in celo povečati izjemno veliko število uporabnikov svoje velike infrastrukturne opreme.

Tematike raziskav in analiz, za katere se je uporabljala velika infrastrukturna oprema IC NIB, so bile izjemno raznovrstne. Tako veliko število uporabnikov in raznovrstnost tematik kaže 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.

Velik prispevek IP NIB k izkoriščenosti infrastrukturne opreme se kaže tudi v podatku, da je v letu 2019 kar 28 % uporabnikov IP NIB prihajalo iz drugih RO.

IP NIB je tudi v letu 2019 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 2019 prav tako pomenil osnovo za sodelovanje pri evropskih in drugih mednarodnih projektih. Z moderno in dobro vzdrževano (v skladu z 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.

In 2019 IC MBP completed an overhaul of the oceanographic buoy Vida after five years. This included the painting of the interior and the outer surface of the hull, battery installation, new electrical enclosure, and antennas mounting. Testing of the measuring instruments was done onshore and after placing the buoy on the offshore position, after all the instruments were connected on top and below the buoy (acoustic current meter, temperature, salinity, and oxygen sensors). Besides that, all surveillance cameras were also replaced. In addition to the renovated hull, the buoy has also an updated and fully controlled energy system with much more environmentally-friendly batteries and three new solar panels. Oceanographic buoy Vida has also been upgraded with new hardware and software. Primary data transmission is now through the GSM system, which is consuming less energy, and radio-frequency transmission only takes place if GSM does not work. Thus, the 2019 oceanographic buoy was completely restored and upgraded.

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 organizations. Training courses in equipment use are organized for frequent users. It is also possible, however, 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 and 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 centers 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 are available in near real-time.

In 2019, the IP NIB's large infrastructural equipment had 120 distinct users with which the IP NIB achieved to preserve and even enlarge the extremely high number of users of its large infrastructural equipment.

The subjects of research and analyses carried out by the IC NIB's large infrastructural equipment were extremely diverse. A 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.

The IP NIB's large contribution to the utilization of the infrastructural equipment is reflected in the fact that in 2019 as many as 28% of IP NIB users came from other research organizations.

In 2019, the IP NIB continued to ensure cooperation among the researchers of various research programs, 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 2019. The modern and well-maintained (according 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 specialized analyses.

7.0 BIOLOŠKA KNJIŽNICA THE BIOLOGY LIBRARY

Foto/photo: B. Černač

OSEBJE
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VODJA
HEAD
Černač, Barbara

SODELAVCI
STAFF
Glavač, Lučka
Writzl, Petra (Oddelek za biologijo Biotehniške fakultete Univerze v Ljubljani)

Foto/photo: B. Černač

Biološka knjižnica je specialna in visokošolska javno dostopna knjižnica. Delujemo v okviru Nacionalnega inštituta za biologijo in Oddelka za biologijo Biotehniške fakultete Univerze v Ljubljani ter se kot podporna in servisna služba vključujemo v raziskovalne, razvojne in pedagoške dejavnosti obeh ustanov. Naša knjižnična zbirka obsega preko 80.000 znanstvenih knjig, znanstvenih revij, zaključnih del študija... Naši tipični uporabniki so raziskovalci, univerzitetni predavatelji in študentje s področja biologije in sorodnih ved. Na voljo pa smo tudi najširši javnosti (raziskovalcem in študentom drugih ved...). Delujemo na dveh lokacijah: v Biološkem središču v Ljubljani in na Morski biološki postaji Piran.

STORITVE

- **hranjenje, vzdrževanje in dopolnjevanje knjižnične zbirke**
- **zagotavljanje spletnega dostopa do e-revij, e-knjig in baz podatkov:** dogovori in sodelovanje z nabavnimi konzorciji, tehnično urejanje dostopov, oddaljeni dostop do e-virov
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- **izposoja** gradiva notranjim in zunanjim uporabnikom, sprejemanje rezervacij in naročil gradiva (tudi preko spletne storitve »Moja knjižnica«)
- **medknjižnična izposoja**: dobava gradiva iz knjižnic v Sloveniji in tujini
- **pomoč in informacijska podpora** našim uporabnikom
- **informacijske storitve**: izdelovanje analiz citiranosti, statistik in letnih poročil za oceno raziskovalne uspešnosti
- **referenčne storitve**: iskanje literature v Cobissu in drugih katalogih, na internetu (v bazah podatkov, e-revijah, repozitorijih...), izvajanje retrospektivnih poizvedb...
- **bibliografije raziskovalcev in ocenjevanje raziskovalne uspešnosti**: izdelovanje bibliografij raziskovalcev sistemu COBISS in sodelovanje pri vrednotenju raziskovalne uspešnosti v sistemu SICRIS za zaposlene v obeh matičnih ustanovah
- **izobraževanje uporabnikov** o uporabi storitev knjižnice in v samostojnem iskanju informacij po naši knjižnični zbirki in elektronskih informacijskih virih
- **tehnični pregled oblike zaključnih del študentov** Oddelka za biologijo Bioteniške fakultete Univerze v Ljubljani in **pregled nalog s protiplagiatorskim programom** Turnitin
- **tehnični pregled znanstvenih knjig** v pripravi za objavo
- **svetovanje kandidatom za izvolitve v habilitacijskih postopkih** in tehnični pregledi njihovih vlog
- **svetovanje avtorjem pri objavljanju v odprtem dostopu**
- **vnosi objav v polnem besedilu v repozitorij Nacionalnega inštituta za biologijo (DiRROS) in Repozitorij Univerze v Ljubljani (RUL)** ob spoštovanju avtorskega prava in zahtev založnikov
- **izmenjava revij** za **Acta Biologica Slovenica** (nekdanji Biološki vestnik) in **Natura Sloveniae** s številnimi slovenskimi in tujimi partnerskimi ustanovami
- **vzdrževnje spletnega mesta in Facebook profila** za več informacij o Biološki knjižnici in aktualnem dogajanju v slovenski biologiji
- **čitalnica** : 67 mest za tihi študij
- **dostop do računalnikov, možnost povezave v brezžično omrežje** (Eduroam)

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Vetrnica *Sagartiogeton viduatus*, ki kot epibiont živi pritrjen na listu prave morske trave (*Zostera marina*) (foto: B. Mavrič).
Sea anemone *Sagartiogeton viduatus*, living as epibiont on the leaf of eel-grass (*Zostera marina*) (Photo: B. Mavrič).

3.0

ODDELEK ZA BIOTEHNOLOGIJO IN SISTEMSKO BIOLOGIJO

DEPARTMENT OF BIOTECHNOLOGY AND SYSTEMS BIOLOGY

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

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

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