NACIONALNI INŠTITUT ZA BIOLOGIJO
NATIONAL INSTITUTE OF BIOLOGY

2017

POROČILO O DELU

ANNUAL REPORT

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ANNUAL REPORT

Fotografija na naslovnici: Meduza *Aequorea sp.* (foto: Tihomir Makovec). Cover photograph: Jellyfish *Aequorea sp.* (Photo: Tihomir Makovec).

Nacionalni inštitut za biologijo (foto: Damjan Končar). National Institute of Biology (Photo: Damjan Končar).

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.

MISSION

- Creating new knowledge through basic research in the field of biology and related natural sciences, environmental protection, biotechnology and biomedicine.
- Applying newly created knowledge in industry with the goal of improving the quality of life.
- Transfering knowledge to younger generations through education at undergraduate and graduate level.

VIZIJA

- Želimo ustvarjati vrhunsko znanje in tehnologije na področju ved o življenju in njegovem 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.

VISION

- We wish to create elite knowledge and technologies in the field of life sciences and their environments as an internationally renowned autonomous institution.
- We will be taking care of the satisfaction and education of top-level personnel through good organization and state-of-the-art equipment.
- We will ensure our long-term development in close association with the society and the business sector.

VSEBINA

CONTENTS

»Naredi tisto, kar moraš in moreš,
s tistim, kar znaš, tam, kjer si …«

"Do what you can,
with what you have, where you are."

Theodore Roosevelt

Namesto uvodnika, ki sem ga pisala več kot 20 let vodenja NIB-a, bi tokrat ob svojemu odhodu s tega položaja vsem, ki ostajajo, posvetila misel Theodorja Roosevelta:

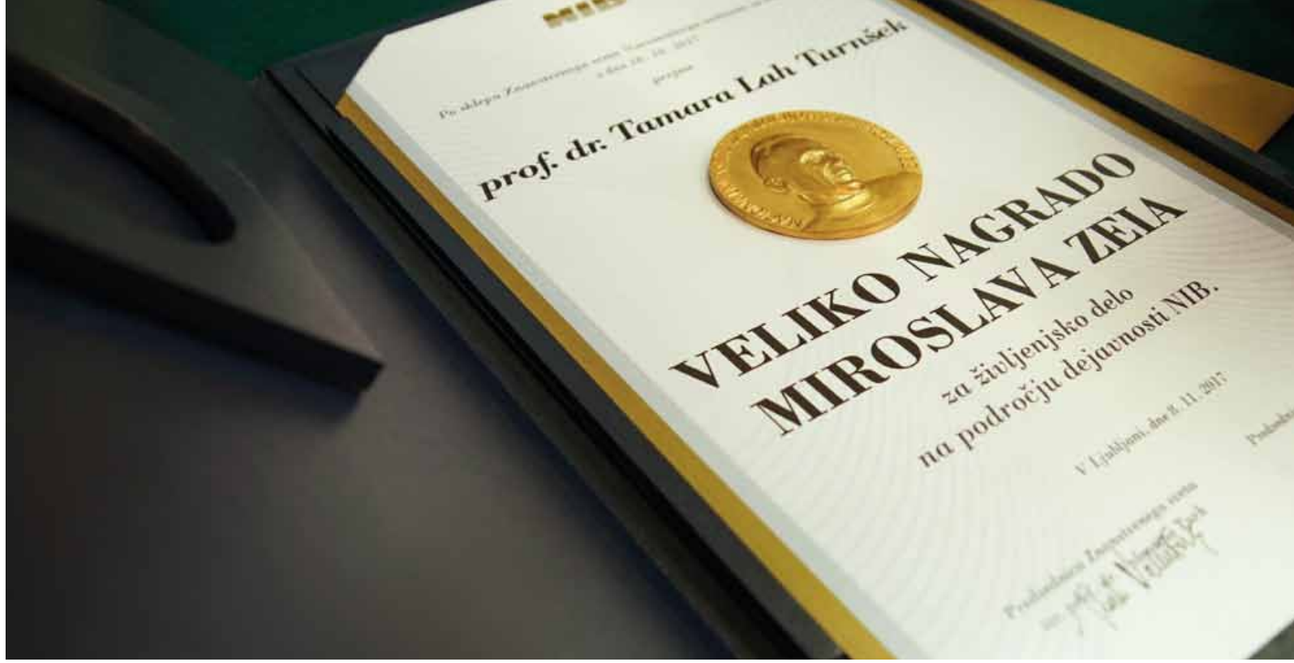
»Naredi tisto, kar moraš in moreš, s tistim, kar znaš, tam, kjer si …«

To sem bila jaz.

A z NIB-a sicer še ne želim oditi, saj želim biti priča novemu vzponu NIB-a, ki prav gotovo prihaja in to si/nam želim prav v tekočem optimističnem letu, ko se državi obetajo boljši časi …

Na prehojeni poti dvaindvajsetih let so seveda bili najprej vzponi, zatem padci in znova nas je poneslo še višje, tako da smo podvojili svoje sile. Temu je sledilo obdobje suhih krav, ko smo se skrčili za tretjino. A morda tudi okrepili drugi dve tretjini, ki sta ostali in bosta v novem obdobju pod novim vodstvom zmožni ne le nadomestiti izgubo, ampak tudi rasti do višine in obzorij, kamor še nismo segli! V izzivih znanosti, v najboljšem izobraževanju najboljših, uresničevanju smelih poslovnih idej, ki se bodo vraščale v ključne gospodarske trende družbe S4 industrij (slovenska Strategija pametne specializacije) in tistih, o katerih še niti ne sanjamo. A tudi v izzivih miru in trajne skrbi za naravo, ki nas v tem delu sveta, naše dežele in tu pod Rožnikom, še vedno obdaja …

prof. dr. Tamara Lah Turnšek
direktorica



Priznanje ob prejemu Velike nagrade Miroslava Zeia (foto: Damjan Končar).
Recognition on receiving the Miroslav Zei Lifetime Achievement Award (Photo: Damjan Končar).

Instead of an editorial, which I have been writing for more than 20 years while managing NIB, now, as I am leaving my position, I would like to dedicate a quote by Theodore Roosevelt to all who are staying behind:

"Do what you can, with what you have, where you are."

That was what I did.

I do not want to leave NIB just yet, because I want to witness its new rise, which is surely coming and which I wish for myself/us in the current optimistic year, when better times are in store for our country…

On the path traversed over the past twenty-two years, there were ups, and then there were downs, and then we again soared even higher, doubling our forces. This was followed by a dry spell, when our numbers dropped by a third. But perhaps that strengthened the two-thirds that remained and which will now be able to not only compensate for that loss in the new era, under new management, but soar to a height and horizons we have never reached before! Facing the challenges of science, providing the best education to the best, realising bold business ideas, which will become rooted in the key economic trends of a society of S4 (Slovenian Smart Specialisation Strategy) industries, and those we have not even dreamt of. But also facing the challenges of peace and sustainable care for nature, which continues to surround us in this part of the world, in our country, and here, beneath the Rožnik Hill…

Prof. Dr Tamara Lah Turnšek
Director

OB PODELITVI NAGRADE MIROSLAVA ZEIA 2017 ZA ŽIVLJENJSKO DELO

Bogato znanstveno kariero je prof. dr. Tamara Lah Turnšek začela na Inštitutu Jožef Stefan, velik del svojih znanstvenih in strokovnih izkušenj pa je pridobila v tujini: na Oddelku za biokemijo Univerze Newcastle upon Tyne v Veliki Britaniji in v ZDA na Oddelku za farmakologijo Medicinske fakultete na Univerzi Wayne State v Detroitu ter kot gostujoča profesorica in tudi vodja Laboratorija za raziskave metastaziranja na Medicinskem centru Albert Einstein v Filadelfiji.

Osrednje raziskovalno področje profesorice Lah Turnšek je študij vloge proteaz in njihovih inhibitorjev v različnih fizioloških in patoloških stanjih, posebej pri raku dojke in pljuč ter pri možganskih tumorjih, zlasti gliomih. Ne zanima je le razumevanje njihove vloge, ampak predvsem možnosti uporabe teh novih znanj v klinični praksi pri diagnostiki, napovedovanju napredovanja ter kot tarče za zdravljenje raka. Kasneje je svoje raziskave razširila v proučevanje kompleksne vloge mikrookolja tumorjev, tako na njihov razvoj in napredovanje kot tudi na odzive na zdravljenje. V zadnjem času se ukvarja predvsem z raziskavami celičnih interakcij in z rakom povezanih matičnih celic na ravni transkriptomike in proteomike ob uporabi pristopov sistemske biologije.

Profesorica Lah Turnšek je ob prihodu na NIB leta 1996 ustanovila Oddelek za genetsko toksikologijo raka, ki ga je nekaj let tudi vodila, še danes pa je vodja programa skupine Ekotoksikologija, toksikogenomika in biologija raka. Bila je tudi vodja mnogih nacionalnih raziskovalno-razvojnih projektov ter tudi bilateralnih in mednarodnih.

Vsa leta je zelo aktivna na pedagoškem področju. Kot redna profesorica za biokemijo in molekularno biologijo je nosilka in predavateljica predmetov s področja biologije in biokemije raka na drugi stopnji bolonjskega študija ter na podiplomskem študiju različnih fakultet Univerze v Ljubljani ter na Mednarodni podiplomski šoli IJS. Kot vabljena predavateljica je predavala na tujih univerzah, če omenim le dve – bila je »častna gostujoča predavateljica SPINOZA« na Akademskem medicinskem centru Univerze v Amsterdamu, na Univerzi v Sao Paolu pa je izvedla sklop predavanj za doktorske študente biokemije. Bila je mentorica 15 doktorandom ter številnim magistrandom in diplomantom.

Bila je tudi med organizatorji osmih mednarodnih Konferenc o eksperimentalni in translacijski onkologiji – CETO, ki so posvečene raziskavam in zdravljenju raka; zadnji, leta 2017, je tudi predsedovala. Te konference imajo poleg znanstvenega tudi pomemben družbenoekonomski pomen, saj omogočajo stik med raziskovalci in zdravniki ter s tem doprinašajo k hitrejšemu prehodu temeljnih laboratorijskih raziskav do bolnikove postelje.

Profesorica Lah Turnšek je vseskozi aktivno navzoča v javnem prostoru in se aktivno udejstvuje v nacionalni in mednarodni znanstveni politiki ter s tem bistveno prispeva k ugledu in razumevanju naravoslovnih znanosti – ne le v strokovni, temveč tudi v laični javnosti. Med letoma 2000 in 2008 je predsedovala Komisiji za ženske v znanosti in delovala kot aktivna članica EU Helsinške skupine za ženske v znanosti. Vsa leta je bila aktivna članica združenja direktorjev KORIS. Od leta 2014 je izredna članica Inženirske akademije Slovenija. V sedanjem mandatnem obdobju je predsednica Sveta za znanost RS in predsednica Odbora Republike Slovenije za Zoisovo nagrado, Zoisovo priznanje, priznanje ambasador znanosti Republike Slovenije in Puhovo priznanje.

Kot direktorica prof. dr. Lah Turnšek že dobrih 20 let zelo uspešno vodi Nacionalni inštitut za biologijo in ima nedvomne zasluge, da je le-ta danes v Sloveniji tretji največji inštitut na področju naravoslovnih znanosti in prvi na področju biologije. K uspešnemu vodenju so pripomogle tako njene managerske sposobnosti kot tudi dosledno zavzemanje za znanstveno odličnost. Med njenimi pomembnejšimi dosežki je zagotovo razširitev Morske biološke postaje v moderno opremljeno infrastrukturo ob piranski obali v letu 2006.

ON RECEIVING THE 2017 MIROSLAV ZEI LIFETIME ACHIEVEMENT AWARD:

Prof. Dr Tamara Lah Turnšek began her rich scientific career at the Jožef Stefan Institute, and later gained much of her scientific and professional experience abroad: at the Department of Biochemistry of the University of Newcastle-upon-Tyne in Great Britain; in the USA at the School of Medicine of Wayne State University in Detroit; and as a visiting lecturer and head of the Metastasis Research Laboratory at the Einstein Medical Center in Philadelphia.

Professor Lah Turnšek's main area of research is the study of the role of proteases and their inhibitors in a variety of physiological and pathological conditions, especially in breast cancer, lung cancer and brain tumours, mostly gliomas. She is interested not only in understanding their role, but above all in the possibilities of applying this new knowledge to clinical practice for diagnostics, predicting progression, and as targets for cancer treatment. She later expanded her research to the study of the complex role of tumours' microenvironment, of their development and progression, and of reactions to treatment. Recently, she has been engaged primarily in researching cellular interactions and cancer-related stem cells at the level of transcriptomics and proteomics, employing the approaches of systems biology.

When arriving at NIB in 1996, Professor Lah Turnšek founded the Department of Genetic Toxicology and Cancer Biology, which she ran for several years; she is still the head of this group's programme "Cancer Ecotoxicology, Toxicogenomics and Biology". She was also the manager of many national research and development projects, as well as bilateral and international ones.

Throughout the years, she has been very active in the sphere of education. As a full professor of Biochemistry and Molecular Biology, she is the leader and lecturer of courses in Cancer Biology and Biochemistry at the second cycle of Bologna studies and at the postgraduate studies of various faculties of the University of Ljubljana, and at the Jožef Stefan International Postgraduate School. She has lectured at foreign universities as an invited lecturer; to mention only two: she was the "SPINOZA Honorary Visiting Lecturer" at the Academic Medical Centre of the University of Amsterdam; at the University of Sao Paolo she held a group of lectures for doctoral students of Biochemistry. She has mentored 15 PhD students, and many master's and bachelor's students.

She was also among the organizers of eight international Conferences on Experimental and Translational Oncology – CETO, which are dedicated to cancer research and treatment; she also chaired the last one in 2017. In addition to scientific importance, these conferences also have great socioeconomic importance, as they enable contact between researchers and doctors, thus contributing to a faster transfer of basic laboratory research to the patient's bedside.

Professor Lah Turnšek has constantly maintained an active presence in the public sphere, and is actively engaged in national and international scientific policies, thus making a substantial contribution to the reputation and understanding of natural sciences, not only in the expert public, but in the lay one as well. Between 2000 and 2008, she presided over the Women in Science Committee and acted as an active member of the EU Helsinki Group on Women in Science. Throughout the years, she was an active member of the KORIS directors' association. Since 2014, she has been an associate member of the Slovenian Academy of Engineering. In the current term, she is the president of the Council for Science and Technology of the Republic of Slovenia, and president of the Committee of the Republic of Slovenia for the Zois Award, Zois Certificate of Recognition, Ambassador of Science Certificate of Recognition and the Puh Certificate of Recognition.

As Director, Prof. Dr Lah Turnšek has been running the National Institute of Biology for over 20 years with great success and is undoubtedly responsible for turning it into the third-largest institute in Slovenia in the field of natural sciences and the leading one in the field of biology. Her successful management was aided by her managerial skills, and her constant commitment to scientific excellence. Among her more important achievements is undoubtedly the expansion of the Marine Biology Station to a modernly equipped infrastructure on the coast of Piran in 2006.

VODSTVO INŠTITUTA
INSTITUTE'S MANAGEMENT

DIREKTORICA
DIRECTOR

prof. dr. Tamara Lah Turnšek (od from 1996)
Mandat Mandate: 1. 1. 2015 – 28. 2. 2018

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

mag. Franc Potočnik (od from 1999)
Mandat Mandate: 1. 1. 2015 – 28. 2. 2018

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

mag. Jure Vindišar
Mandat Mandate: 1. 6. 2017 – 28. 2. 2018

UPRAVNI ODBOR
BOARD OF GOVERNORS

Ivana Erjavec, MKGP – predsednica president
prof. dr. Marina Dermastia, NIB – podpredsednica vice-president
dr. Peter Venturini, Helios d.o.o.
dr. Matjaž Oven, Lek d.d.
Luka Živić, MIZŠ do to 21. 12. 2017, od from 22. 12. 2017 **dr. Eva Batista**
Mandat Mandate: 28. 5. 2014–28. 5. 2018.

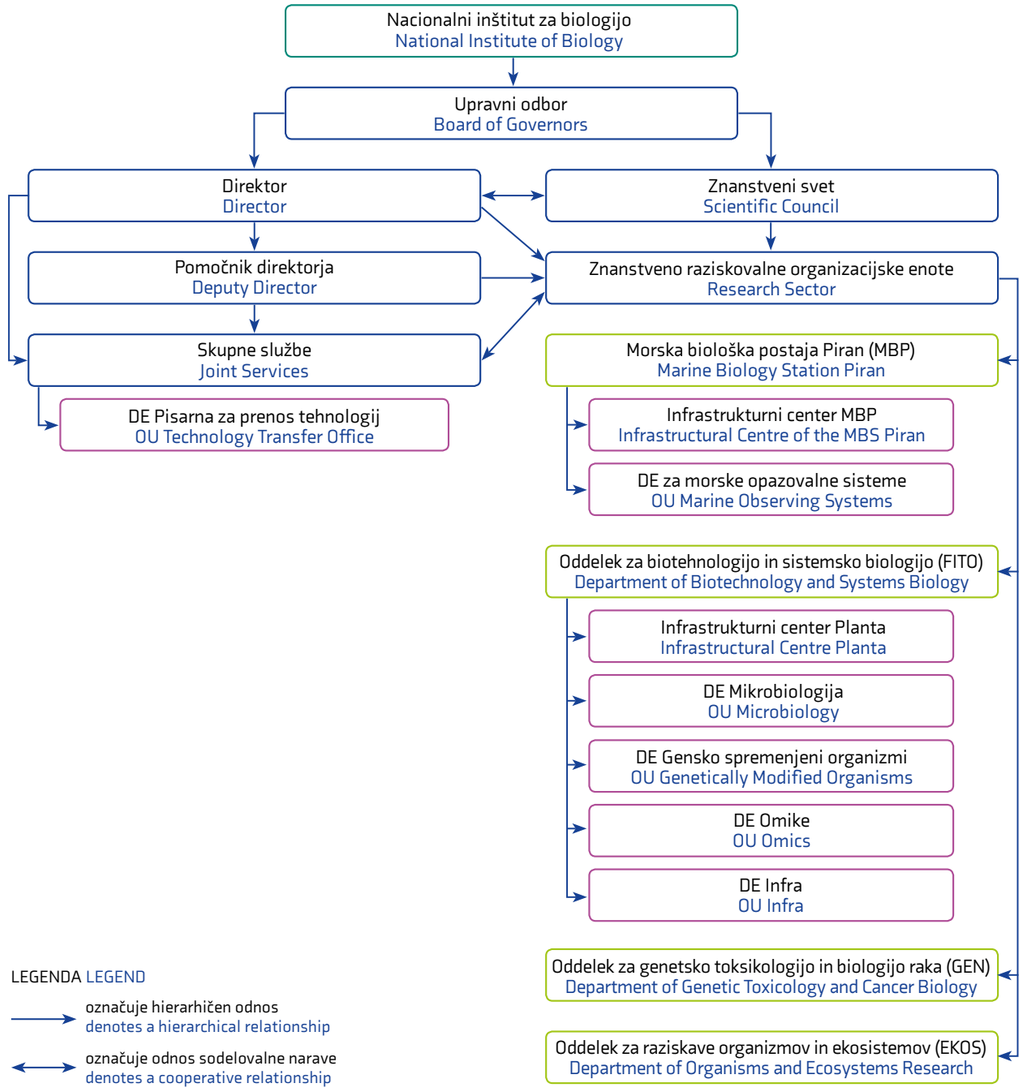
ZNANSTVENI SVET
SCIENTIFIC COUNCIL

izr. prof. dr. Valentina Turk, predsednica
doc. dr. Meta Virant-Doberlet, podpredsednica vice-president
prof. dr. Tamara Lah Turnšek
prof. dr. Anton Brancelj
prof. dr. Marina Dermastia
prof. dr. Metka Filipič
prof. dr. Kristina Gruden
izr. prof. dr. Patricija Mozetič
doc. dr. Andreja Ramšak
izr. prof. dr. Jana Žel
Mandat Mandate: 26. 4. 2016–25. 4. 2020

ČASTNI ČLANI
HONORARY MEMBERS

prof. dr. Kazimir Tarman, od from 25. 10. 2010
dr. Guy Van Den Eede, od from 25. 10. 2010
prof. dr. Cornelis Johannes Forrendinis van Noorden, od from 14. 11. 2014
prof. dr. Tom Turk, od from 8. 11. 2017

ORGANIZACIJSKA SHEMA
ORGANIZATIONAL SCHEME



PREGLED POSLOVANJA INŠTITUTA V LETU 2017

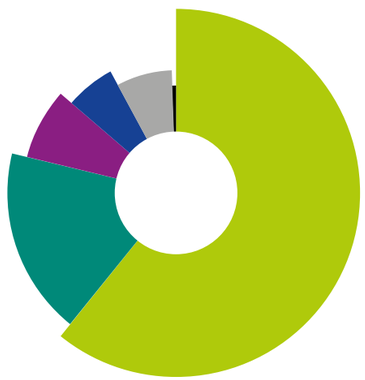
Poslovno leto 2017 je bilo za NIB uspešno. Večina zastavljenih ciljev je bila dosežena, nekateri cilji so bili tudi preseženi.

Finančni cilji, opredeljeni v finančnem načrtu za leto 2017, so bili preseženi tako pri prihodkih kot pri poslovnem izidu. Ustvarjeni prihodki v višini 6.777.621 EUR so bili višji od načrtovanih za 527.899 EUR (8,45 %), ustvarjeni presežek prihodkov nad odhodki (pred obračunom davka od dohodkov pravnih oseb) v višini 161.928 EUR pa je presegel načrtovanega za 153.111 EUR.

V primerjavi z letom 2016 so bili realizirani prihodki NIB-a v letu 2017 višji za 650.188 EUR (10,61 %), realizirani odhodki pa za 563.108 EUR (9,30 %). Posledično je bil v letu 2017 ustvarjen boljši poslovni izid kot v letu 2016 (za 87.080 EUR oz. 116,34 %). Največja rast prihodkov v letu 2017 v primerjavi z letom 2016 je bila dosežena v kategoriji »druga domača javna služba – MIZŠ«, v kateri so prihodki v 2017 znašali 514.331 EUR in so bili od primerljivih prihodkov v letu 2016 višji za 431.315 EUR. Razlog za povečanje prihodkov v letu 2017 je v tem, da je NIB dva projekta v okviru Operativnega programa za izvajanje evropske kohezijske politike v obdobju 2014–2020 v povezavi s Strategijo pametne specializacije in en projekt iz programa ARIMNet2 v letu 2017 izvajal vse leto, v letu 2016 pa le v zadnjih dveh mesecih. Poleg tega je v letu 2017 pričel izvajati tri projekte iz razpisa MIZŠ za spodbujanje raziskovalcev na začetku kariere. Bistveno višji kot v 2016 so bili v letu 2017 tudi ustvarjeni prihodki v kategoriji »tuji trg«. Znašali so 503.876 EUR in so bili od primerljivih prihodkov v letu 2016 višji za 255.107 EUR. Razlogi za višje prihodke v letu 2017 so predvsem v povečanem obsegu dela na razvoju molekularnih metod za karakterizacijo in kvantifikacijo virusov za gensko terapijo za obstoječega naročnika in pridobitev novih naročnikov za tovrstne storitve, povečan obseg dela na karakterizaciji GSO referenčnih materialov in določanje njihove stabilnosti ter izvedba študije biodiverzitete za tujega naročnika.

STRUKTURA PRIHODKOV NIB V LETU 2017

REVENUE STRUCTURE IN 2017



- 60,78 % Prihodki od ARRS Slovenian Research Agency
- 18,04 % Druge javne službe Other public institutions
- 7,57 % Evropski skladi EU funds
- 5,69 % Domači trg Domestic market
- 7,43 % Tuji trg Foreign markets
- 0,48 % Drugi prihodki Other revenues

REVIEW OF THE INSTITUTE'S OPERATIONS IN 2017

The 2017 financial year was a successful one for NIB. Most of the set goals were reached, while some were even exceeded.

The financial goals, laid down in the Financial Plan for 2017, have been exceeded in relation to revenues and the profit and loss. The generated revenues in the amount of 6,777,621 EUR were higher than the planned revenues by 527,899 EUR (8.45%), while the generated excess of revenue over expenditure (prior to charging the corporate income tax) in the amount of 161,928 EUR exceeded the planned surplus by 153.111 EUR.

In 2017, compared to 2016, NIB's realized revenues were higher by 650,188 EUR (10.61%), and the realized expenses by 563,108 EUR (9.30%). Consequently, a higher profit was generated in 2017 than in 2016 (by 87,080 EUR or 116.34%). The greatest increase in revenues in 2017, in comparison with 2016, was recorded in the category "Other Domestic Public Institution – Ministry of Education, Science and Sport", with the revenues in 2017 amounting to 514,331 EUR, thus being higher than the comparable revenues in 2016 by 431,315 EUR (or 519.55%). One reason for the increase in revenues in 2017 is that in that year NIB was implementing two projects under the Operational Programme for the Implementation of the EU Cohesion Policy in the Period 2014 – 2020 in connection with the Smart Specialisation Strategy, and one project under the ARIMNet2 Programme throughout the year, whereas in 2016 it had implemented them only in the last two months. Moreover, in 2017, it began implementing three projects from the call for applications of the Ministry of Education, Science and Sport for encouraging researchers at the start of their careers. The revenues generated under the "Foreign Markets" category were also significantly higher in 2017 than in 2016. They amounted to 503,876 EUR and were higher than the comparable revenues in 2016 by 255,107 EUR (102.55%). The reasons for higher revenues in 2017 mostly lie in a greater volume of work on developing molecular methods for the characterization and quantification of viruses for gene therapy for an existing client, and in the acquisition of new clients for such services; in a greater volume of work on characterizing GMO reference materials and determining their stability; and in implementing a biodiversity study for a foreign client.

PRIHODKI V EUR REVENUES IN EUR	2017	2016	STRUKTURA 2017 (%) STRUCTURE 2017 (%)	INDEKS 2017/16 INDEX 2017/16
Prihodki od ARRS Slovenian Research Agency	4.119.462,35	3.958.157,96	60,78	104,08
Druge javne službe Other public institutions	1.222.720,88	789.851,41	18,04	154,80
Evropski skladi EU funds	513.215,81	680.426,84	7,57	75,43
Domači trg Domestic market	385.866,76	422.637,25	5,69	91,30
Tuji trg Foreign markets	503.875,51	248.768,03	7,43	202,55
Drugi prihodki Other revenues	32.479,72	27.591,93	0,48	117,71
Skupaj prihodki Total revenues	6.777.621,03	6.127.433,39	100	110,61

ODHODKI V EUR EXPENSES IN EUR	2017	2016	STRUKTURA 2017 (%) STRUCTURE 2017 (%)	INDEKS 2017/16 INDEX 2017/16
Stroški dela Labour	4.072.840,22	3.806.068,99	61,56	107,01
Stroški amortizacije Amortization	458.261,16	441.793,05	6,93	103,73
Stroški materiala Material	667.050,62	641.090,48	10,08	104,05
Stroški storitev Services	1.359.769,39	1.078.892,93	20,55	126,03
Drugi stroški in odhodki Other	57.772,07	84.739,55	0,87	68,18
Skupaj odhodki Total expenditure	6.615.693,46	6.052.585,00	100	109,30
REZULTATI POSLOVANJA BUSINESS RESULT	**161.927,57**	**74.848,42**		

Strokovni simpozij All that Life v počastitev življenja in dela prof. dr. Tamare Lah Turnšek (foto: Damjan Končar).
Expert symposium "All That Life" in honour of the life and work of Prof. Dr Tamara Lah Turnšek (Photo: Damjan Končar).

Sodelovanje Nacionalnega inštituta za biologijo na Znanstivalu 2017. Participation of the National Institute of Biology at Znanstival 2017 science festival.

Leto 2017 je bilo za NIB uspešno tudi na področju izvajanja temeljnega raziskovanja. V tem letu so NIB-ovi raziskovalci objavili 100 znanstvenih člankov v revijah s faktorjem vpliva, od teh 59 v revijah v prvem kvartilu. NIB je v 2017 uspešno izvajal tudi aplikativno raziskovanje, pri katerem je posebej izstopala nadaljnja krepitev delovanja na mednarodnem trgu.

Leto 2017 je bilo tudi zaznamovano z NIB-ovim intenzivnim sodelovanjem pri prijavah projektov na različne razpise, pri katerem je bil uspešen na Javnem razpisu ARRS za (so)financiranje raziskovalnih projektov za leto 2018. NIB je kot nosilna organizacija v prvi fazi prijavil 13 predlogov projektov, od katerih jih je bilo 10 uvrščenih v drugo fazo. Tudi z vidika pridobitve novih projektov iz evropskih programov je bilo leto 2017 za NIB uspešno – pričel je izvajati tri projekte iz programa Obzorje 2020, pet projektov iz INTERREG programov ter en projekt iz programa LIFE.

Leta 2017 je NIB, skupaj s še sedmimi slovenskimi javnimi raziskovalnimi organizacijami vstopil v Konzorcij za prenos tehnologij iz JRO v gospodarstvo. Namen petletnega projekta, financiranega s strani MIZŠ, je spodbuditi krepitev povezav in sodelovanja med javnimi raziskovalnimi organizacijami in gospodarstvom ter krepitev kompetenc pisarn za prenos tehnologij, raziskovalcev in podjetij.

2017 was also a successful year for NIB in the field of the implementation of basic research. In that year, NIB's researchers published 100 scientific articles in journals with an impact factor; 59 of them were published in journals in the first quarter. In 2017, NIB was also successfully conducting applied research; especially noteworthy was the further strengthening of its activities in the international market.

2017 was also marked by NIB's intensive submission of project applications to various calls for applications; it was successful in the Public Call for the (Co-) Financing of Research Projects in 2018 of the Slovenian Research Agency. As the applying organization, NIB applied 13 project proposals in Phase I of the call, 10 of which were approved for Phase II. From the aspect of obtaining new projects from EU programmes, 2017 was again a successful year for NIB – it began implementing three projects under the Horizon 2020 programme, five projects under INTERREG programmes, and one project under a LIFE programme.

In 2017, NIB, along with seven other Slovenian public research organizations, joined the Consortium for Technology Transfer from PROs to the Industrial Sector. The purpose of this five-year project, financed by the Ministry of Education, Science and Sport, is to encourage the strengthening of the links and cooperation between public research organizations and industrial partners, as well as strengthening the competences of Technology Transfer Offices, researchers and enterprises.

IZVAJANJE RAZISKOVALNIH PROGRAMOV IN PROJEKTOV

Kot nosilec je NIB leta 2017 izvajal naslednje raziskovalne programe:

- **P1-0237 – Raziskave obalnega morja**, ki poteka v organizacijski enoti MBP (7,78 FTE), obdobje financiranja 2015–2019;
- **P4-0165 – Biotehnologija in sistemska biologija rastlin**, ki poteka v organizacijski enoti FITO (4,7 FTE), obdobje financiranja 2015–2020;
- **P1-0255 – Združbe, interakcije in komunikacije v ekosistemih**, ki poteka v organizacijski enoti EKOS (6,59 FTE) ter v soizvajalski organizaciji Prirodoslovnega muzeja Slovenije (0,19 FTE), obdobje financiranja 2017–2022;
- **P1-0245 – Ekotoksikologija**, toksikološka genomika in karcinogeneza, ki se ga izvaja v organizacijski enoti GEN (3,35 FTE), obdobje financiranja 2015–2018.

Poleg teh štirih raziskovalnih programov je organizacijska enota MBP sodelovala še pri izvajanju programa **P1-0143 – Kroženje snovi v okolju, snovna bilanca in modeliranje okoljskih procesov ter ocena tveganja**, katerega nosilec je Institut Jožef Stefan v obsegu 0,32 FTE za NIB.

NIB je leta 2017 izvajal tudi infrastrukturni program v obsegu 6 FTE.

NIB je leta 2017 izvajal 19 projektov ARRS v skupnem obsegu 17.455 raziskovalnih ur oz. 10,26 FTE, in sicer:

- 13 temeljnih (6 kot nosilec),
- 2 aplikativna,
- 3 podoktorske projekte in
- 1 projekt, sofinanciran po komplementarni shemi (kot nosilec).

Obseg financiranja projektov s strani ARRS je bil v letu 2017 za 0,49 FTE oz. 0,05 % manjši kot v preteklem letu.

NIB je leta 2017 izvajal 4 projekte v sklopu CRP »Zagotovimo si hrano za jutri« in 1 projekt v okviru »CRP 2016« v skupni vrednosti 73.922 EUR, in sicer:

- 3 kot nosilec in
- 2 kot sodelujoča raziskovalna organizacija.

Obseg projektov CRP se je po obsegu sredstev leta 2017 v primerjavi s preteklim letom povečal za 49,55 %.

V 2017 je NIB izvajal dva projekta iz 7. Okvirnega programa EU in sedem projektov iz programa Obzorje 2020. Od teh so se v tem letu trije zaključili, trije pa pričeli izvajati. Višina ustvarjenih prihodkov na teh projektih je znašala 278.597 EUR in je predstavljala 4,11 % vseh prihodkov NIB-a.

Poleg teh je NIB v letu 2017 izvajal še dva projekta iz programa ARIMNET, ki sodi v 7. Okvirni program EU ter en projekt iz programa EMPIR, ki je sestavni del programa Obzorje 2020. Višina prihodkov iz teh treh projektov je v letu 2017 znašala 114.858 EUR.

V 2017 je NIB izvajal deset projektov iz drugih mednarodnih programov financiranja (LIFE, INTERREG Italija – Slovenija, INTERREG Slovenija – Hrvaška, INTERREG Europe, itd.).

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

Višina ustvarjenih prihodkov na teh projektih je znašala 585.345 EUR in je predstavljala 8,63 % vseh prihodkov v letu 2017.

RESEARCH PROGRAMMES AND PROJECTS

In 2017 NIB acted as coordinator of the following research programmes:

- **P1-0237 – »Coastal sea research«** (7.78 FTE), carried out in MBS organisation unit, duration 2015-2019;
- **P4-0165 – »Biotechnology and system biology of plants«** (4.7 FTE), carried out in FITO organisation unit, duration 2015-2020;
- **P1-0255 – »Communities, interactions and communications in ecosystems«** (6.59 FTE), carried out in EKOS organisation unit in cooperation with Slovenian Museum of Natural History (0.19 FTE), duration 2017–2022;
- **P1-0245 – »Ecotoxicology, toxicogenomics and carcinogenesis«** (3.35 FTE), carried out in GEN organisation unit, duration 2015-2018.

In addition to the four programmes listed above, MBS department acted as partner in **P1-0143 »Cycling of substances in the environment, mass balances, modelling of environmental processes and risk assessment«** programme with Jožef Stefan Institute as coordinator and NIB as partner organisation with 0.32 FTE.

In addition, an infrastructure programme (6 FTE) was carried out at NIB in 2017.

In 2017, 19 projects funded by the Slovenian Research Agency were carried out at NIB, with research time amounting in total to 17,455 working hours or 10,26 FTE in the scope of:

- 13 basic research projects (6 as coordinator),
- 2 applicative research projects,
- 3 postdoctoral projects,
- 1 project co-financed in an ERC Complementary Scheme (as coordinator).

In 2017 the financing of NIB projects by the Slovenian Research Agency was 0.05% lower in comparison to the previous year.

4 projects in the scope of the target research project »Ensuring food for tomorrow« and 1 project in the scope of the target research project »CRP 2016«, with total funds amounting to 73,922 EUR, were carried out at NIB in 2017. In three NIB acted as coordinator and in two as participating research organisation.

The scale of financing from target research projects was 49.55% higher in comparison to that in the previous year.

In 2017, NIB implemented two projects under the 7th EU Framework Programme and seven projects under the Horizon 2020 programme. Of these, three of them were concluded this year, while three began implementation. The revenues generated by these projects amounted to 278,597 EUR and stood for 4.11% of all NIB's revenues.

Moreover, in 2017, NIB also implemented two projects under the ARIMNET programme, which falls under the 7th EU Framework Programme, and one project under the EMPIR programme, which is an integral part of the Horizon 2020 programme. In 2017, the revenues from these three projects amounted to 114,858 EUR.

In 2017, NIB implemented ten projects under other international financing programmes (LIFE, INTERREG Italy – Slovenia, INTERREG Slovenia – Croatia, INTERREG Europe, etc.).

Furthermore, it implemented six other projects, co-financed by European cohesion and investment funds through Slovenian ministries: two projects from the call for applications of the Ministry of Science, Education and Sport "R&D&I in Value Chains and Networks", three projects from the call for applications of the Ministry of Science, Education and Sport for encouraging researchers at the start of their careers, and one from the call for applications "Promoting Knowledge Transfer Activities through the Operation of Technology Transfer Offices".

The revenues generated by these projects amounted to 585,345 EUR and stood for 8.63% of all NIB's revenues in 2017.

Raziskovalni rastlinjak Nacionalnega inštituta za biologijo (foto: Luka Svetic).
Research greenhouse of the National Institute of Biology (Photo: Luka Svetic).

INVESTICIJE

NIB je v letu 2017 realiziral investicijska vlaganja v višini 480.109,09 EUR. Aktivirana so bila vlaganja v višini 457.502,27 EUR, v pridobivanju pa ostaja izdelava projektne dokumentacije za načrtovano investicijo »Biotehnološko stičišče NIB« v višini 22.606,82 EUR. Viri nabav so neporabljena amortizacija preteklih let in obračunana amortizacija tekočega leta v višini 410.653,86 EUR, prejeti investicijski transfer s strani MIZŠ v višini 20.000,00 EUR, prejeti investicijski transfer s strani MORS v višini 1500,00 EUR, sredstva prejeta iz projektnega financiranja (BIDREX, LIFE, NAT2CARE) v višini 6262,58 EUR in razporejeni presežki prihodkov preteklih let po Sklepu Vlade RS št. 47606-4/2014-4 z dne 6. 1. 2015 v višini 41.692,65 EUR.

V letu 2017 je bila za načrtovano investicijo »Biotehnološko stičišče NIB« izdelana naslednja investicijska dokumentacija: prenovljeni dokument identifikacije investicijskega projekta, dokument predinvesticijske zasnove, investicijski program in ocena upravičenosti investicijskega projekta. Nastali stroški za izdelavo navedene projektne dokumentacije so znašali 22.606,82 EUR, ki jih je v višini 20.000 EUR financiral MIZŠ, NIB pa je iz lastnih sredstev (presežki preteklih let) zagotovil razliko v višini 2606,82 EUR.

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

INVESTMENTS

In 2017, NIB realized investments in the amount of 480,109.09 EUR. Investments in the amount of 457,502.27 EUR were activated, while the investment project identification document for the planned "Biotechnological Hub NIB" in the amount of 22,606.82 EUR is still in preparation. Sources of financing are the unabsorbed depreciation from previous years and the charged depreciation of the current year in the amount of 410,653.86 EUR; a received investment transfer from the Ministry of Education, Science and Sport in the amount of 20,000.00 EUR; a received investment transfer from the Ministry of Defence in the amount of 1,500.00 EUR; funds received from project financing (BIDREX, LIFE, NAT2CARE) in the amount of 6,262.58 EUR; and allocated surpluses of revenues from previous years, pursuant to the Decision of the Government of the Republic of Slovenia No. 47606-4/2014-4 of 6 January 2015, in the amount of 41,692.65 EUR.

In 2017, the following investment documents were prepared for the planned investment "Biotechnological Hub NIB": a revised investment project identification document, a pre-investment design document, an investment programme, and an investment project eligibility assessment. The costs incurred by preparing the above-mentioned project documents amounted to 22,606.82 EUR, of which 20,000 EUR were financed by the Ministry of Education, Science and Sport, whereas NIB provided the remaining amount of 2,606.82 EUR from its own funds (the surpluses of previous years).

ZAPOSLENI V LETU 2017

Inštitut je bil v letu 2017 sestavljen iz štirih raziskovalnih enot in Skupnih služb. Zaposleni v največjih dveh enotah predstavljajo 58 % vseh zaposlenih na NIB-u. Oddelek za biotehnologijo in sistemsko biologijo je na 31. 12. 2017 zaposloval 41 sodelavcev, enota Morska biološka postaja Piran 29 sodelavcev, Oddelek za genetsko toksikologijo in biologijo raka 13 sodelavcev, Oddelek za raziskave organizmov in ekosistemov 21, Skupne službe pa 15 sodelavcev.

Na NIB-u je bilo tako na dan 31. 12. 2017 119 zaposlenih, od tega 68 raziskovalcev, 17 mladih raziskovalcev ter 34 strokovno-tehničnih in administrativnih sodelavcev.

V letu 2017 se je na novo zaposlilo 17 sodelavcev, 8 je delovno razmerje na NIB-u prenehalo.

V letu 2017 so doktorirali 3 mladi raziskovalci, z usposabljanjem je pričelo 5 mladih raziskovalcev.

Na dan 31. 12. 2017 je bilo na inštitutu zaposlenih 55 % delavcev z doktoratom znanosti, 5 % z magisterijem znanosti, 31 % s VII. stopnjo izobrazbe, 9 % zaposlenih je imelo nižjo izobrazbo od VII. stopnje.

STANJE PO ORGANIZACIJSKIH ENOTAH NA DAN 31. 12. 2017

NUMBER OF STAFF BY UNITS ON 31. 12. 2017

- 24 % MBP MBS
- 34 % FITO
- 11 % GEN
- 18 % EKOS
- 13 % Skupne službe Joint Services

HUMAN RESOURCES

In 2017 NIB consisted of four research departments and Joint Services. 58% of all NIB employees worked in the largest two departments; Department of Biotechnology and Systems Biology (FITO) employed 41 employees and Marine Biology Station Piran (MBS) had 29 employees. Other departments had a smaller number of employees: 13 at the Department of Genetic Toxicology and Cancer Biology (GEN), 21 at the Department of Organisms and Ecosystems Research (EKOS) and 15 at Joint Services.

On 31. 12. 2017 119 people worked at NIB. Among them, 68 worked as researchers, 17 as early-stage researchers and 34 as technicians and administrative staff.

In 2017 17 employees were newly hired and 8 finished their career at the Institute.

3 early-stage researchers finished their PhDs and 5 early-stage researchers started their training in 2017.

On 31. 12. 2017 the percent of employees with a PhD was 55% , 5% held a MSc, 31% completed higher education, 9% had finished higher vocational education or secondary school.

IZOBRAZBENA STRUKTURA NA 31. 12. 2017

EDUCATIONAL STRUCTURE ON 31. 12. 2017

- 55 % Doktorat znanozti PhD
- 5 % Magisterij znanosti MsC
- 31 % VII. stopnja Higher education
- 4 % VI. stopnja Higher Vocational
- 5 % V. stopnja High school

DOKTORATI, MAGISTERIJI IN DIPLOME V LETU 2017

DOCTORAL DISSERTATIONS, MASTER'S THESES AND UNDERGRADUATE THESES IN 2017

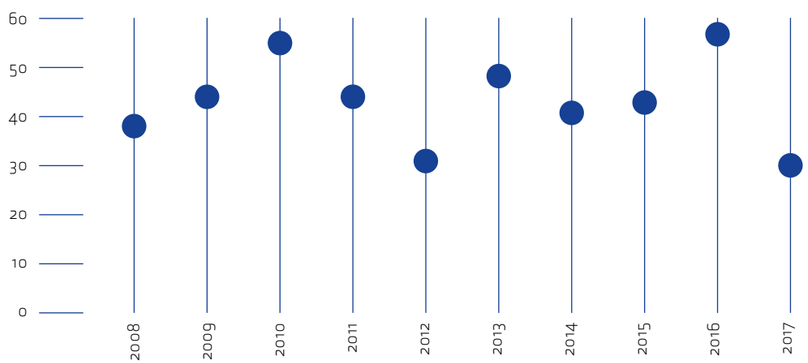
Svojo doktorsko disertacijo so pripravili pod (so)mentorstvom raziskovalcev z NIB in jo zagovarjali v letu 2017:

Doctoral dissertations under the (co)supervision of NIB researchers in 2017:

ŠTUDENT STUDENT	(SO)MENTOR (CO)SUPERVISOR
Chersicola, Marko (NIB)	Mentorica prof. dr. Marina Dermastia (FITO)
Korinšek, Gašper	Mentor prof. dr. Tadej Tuma, somentorica doc. dr. Meta Virant-Doberlet (EKOS)
Novak, Matjaž (NIB)	Mentorica prof. dr. Metka Filipič (GEN), somentorica doc. dr. Bojana Žegura (GEN)
Pavšič, Jernej (NIB)	Mentorica izr. prof. dr. Jana Žel (FITO), somentorica dr. Mojca Milavec (FITO)
Vodopivec, Martin (NIB)	Mentorica prof. dr. Alenka Malej (MBP), somentor dr. Álvaro Judice Peliz

ŠTEVILO DIPLOMSKIH, MAGISTRSKIH IN DOKTORSKIH NALOG POD (SO)MENTORSTVOM RAZISKOVALCEV Z NACIONALNEGA INŠTITUTA ZA BIOLOGIJO V OBDOBJU 2008-2017

NUMBER OF UNDERGRADUATE THESES, MASTER'S THESES AND DOCTORAL DISSERTATIONS UNDER (CO)SUPERVISION OF NIB RESEARCHERS IN YEARS 2008-2017



ŠTEVILO ZAGOVARJANIH MAGISTRSKIH IN DOKTORSKIH NALOG TER MENTORSTEV IN SOMENTORSTEV S STRANI ZAPOSLENIH NA NIB V LETU 2017

NUMBER OF MASTER'S THESES, DOCTORAL DISSERTATIONS, SUPERVISIONS AND CO-SUPERVISIONS BY NIB EMPLOYEES IN YEAR 2017

magistrska naloga Master's Thesis	1
doktorska disertacija Doctoral Dissertation	2
mentor pri doktorskih disertacijah Supervisor for Doctoral Dissertations	4
mentor pri magistrskih delih Supervisor for Master's Thesis	11
mentor pri diplomskih delih Supervisor for Undergraduate Theses	6
somentor pri doktorskih disertacijah Co-Supervisor for Doctoral Dissertations	3
somentor pri magistrskih delih Co-Supervisor for Master's Thesis	10
somentor pri diplomskih delih Co-Supervisor for Undergraduate Theses	2

OBJAVE IN CITIRANOST V LETU 2017

PUBLICATIONS AND CITATIONS IN 2017

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:

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	ŠT. OBJAVLJENIH ZNANSTVENIH ČLANKOV NO. 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 NO. OF PURE CITATIONS
2013	90	2,682	2	1780
2014	92	2,735	2	2313
2015	98	2,604	2	2363
2016	98	2,908	2	2468
2017	113	2,899	2	2421

ČLANKI, OBJAVLJENI V REVIJAH Z NAJVIŠJIM FAKTORJEM VPLIVA
ARTICLES PUBLISHED IN JOURNALS WITH THE HIGHEST IMPACT FACTOR

KOSEL, Janez, GUTIÉRREZ-AGUIRRE, Ion, RAČKI, Nejc, DREO, Tanja, RAVNIKAR, Maja, DULAR, Matevž. Efficient inactivation of MS-2 virus in water by hydrodynamic cavitation. *Water research*, ISSN 0043-1354. [Print ed.], Nov. 2017, vol. 124, str. 465-471, ilustr., doi: 10.1016/j.watres.2017.07.077. [COBISS.SI-ID 15600923],
IF (JCR)= 6,942

WALDHERR, Monika, MIŠÍK, Miroslav, FERK, Franziska, TOMC, Jana, ŽEGURA, Bojana, FILIPIČ, Metka, MIKULITS, Wolfgang, MAI, Sören, HAAS, Oskar, HUBER, Wolfgang W., HASLINGER, Elisabeth, KNASMÜLLER, Siegfried. Use of HuH6 and other human-derived hepatoma lines for the detection of genotoxins : a new hope for laboratory animals?. *Archives of toxicology*, ISSN 0340-5761, 2017, 14 str., [in press], doi: 10.1007/s00204-017-2109-4. [COBISS.SI-ID 4521807]
IF (JCR)= 5,901

ŽAGAR, Anamarija, CARRETERO, Miguel A., VREZEC, Al, DRAŠLER, Katarina, KALIONTZOPOULOU, Antigoni. Towards a functional understanding of species coexistence : ecomorphological variation in relation to whole-organism performance in two sympatric lizards. *Functional ecology*, ISSN 0269-8463, 2017, vol. 31, iss. 9, str. 1780-1791, ilustr., doi: 10.1111/1365-2435.12878. [COBISS.SI-ID 4728998]
IF (JCR)= 5,630

RIPPLE, William J., ELERŠEK, Tina, GOLOB, Urša, KROFEL, Miha, KURALT, Žan, MALEJ, Alenka, MRAMOR KOSTA, Neža, VERK, Nataša, WESTERGREN, Marjana, et al. World scientists' warning to humanity: a second notice. *Bioscience*, ISSN 0006-3568, dec. 2017, vol. 67, iss. 12, str. 1026-1028., doi: 10.1093/biosci/bix125. [COBISS.SI-ID 4973222]
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BREZNIK, Barbara, MOTALN, Helena, VITTORI, Miloš, ROTTER, Ana, LAH TURNŠEK, Tamara. Mesenchymal stem cells differentially affect the invasion of distinct glioblastoma cell lines. *Oncotarget*, ISSN 1949-2553, 2017, vol. 8, no. 15, str. 25482-25499, doi: 10.18632/oncotarget.16041. [COBISS.SI-ID 4238415]
IF (JCR)= 5,168

MITROVIĆ, Ana, SOSIČ, Izidor, KOS, Špela, LAMPREHT TRATAR, Urša, BREZNIK, Barbara, KRANJC, Simona, MIRKOVIĆ, Bojana, GOBEC, Stanislav, LAH TURNŠEK, Tamara, ČEMAŽAR, Maja, SERŠA, Gregor, KOS, Janko. Addition of 2-(ethylamino)acetonitrile group to nitroxoline results in significantly improved anti-tumor activity in vitro and in vivo. *Oncotarget*, ISSN 1949-2553, 2017, vol. 8, no. 35, str. 59136-59147, ilustr., doi: 10.18632/oncotarget.19296. [COBISS.SI-ID 4360305]
IF (JCR)= 5,168

KNIFIC, Tamara, OSREDKAR, Joško, SMRKOLJ, Špela, TONIN, Irena, VOUK, Katja, BLEJEC, Andrej, FRKOVIĆ-GRAZIO, Snježana, LANIŠNIK-RIŽNER, Tea. Novel algorithm including CA-125, HE4 and body mass index in the diagnosis of endometrial cancer. *Gynecologic oncology*, ISSN 0090-8258. [Print ed.], Oct. 2017, vol. 147, iss. 1, str. 126-132, doi: 10.1016/j.ygyno.2017.07.130. [COBISS.SI-ID 33323737]
IF (JCR)= 4,959

BALABANIČ, Damjan, FILIPIČ, Metka, KRIVOGRAD-KLEMENČIČ, Aleksandra, ŽEGURA, Bojana. Raw and biologically treated paper mill wastewater effluents and the recipient surface waters: cytotoxic and genotoxic activity and the presence of endocrine disrupting compounds. *Science of the total environment*, ISSN 0048-9697, 2017, vol. 574, str. 78-89, doi: 10.1016/j.scitotenv.2016.09.030. [COBISS.SI-ID 3971919]
IF (JCR)= 4,900

JOVANOVIĆ, Jovana, KOLAREVIĆ, Stoimir, MILOŠKOVIĆ, Aleksandra, RADOJKOVIĆ, Nataša, SIMIĆ, Vladica, DOJČINOVIĆ, Biljana, KRAČUN-KOLAREVIĆ, Margareta, PAUNOVIĆ, Momir, KOSTIĆ, Jovana, SUNJOG, Karolina, TIMILIJIĆ, Jovana, DJORDJEVIĆ, Jelena, GAČIĆ, Zoran, ŽEGURA, Bojana, VUKOVIĆ-GAČIĆ, Branka. Evaluation of genotoxic potential in the Velika Morava River Basin in vitro and in situ. *Science of the total environment*, ISSN 0048-9697, 2017, vol. , no. , 11 str., [in press], doi: 10.1016/j.scitotenv.2017.10.099. [COBISS.SI-ID 4481103]
IF (JCR)= 4,900

NOVAK, Matjaž, ŽEGURA, Bojana, MODIC, Barbara, HEATH, Ester, FILIPIČ, Metka. Cytotoxicity and genotoxicity of anticancer drug residues and their mixtures in experimental model with zebrafish liver cells. *Science of the total environment*, ISSN 0048-9697, 2017, vol. 601/602, str. 293-300, doi: 10.1016/j.scitotenv.2017.05.115. [COBISS.SI-ID 4339279]
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HIRA, Vashendriya V. V., VERBOVŠEK, Urška, BREZNIK, Barbara, SRDIČ, Matic, NOVINEC, Marko, KAKAR, Hala, WORMER, Jill, SWAAN, Britt van der, LENARČIČ, Brigita, JULIANO, Luiz, MEHTA, Shwetal, NOORDEN, Cornelis J. F. van, LAH TURNŠEK, Tamara. Cathepsin K cleavage of SDF-1[alpha] inhibits its chemotactic activity towards glioblastoma stem-like cells. *Biochimica et biophysica acta. BBA, Molecular cell research*, ISSN 0167-4889. [Print ed.], 2017, vol. 1864, no. 3, str. 594-603, doi: 10.1016/j.bbamcr.2016.12.021. [COBISS.SI-ID 4162895]
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IF (JCR)= 4,404

VODOPIVEC, Martin, PELIZ, Álvaro Judice, MALEJ, Alenka. Offshore marine constructions as propagators of moon jellyfish dispersal. *Environmental research letters*, ISSN 1748-9326, 2017, vol. 12, no. 084003, str. 1-10, ilustr., doi: 10.1088/1748-9326/aa75d9. [COBISS.SI-ID 4346191]
IF (JCR)= 4,404

BIBLIOGRAFIJA INŠTITUTA V LETIH 2008 – 2017
(ANALITIČNI PODATKI)
INSTITUTE'S BIBLIOGRAPHY IN 2008 – 2017
(ANALYTICAL DATA)

ZVRST DOKUMENTA / TYPE OF DOCUMENT	LETA / YEARS 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	SKUPAJ / TOTAL
znanstveni članki z IF scientific papers with IF	58	71	58	72	86	83	79	80	82	97	**766**
znanstveni članki brez IF other scientific papers	24	25	21	9	16	7	13	18	16	16	**165**
strokovni in poljudni članki professional and popular articles	63	76	56	69	66	62	45	43	62	58	**600**
objavljeni prispevki s kongresov published conference papers	25	40	40	39	18	24	16	17	16	24	**259**
povzetki s kongresov published conference paper abstracts	115	161	145	159	101	166	166	156	149	159	**1477**
poglavja v knjigah book chapters	9	12	13	10	14	28	11	9	7	18	**131**
knjige books	5	1	3	4	4	3	6	1	6	5	**38**
poročila reports	31	30	30	27	28	34	23	35	38	51	**327**
doktorska dela dissertation theses	3	4	7	8	7	9	8	4	4	2	**56**
magistrska dela master's theses				1	1		2	1	2	1	**8**
patenti patents			2	4	3	2	2	2	0	1	**16**
razno other	76	73	93	128	121	207	138	161	151	217	**1365**
SKUPAJ TOTAL	**409**	**493**	**468**	**530**	**465**	**625**	**509**	**527**	**533**	**649**	**5208**

Prispevki soavtorjev iz različnih oddelkov NIB so šteti enkrat.
Papers are counted by the department of the first author.

USPEHI, NAGRADE IN PRIZNANJA V LETU 2017

VELIKA NAGRADA MIROSLAVA ZEIA ZA ŽIVLJENJSKO DELO NA PODROČJU DEJAVNOSTI NACIONALNEGA INŠTITUTA ZA BIOLOGIJO

Ljubljana, 8. 11. 2017

Veliko nagrado Miroslava Zeia za življenjsko delo na področju dejavnosti Nacionalnega inštituta za biologijo za leto 2017 je prejela prof. dr. Tamara Lah Turnšek, vrhunska in mednarodno uveljavljena znanstvenica ter dolgoletna direktorica Nacionalnega inštituta za biologijo, ki je s svojim predanim delom in vztrajnostjo zgradila inštitut do sedanjih razsežnosti ter ponesla njegov sloves v svet. V počastitev življenja in dela profesorice Tamare Lah Turnšek je na NIB-u ta dan potekal tudi strokovni simpozij »ALL THAT LIFE«, na katerem so predavali mednarodno priznani strokovnjaki, s katerimi je na svoji bogati znanstveni poti sodelovala profesorica Lah Turnšek.

PRIZNANJE ČASTNI ČLAN NACIONALNEGA INŠTITUTA ZA BIOLOGIJO

Ljubljana, 8. 11. 2017

Priznanje Častni član Nacionalnega inštituta za biologijo je prejel prof. dr. Tom Turk. Ta naziv Nacionalni inštitut za biologijo podeljuje raziskovalcem, ki niso zaposleni na NIB-u, vendar z dolgoletnim delom bistveno prispevajo k ugledu in znanstveni odličnosti NIB-a.

Prof. dr. Tamara Lah Turnšek (foto: Damjan Končar).

Prof. dr. Tom Turk (foto: Damjan Končar).

ACHIEVEMENTS, AWARDS AND ACKNOWLEDGMENTS IN 2017

THE GRAND MIROSLAV ZEI AWARD FOR LIFE WORK IN THE FIELD OF THE ACTIVITIES OF THE NATIONAL INSTITUTE OF BIOLOGY

Ljubljana, 8. 11. 2017

The Grand Miroslav Zei Award for Life Work in the Field of the Activities of the National Institute of Biology for the year 2017 was presented to Prof. Dr Tamara Lah Turnšek, a first-class and internationally renowned scientist, and a long-time director of the National Institute of Biology, whose dedicated work and perseverance have built up the institute to its current proportions and made its reputation known throughout the world. On that day, in honour of the life and work of Professor Tamara Lah Turnšek, NIB held an expert symposium entitled "ALL THAT LIFE", at which internationally recognized experts, with whom Prof Lah had collaborated during her rich scientific career, gave lectures.

HONORARY MEMBER OF THE NATIONAL INSTITUTE OF BIOLOGY

Ljubljana, 8. 11. 2017

The title The Honorary Member of the National Institute of Biology was presented to Prof. Dr Tom Turk. The National Institute of Biology awards this esteemed title The Honorary Member of the National Institute of Biology to researchers who are not employed at the Institute, yet who, through their years of hard work, have contributed to its reputation and scientific excellence.


Izbor Mentor leta. The Mentor of the Year competition.

NAGRADE ZA IZJEMNO DOKTORSKO DELO NA PODROČJU DEJAVNOSTI NACIONALNEGA INŠTITUTA ZA BIOLOGIJO

Ljubljana, 8. 11. 2017

Nagrado za izjemno doktorsko delo na področju dejavnosti Nacionalnega inštituta za biologijo so prejeli dr. Martin Vodopivec, dr. Jernej Pavšič in dr. Denis Kutnjak.

PRIZNANJE PROMETEJ ZNANOSTI ZA ODLIČNOST V KOMUNICIRANJU V ZNANOSTI

Ljubljana, 22. 1. 2018

Slovenska znanstvena fundacija je podelila priznanje Prometej znanosti za odličnost v komuniciranju v znanosti organizacijskemu odboru za izvedbo slovenskega Dneva očarljivih rastlin v letih od 2012 do 2017. Med nagrajenci so bile tudi izr. prof. dr. Maruša Pompe Novak, dr. Špela Beabler in prof. dr. Marina Dermastia. Prvega dogodka leta 2012 se je udeležilo 250 ljudi, v naslednjih letih pa se je število več kot potrojilo. Osrednji dogodek poteka v Ljubljani, v začetku v Botaničnem vrtu, od leta 2016 pa v Biološkem središču v Ljubljani. Poleg dogajanja na številnih stojnicah in delavnicah dogodek spremljajo likovni, literarni, fotografski natečaji in priložnostna predavanja.

PRIZNANJE BIOTEHNIŠKE FAKULTETE UNIVERZE V LJUBLJANI

Ljubljana, 16. 10. 2017

Na slavnostni prireditvi ob sedemdesetletnici Biotehniške fakultete je Nacionalni inštitut za biologijo prejel priznanje za dolgoletno in zgledno sodelovanje med ustanovama.

PRIZNANJE FINALIST IZBORA MENTOR LETA 2016

Ljubljana, 22. 3. 2017

Društvo doktorskih študentov in raziskovalcev na začetku kariere v sodelovanju z Javno agencijo za raziskovalno dejavnost Republike Slovenije (ARRS) vsako leto podeljuje nagrado Mentor leta, nagrade pa prejmejo tudi štirje finalisti izbora Mentor leta. Med letošnjimi 101 nominiranimi mentorji je nagrado za finalista izbora Mentor leta 2016 prejel tudi doc. dr. Al Vrezec, raziskovalec na Oddelku za raziskave organizmov in ekosistemov.

RAZISKOVALCI ODDELKA ZA BIOTEHNOLOGIJO IN SISTEMSKO BIOLOGIJO SO PREJELI VEČ NAGRAD SLOVENSKIH STROKOVNIH ZDRUŽENJ IN DRUGIH NAGRAD:

Izr. prof. dr. Maruša Pompe Novak je prejela nagrado Slovenskega društva za biologijo rastlin.

Dr. Tanja Dreo je dobila Plaketo Slovenskega mikrobiološkega društva za uspešen prenos raziskovalno-razvojnega dela v aktualno diagnostično prakso.

Dr. Denis Kutnjak je prejel prvo nagrado Slovenskega mikrobiološkega društva, ki so jo letos prvič podeljevali v okviru sekcije mladi doktorji mikrobiologije.

Špela Alič je za svojo predstavitev bakteriofagov pri zdravljenju gnilobe krompirja zasedla odlično 3. mesto za triminutni »elevator pitch« na študentski konferenci, ki je združila dve tradicionalni konferenci: Študentsko konferenco Mednarodne podiplomske šole Jožefa Stefana (MPŠ) in Dan mladih raziskovalcev kemije, biokemije, materialov in okolja (KMBO).

Tjaša Stare je prejela nagrado za najboljši poster na kongresu Slovenskega biokemijskega društva, Bled 21. 9. 2017.

Arijana Filipić je prejela nagrado za najboljši poster na mednarodnem kongresu Central European Symposium on Plasma Chemistry, 4. 9. 2017, Sveti Martin na Muri (Hrvaška) in nagrado za najboljše predavanje v kategoriji »Technologies for the earth and environment«, Cutting Edge, 19. 9. 2017 v Ljubljani.

NAGRADA ZLATI LEGAT 2015

Ljubljana (Slovenska akademija znanosti in umetnosti), 7. 4. 2017

Doc. dr. Al Vrezec in prof. dr. Davorin Tome sta na letnem zboru članov Društva za opazovanje in proučevanje ptic Slovenije (DOPPS) prejela stanovsko nagrado Zlati legat za najboljše ornitološko delo v Sloveniji za leto 2015 za članek, ki obravnava prvo ekološko modeliranje razširjenosti izbranih ogroženih ptic v Sloveniji, ki je nastal v okviru CRP projekta V4-1143 v sodelovanju z Gozdarskim inštitutom Slovenije in DOPPS.

VALVASORJEVA NAGRADA ZA LETO 2016

Ljubljana (Narodna galerija), 15. 5. 2017

Doc. dr. Al Vrezec je prejel Valvasorjevo nagrado za leto 2016, ki jo podeljuje Slovensko muzejsko društvo.

AWARDS FOR EXCEPTIONAL DOCTORAL WORK IN THE FIELD OF THE RESEARCH ACTIVITIES OF THE NATIONAL INSTITUTE OF BIOLOGY

Ljubljana, 8. 11. 2017

Awards for Exceptional Doctoral Work in the Field of the Research Activities of the National Institute of Biology was presented to Dr Martin Vodopivec, Dr Jernej Pavšič in Dr Denis Kutnjak.

RECOGNITION AWARD PROMETHEUS OF SCIENCE FOR EXCELLENCE IN SCIENCE COMMUNICATION

Ljubljana, 22 January 2018

The Slovenian Science Foundation bestowed the recognition award Prometheus of Science for Excellence in Science Communication to the organizing committee for holding the Slovenian Fascination of Plants Day from 2012 to 2017. The award winners included Assoc. Prof. Dr Maruša Pompe Novak, Dr Špela Beabler and Prof. Dr Marina Dermastia. The first event in 2012 had been attended by 250 people; in the years that followed, the number more than tripled. The central event is held in Ljubljana; at first at the Botanic Gardens, and from 2016 onwards at the Biological Centre in Ljubljana. In addition to activities at numerous booths and workshops, this event is accompanied by art, literary and photography contests, and occasional lectures.

RECOGNITION AWARD OF THE BIOTECHNICAL FACULTY OF THE UNIVERSITY OF LJUBLJANA

Ljubljana, 16 October 2017

At a solemn ceremony on the seventieth anniversary of the Biotechnical Faculty, the National Institute of Biology received a recognition award for long-term and exemplary cooperation between these two institutions.

RECOGNITION AWARD FINALIST OF THE MENTOR OF 2016 COMPETITION

Ljubljana, 22 March 2017

Each year, Društvo doktorskih študentov in raziskovalcev na začetku kariere (Society of PhD Students and Early-Career Researchers) in cooperation with the Slovenian Research Agency (ARRS) confers the Mentor of the Year Award, while also giving awards to the four finalists of the Mentor of the Year competition. Among this year's 101 nominated mentors, the award for a finalist of the Mentor of 2016 competition was given to Assist. Prof. Dr Al Vrezec, researcher at the Department of Organisms and Ecosystems Research.

RESEARCHERS OF THE DEPARTMENT OF BIOTECHNOLOGY AND SYSTEMS BIOLOGY HAVE RECEIVED SEVERAL AWARDS FROM SLOVENIAN PROFESSIONAL SOCIETIES, AND OTHER AWARDS:

Assoc. Prof. Dr Maruša Pompe Novak has received an award from the Slovenian Society of Plant Biology.

Dr. Tanja Dreo has received a Plaque of the Slovenian Microbiological Society for a successful transfer of research and development to current diagnostics.

Dr. Denis Kutnjak has received an award from the Slovenian Microbiological Society, which was awarded for the first time this year, under the section Young Doctors of Philosophy in Microbiology.

Špela Alič won excellent 3rd place for her presentation of bacteriophage in controlling potato rot with her three-minute "elevator pitch" at a student conference, which had combined two traditional conferences: the Student Conference of the Jožef Stefan International Postgraduate School and the Day of Early-Stage Researchers of Chemistry, Biochemistry, Materials and Environment.

Tjaša Stare has received an award for best poster at the congress of the Slovenian Biochemical Society in Bled, 21 September 2017.

Arijana Filipić has received an award for best poster at the international congress Central European Symposium on Plasma Chemistry, 4 September 2017, Sveti Martin na Muri, Croatia, and an award for best lecture in the category "Technologies for the Earth and Environment", Cutting Edge, 19 September 2017, Ljubljana.

ZLATI LEGAT 2015 AWARD

Ljubljana (Slovenian Academy of Sciences and Arts), 7 April 2017

At the annual meeting of members of Društvo za opazovanje in proučevanje ptic Slovenije (DOPPS – Society for Observation and Study of Birds of Slovenia), Assist. Prof. Dr Al Vrezec and Prof. Dr Davorin Tome received the Zlati legat peer award for best ornithological work in Slovenia for 2015 for their article discussing the first ecological modelling of the distribution of selected endangered birds in Slovenia, which had been created under the Target Research Programme of the V4-1143 project, in cooperation with the Slovenian Forestry Institute and DOPPS.

VALVASOR AWARD FOR 2016

Ljubljana (National Gallery of Slovenia), 15 May 2017

Assist. Prof. Dr Al Vrezec received the Valvasor Award for 2016, which is conferred by Slovensko muzejsko društvo (Slovenian Museum Society).

IZUMI IN INOVACIJE

Izumi in inovacije so za NIB velikega pomena, saj predstavljajo steber sodelovanja z gospodarstvom, kar je eden od dolgoročnih ciljev NIB-a, opredeljenih v Programu dela NIB-a za obdobje 2014–2018. Na NIB-u je področje izumov in inovaciji v domeni Komisije za izume, ki je sestavljena raziskovalcev, ki jih predlagajo Oddelki NIB--a ter predstavnikov Pisarne za prenos tehnologij.

V letu 2017 je bila za izum dr. Bojana Sedmaka s partnerji Arhel d.o.o., Biotehniška fakulteta Univerze v Ljubljani in Envita d.o.o. »Metoda in sistem za sočasno zaznavanje koncentracije mikrodelcev v suspenziji in njihovih morfoloških in fizioloških značilnosti« sprejeta odločitev, da v kontekstu komercializacije izuma prijave patenta izven EU (Japonska, Rusija, Kitajska ZDA, Kanada) zaradi relativno visokih in nepredvidljivih stroškov, ki bi nastopili v fazi preverbe patentne prijave, ter zaradi nepredvidljivega izida glede podelitve patenta izven EU ne bi bile smiselne. Tako se nadaljuje postopek za podelitev patenta v okviru EPO.

Konec leta 2017 se je v okviru izdelave Dokumenta identifikacije investicijskega projekta Biotehnološko stičišče NIB-a (BTS-NIB) ter tudi v okviru poročila ekspertne evalvacijske skupine KEN začela oblikovati strategija prednostnih raziskovalnih in inovacijskih področij NIB-a.

PRENOS ZNANJA V GOSPODARSTVO

S trženjem produktov in storitev na NIB-u se sistemsko ukvarja leta 2010 ustanovljena Pisarna za prenos tehnologij. Leta 2017 je NIB skupaj s še sedmimi slovenskimi javnimi raziskovalnimi organizacijami vstopil v Konzorcij za prenos tehnologij iz JRO v gospodarstvo. Namen petletnega projekta, financiranega s strani MIZŠ, je spodbuditi krepitev povezav in sodelovanja med javnimi raziskovalnimi organizacijami in gospodarstvom ter krepitev kompetenc pisarn za prenos tehnologij, raziskovalcev in podjetij.

Kadrovsko se je Pisarna za prenos tehnologij v letu 2017 okrepila s tremi sodelavci, vključno z vodjem, ki je pomočnik direktorja za projektno podporo in prenos tehnologij.

Pomembno področje, kjer raziskovalci NIB-a uspešno tržijo in komercializirajo svoje znanje, tako za domače kot tuje naročnike, je razvoj in izvajanje molekularnih metod za kvantifikacijo virusov za gensko terapijo. Na tem področju je bilo sklenjenih več dolgoročnih sodelovanj ali izkazanih namer o sodelovanju z domačimi in tujimi naročniki. Glede na aktualna dogajanja na trgu proizvodov za gensko terapijo se pričakuje povečanje interesa, predvsem tujih podjetij za razvojno in komercialno sodelovanje z NIB-om.

Z uspešno implementacijo sistema kakovosti za testiranje mutagenosti v skladu z OECD načeli dobre laboratorijske prakse je bil v letu 2017 postavljen temelj za trženje tudi teh storitev za domače in tuje naročnike. Akreditacija sistema je načrtovana za leto 2018.

V letu 2017 sta se pričela dva INTERREG projekta (Fish Agro Tech in Trans-Glioma), v okviru katerih načrtujemo v naslednjih dveh letih izvesti prenos tehnologij in okrepiti sodelovanje s slovenskimi in italijanskimi industrijskimi partnerji na področjih ribištva in kmetijstva ter novih terapij glioblastoma.

INVENTIONS AND INNOVATIONS

Inventions and innovations are of crucial importance to NIB as they represent the core of our collaboration with economic subjects. This pillar is one of NIB's long-term goals, as determined in the 2014 – 2018 NIB Programme. Management of inventions and innovations is the domain of the Committee for Innovation, members of which are researchers nominated by NIB departments, and Technology Transfer Office (TTO) employees.

As regards the invention of Dr Bojan Sedmak and partners Arhel Ltd., Biotechnical Faculty, University of Ljubljana and Envita Ltd., "Method and system for simultaneous detection of micro-particle concentration in suspension and their morphological and physiological traits", a decision has been adopted that, in light of the commercialisation potential, a patent application would not be appropriate outside the EU (Japan, Russia, China, USA, Canada) due to the high and unpredictable estimated costs in the examination phase and the unpredictable outcome of the decision on granting a patent. The procedure for obtaining a patent is, however, proceeding within the framework of EPO.

At the end of 2017, in the framework of the preparation of an investment project identification document for the Biotechnological Hub NIB (BTH- NIB), and in the framework of the KEN Expert Evaluation Team's report, the strategy of NIB's priority research and innovation areas was launched.

TRANSFERRING TECHNOLOGY TO INDUSTRY

Marketing of NIB products and services is the domain of the Technology Transfer Office (TTO), set up in 2010. In 2017, NIB, along with seven other Slovenian PROs, joined the Consortium for Technology Transfer from PROs to the Industrial Sector. The purpose of the five-year project, financed by the Ministry of Education, Science and Sport, is to encourage the strengthening of the links and cooperation between public research organizations and industrial partners, as well as strengthening the competences of Technology Transfer Offices, researchers and enterprises.

In 2017, TTO was enhanced with three new co-workers, including the Head of NIB's TTO who is the assistant director for project support and technology transfer.

An important area in which NIB researchers successfully market and commercialize their knowledge, both for domestic and foreign clients, is the development and implementation of molecular methods for the quantification of viruses for gene therapy. In this field, several long-term cooperation agreements or demonstrated intentions for cooperation with domestic and foreign clients have been concluded. Given the current developments in the market for gene therapy products, the interest in R&D and commercial cooperation with NIB is expected to increase, especially from foreign companies.

With the successful implementation of a quality system for mutagenicity testing in accordance with the OECD Principles of Good Laboratory Practice in 2017, the basis for marketing these services for domestic and foreign clients was also laid down. Accreditation of the system is planned for 2018.

In 2017, two INTERREG projects (Fish Agro Tech and Trans-Glioma) were started, under which we plan to carry out technology transfer and intensify our cooperation with Slovenian and Italian industrial partners in the fields of fisheries and agriculture, and new glioblastoma therapies over the next two years.

Nacionalni inštitut za biologijo (foto: Luka Svetic). National Institute of Biology (Photo: Luka Svetic).

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 in podporo prenosu znanja in tehnologij.

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

Joint Services perform some individual business functions such as finance and accounting, managing human resources, public procurement, general services, managing the information system, support to governing bodies of NIB and similar activities. They are also in charge of providing support to research departments, mainly administration support for project management and support to knowledge and technology transfer.

Biology Library, part of the Joint Services, is managed jointly by the National Institute of Biology and the Biology Department of the Biotechnical Faculty, University of Ljubljana. Active in two locations: at the Biological Centre in Ljubljana and at the Marine Biology Station Piran.

1.0 SKUPNE SLUŽBE JOINT SERVICES

1.0

OSEBJE STAFF

DIREKTORICA DIRECTOR

Lah Turnšek, Tamara

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

Potočnik, Franc

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

Vindišar, Jure

GLAVNA PISARNA MAIN OFFICE

Malec, Maja
Ploj, Katja

RAČUNOVODSTVO ACCOUNTING

Rak, Mojca
Rigler, Karolina
Svenšek, Jelka
Verderber, Irena

KADROVSKE ZADEVE HUMAN RESOURCES

Goršič, Dunja

PROJEKTNA PODPORA IN ODNOSI Z JAVNOSTMI PUBLIC RELATIONS AND PROJECT ASSISTANCE

Končar, Helena

JAVNA NAROČILA LEGAL DEPARTMENT

Tomšič, Alenka

KNJIŽNJICA LIBRARY

Černač, Barbara
Glavač, Lučka

2.0

ODDELEK
MORSKA
BIOLOŠKA
POSTAJA PIRAN

DEPARTMENT
MARINE
BIOLOGY
STATION PIRAN

Cratena peregrina, eden najpogostejših polžev gološkrgarjev v našem morju (foto: Lovrenc Lipej).

Cratena peregrina, one of the most common nudibranchs in our sea (Photo: Lovrenc Lipej).

VODJA: Doc. dr. Andreja Ramšak
HEAD: Assist. Prof. Dr Andreja Ramšak

Doc. dr. Andreja Ramšak je od leta 2016 vodja enote Morska biološka postaja Piran. Njeno raziskovalno delo je osredotočeno na primerjalno genomiko morskih organizmov, filogenetske odnose med ožigalkarji in odziv morskih organizmov na onesnaževala. Je članica v odborih domačih in mednarodnih združenj LifeWatch.SI (ERIC), LTER, Evropska mreža morskih inštitutov in postaj MARS, EUROMARINE in Mreže za onesnažila MSFD. Sodeluje v pedagoškem delu na Univerzi na Primorskem in na Mednarodni podiplomski šoli Jožefa Stefana. Aktivno je vključena v projekt povezovanja morskih bioloških postaj (AssemblePlus) in v prenos znanj v ribiški in kmetijski sektor.

Assist. Prof. Dr Andreja Ramšak has been since 2016 Head of the Marine Biology Station Piran. Her research focuses on comparative genomics of marine organisms, phylogenetic relationships among the cnidarians and the response of marine organisms to pollutants. She is a member of the committees of national and international associations LifeWatch.SI (ERIC), LTER, MARS- European Network of Marine Institutes and Stations, EUROMARINE and the MSFD Network of Contaminants. She participates in pedagogical work at the University of Primorska and Jožef Stefan International Postgraduate School. She is actively involved in the project of connecting marine biological stations (AssemblePlus) and transfer of knowledge in the fisheries and agricultural sector.

Spremenljivost in odzivnost morskih ekosistemov

2.0

ODDELEK
MORSKA
BIOLOŠKA
POSTAJA PIRAN

Roj invazivne tujerodne rebrače, *Mnemiopsis leidyi* (foto: Borut Mavrič).
Swarm of invasive non-native warty comb jelly, *Mnemiopsis leidyi* (Photo: Borut Mavrič).

KLJUČNE DEJAVNOSTI

V letu 2017 je Morska biološka postaja Piran (MBP) kot vodilna enota za raziskave morskih ekosistemov v Sloveniji nadaljevala temeljne in uporabne raziskave v okviru dveh raziskovalnih programov ter več mednarodnih in nacionalnih projektov. V tem letu smo se vključili v projekte, ki nam omogočajo nadgradnjo raziskovalnega dela, prenos znanja do uporabnikov na področju ribištva in kmetijstva ter povezovanje s sorodnimi institucijami. Multi- in interdisciplinarne raziskave v okviru programov zagotavljajo temeljna znanja o zgradbi in delovanju ekosistemov ter biogeokemičnih procesih v obalnih morskih območjih, kjer so organizmi in ekosistemi izpostavljeni kombinaciji številnih dejavnikov, ki delujejo v različnih prostorskih in časovnih merilih.

PODROČJE RAZISKAV

- Raziskujemo različne ravni biološke raznolikosti – od genoma do vrstne sestave in raznovrstnosti življenjskih okolij (plankton, bentoški nevretenčarji, makroalge, obrežne ribje združbe, podvodni travniki, biogene formacije). V raziskave vključujemo pristope primerjalne genomike ter evolucijske vidike.
- Raziskujemo vlogo fitoplanktona pri kroženju ogljika in fotosintetske značilnosti, analiziramo časovne serije za razumevanje vpliva podnebnih sprememb in evtrofikacije. Raziskujemo vpliv organske in anorganske snovi na delovanje in raznolikost morskih mikrobnih združb ter spremembe na fizikalne in kemijske okoljske parametre.
- 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 preučujemo v različnih vrstah (školjke, ribe), predvsem na subceličnem nivoju.
- Razvijamo programe za spremljanje stanja morja, ki vključujejo biološke elemente in fizikalne ter kemijske parametre v skladu z državno in evropsko okoljsko zakonodajo (MSFD in WFD). Izvajamo različne programe monitoringa morja za vrednotenje dobrega ekološkega stanja (GES); še posebej na področju biodiverzitete, tujerodnih vrst in popise habitatov.

Variability and resilience of marine ecosystems

2.0

DEPARTMENT
MARINE
BIOLOGY
STATION PIRAN

Črnoglava babica, *Microlipophrys nigriceps* (foto: Lovrenc Lipej). Black-headed blenny, *Microlipophrys nigriceps* (Photo: Lovrenc Lipej).

TOPIC AREAS

In 2017, the Marine Biology Station Piran (MBS) was the leading unit for marine ecosystem research in Slovenia working on basic and applied research in the framework of two research programmes and several national and international applied projects. This year, we have been involved in projects that enable us to upgrade our research work, transfer knowledge to users in the field of fisheries and agriculture, and to connect with related institutions. Multi- and interdisciplinary research performed under the two programmes produces basic knowledge on the structure and functioning of marine ecosystems and on biogeochemical processes in the coastal sea, where organisms are exposed to a combination of many factors that affect them at different spatial and temporal scales.

MAIN RESEARCH AREAS

- Research on different levels of biodiversity from genome to species composition and diversity of habitats (plankton, benthic invertebrates, macroalgae, seagrass meadows, coastal fish assemblage and biogenic formations). Research topics include comparative genomics and evolutionary aspects.
- Study of the role of phytoplankton in the carbon cycle and its photosynthetic characteristics; analysis of time series to understand the impact of climate changes and eutrophication. Research on the impact of organic and inorganic matter on the functioning and diversity of marine microbial communities as well as changes in physical and chemical environmental parameters.
- Research of the impact of climate change and marine anthropogenic activities on organisms and the environment. Focus on the cycling and degradation of pollutants, oxidation processes in wastewaters, and the importance of the marine environment in substance degradation. We are studying the effects of pollutants on several marine species (mussels, fish), mostly on the subcellular level.
- Developing programmes for sea monitoring, which include biological elements, and physical and chemical parameters, harmonized with national and European environmental legislation (MSFD and WFD). We are implementing different sea monitoring programmes to assess the good environmental status (GES).

- Raziskujemo dinamiko vodnih mas in modeliranje v obalnem morju ter razvijamo avtomatizirano obdelavo podatkov, 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. Razvijamo inovacije na področju opazovanja morja in uporabljamo moderno tehnologijo (HF radar) za opazovanje in napovedovanje tokovanja.
- Povezujemo se v mrežo evropskih morskih bioloških postaj, razvijamo inovativne raziskovalne metodologije in raziskovalne koncepte, omogočamo dostop do bioloških virov, zgodovinskih podatkov iz opazovanj, najsodobnejše eksperimentalne in analitske zmogljivosti z integriranimi delovnimi postopki in napredne možnosti izobraževanja. Nadaljujemo tradicijo morskih postaj, ki so ponujale svoje zmogljivosti tudi drugim raziskovalcem. Zainteresiranim raziskovalcem in študentom ponujamo bivanje v dormitoriju in delo v sodobnih laboratorijih ter na morju.
- Splošni javnosti smo predstavili raziskovalno delo v sklopu predavanj v okviru razstave Naše malo veliko morje v Prirodoslovnem muzeju Slovenije ter razstave Odpadki: končna postaja morje v Muzeju za arhitekturo in oblikovanje, organizirali smo Dan odprtih vrat 2017, ki se ga je udeležilo 300 obiskovalcev, Dan biotske raznovrstnosti smo proslavili s predstavitvijo knjige Biogene formacije v slovenskem morju, javnosti in novinarjem smo razlagali pojave v morju ter jih tako osveščali.
- Organizirali smo delavnico v okviru projekta SMS (Sensing toxicants in Marine waters makes Sense using biosensors; 7. Okvirni program (EU) – OCEAN 2013.1).

RAZISKOVALNI PROGRAM P1-0237 »RAZISKAVE OBALNEGA MORJA«

Osrednji del programa so predstavljale raziskave biodiverzitete planktona, obrežnih ribjih združb ter bentoške favne, flore in vegetacije, kar se kaže tudi v številu objavljenih člankov.

Raziskave biologije in ekologije bentoških organizmov so potekale v slovenskem morju in na Hrvaškem (Nacionalni park Brijoni, Veliko jezero na Mljetu). Podatke smo pridobili s potapljaškimi vzorčenji in z uporabo nedestruktivne metode (visual census, digitalizacija podatkov). Sodelavec je bil avtor in gostujoči urednik pri dveh preglednih člankih (collective article) o biodiverziteti Sredozemskega morja, s poudarkom na vrstah, povezanih s procesi bioinvazije in tropikalizacije. Problem bioinvazije je bil obravnavan tudi v primeru tujerodne vrste rebrače *Mnemiopsis leidyi*, ki je bila v severnem Jadranu v večjem številu zabeležena poleti in jeseni 2016, še veliko bolj pa v letu 2017. Prvi izsledki o recentnem množičnem pojavljanju rebrače, objavljeni v krajšem članku, so bili izhodišče za nadaljnje in bolj ciljno usmerjene raziskave biologije *M. leidyi* ter poskusa ocene številnosti in pojavljanja te vrste. Izvedli smo tudi laboratorijske kontrolirane poizkuse, v katerih smo spremljali bakterijsko razgradnjo organske snovi želatinoznega izvora. Analizo strukture mikrobne združbe smo nadgradili z novimi pristopi naslednje generacije Ilumina sekveniranja in RT-qPCR detekcije patogenih virusov v morski vodi.

Nadaljevali smo s preučevanjem habitata sredozemske korale, ki gradi biogene formacije v slovenskem delu Tržaškega zaliva, v Mljetskem jezeru in v Boki Kotorski. Te raziskave so bile vključene v projekte znanstveno-raziskovalnega sodelovanja med Slovenijo in Hrvaško oz. Črno goro, v okviru katerih smo preučevali vplive podnebnih in oceanografskih sprememb na ogroženo vrsto sredozemske kamene korale. Oba projekta sta se zaključila decembra 2017.

Biodiverzitetnemu sklopu raziskav smo dodali študijo pestrosti vrst toksičnega fitoplanktonskega rodu *Pseudo-nitzschia* na podlagi morfoloških znakov (elektronska mikroskopija) in genetskih markerjev (kloroplastna DNA, jedrni markerji z rDNA operona). Vzpostavili smo banko kultur sevov vrst *Pseudo-nitzschia*, izoliranih iz Tržaškega zaliva, vzporedno pa smo spremljali dinamiko teh vrst oz. roda v naravnih vzorcih. Prvi rezultati so bili predstavljeni na študentski konferenci Mednarodne podiplomske šole Jožefa Stefana.

Objavljena sta bila tudi prva izmed več poslanih prispevkov v posebno številko revije *Marine Pollution Bulletin* o popisu avtohtonih in tujerodnih vrst v planktonskih in bentoških združbah jadranskih pristanišč, ki so bila predmet raziskav v že zaključenem mednarodnem projektu BALMAS.

- Research on the dynamics of water masses and modelling in the coastal marine environment; developing automated processing of data; augmentation of infrastructure development at sea. Our knowledge and experience enable us to offer solutions for a variety of companies and a range of activities at sea and in the coastal area. We are developing innovations in the area of sea observation and use state-of-the-art technology (HF radar) for observing and forecasting currents.
- We are connected to the network of European marine biology stations; develop innovative research methodologies and research concepts; provide access to biological resources, historical data from observations, state-of-the-art experimental and analytical capabilities with integrated working procedures, and advanced educational opportunities. Accordingly, in the tradition of marine stations we also offer our capacities to other researchers. The interested researchers and students are invited to stay at our dormitory and work in state-of-the-art laboratories and in the field.
- To the general public, we presented our research work in the framework of lectures under the exhibition Our Little Big Sea at the Slovenian Museum of Natural History and the exhibition Wastes: The Final Destination – Sea at the Museum of Architecture and Design; we organized the Open Doors Day 2017, which was attended by 300 visitors; we celebrated Biodiversity Day with a presentation of the book *Biogenic formations in the Slovenian Sea*; we explained the phenomena in the sea to the public and journalists, thus raising their awareness.
- We organized a workshop within the framework of the SMS project (Sensing Toxicants and Marine Waters Makes Sense Using Biosensors; 7th Framework Programme (EU) - OCEAN 2013.1).

RESEARCH PROGRAMME P1-0237 "COASTAL MARINE RESEARCH"

The main part of the programme was focused on the research of plankton biodiversity, littoral fish assemblages and the benthic fauna, flora and vegetation, which is also evident in the number of published articles.

The study of the biology and ecology of benthic organisms took place in the Slovenian sea and in Croatia (National Park Brijuni and Veliko Jezero (Large Lake) on Mljet Island). Data were obtained by SCUBA diving and by using a non-destructive method (visual census, data digitization). A researcher from MBS co-authored and co-edited two collective articles on the biodiversity of the Mediterranean Sea, with emphasis on species associated with bioinvasion and tropicalization. The problem of bioinvasion was also addressed in the case of the non-native ctenophore *Mnemiopsis leidyi*, which was recorded in the northern Adriatic in the summer and autumn of 2016, and much more so in 2017. The first findings on the recent mass appearance of this comb jelly, published in a short article, were the starting point for more targeted research on the biology of *M. leidyi* and an attempt to estimate the incidence and occurrence of this species. We also carried out laboratory-controlled experiments in which we observed the bacterial degradation of jelly comb-originated organic matter. An analysis of the structure of the microbial group was upgraded with new approaches to the next generation of Ilumina sequencing and RT-qPCR detection of pathogenic viruses in seawater.

We continued the study of the Mediterranean stony coral *Cladocora caespitosa* habitat that builds biogenic formations in the Slovenian part of the Gulf of Trieste, in Lake Mljet, and in the Boka Kotorska Bay. These studies were included in scientific research cooperation projects between Slovenia on one side and Croatia and Montenegro on the other, in which we studied the effects of climate and oceanographic properties on the endangered species of the Mediterranean stony coral. Both projects ended in December 2017.

A study of the diversity of species of the toxic phytoplankton genus *Pseudo-nitzschia*, based on morphological signs (electronic microscopy) and genetic markers (chloroplast DNA, core markers with rDNA operon), was part of the biodiversity assay. We have established cultures of strains of different species of *Pseudo-nitzschia* isolated from the Gulf of Trieste, while in parallel we monitored the dynamics of these species in the natural environment. Preliminary results were presented at a student conference of the Jožef Stefan International Postgraduate School.

Some results of the recently completed international project BALMAS were already published in a special issue of the *Marine Pollution Bulletin*. The papers present inventory lists and some ecologic aspects of native and non-indigenous species of planktonic and benthic communities in twelve Adriatic ports.

Posebnost morske cvetače *(Cotylorhiza tuberculata)* so simbiontske alge (foto: Tihomir Makovec).
The specialty of fried egg jellyfish *(Cotylorhiza tuberculata)* is symbiotic algae (Photo: Tihomir Makovec).

Pomemben sklop programa so tudi raziskave onesnaženja slovenskega morja, kjer je matriks bodisi usedlina ali organizem. Tako smo objavili prispevke o kopičenju in biomonitoringu elementov v sledeh v sredozemskih morskih travah, o sezonsko odvisnem potencialu metilacije živega srebra ter o porazdelitvi in viru alifatskih ogljikovodikov v površinskih obalnih sedimentih slovenskega morja. Preučevali smo tudi odzive biomarkerjev v tarčnem organizmu (*Mytilus galloprovincialis*) na različne koncentracije dveh skupin onesnažil – organske kemične spojine in kovine. Zaključena in objavljena je bila mineraloška, geokemična in termofizikalna karakterizacija lastnosti solinskega blata Sečoveljskih solin za uporabo pri peloterapiji.

Pri procesno orientiranem modeliranju smo se osredotočili na dve področji: modeliranje resuspenzije sedimentov zaradi pomorskega prometa, valov in tokov ter modeliranje populacijske dinamike, disperzije in povezanosti populacij meduz klobučnjaka *Aurelia aurita* s.l. Rezultate slednjega je mladi raziskovalec predstavil v svoji doktorski disertaciji in članku, ki je kmalu po objavi julija 2017 dosegel veliko odmevnost.

Programske raziskave pomagajo pri implementaciji koncepta ekosistemskega pristopa upravljanja v morsko okolje in nudijo podporo evropskim oz. nacionalnim politikam o vodah. Tako smo lani objavili rezultate študij za vrednotenje ekološkega stanja morja z uporabo fitoplanktonskih metrik in različnih bentoških indeksov.

Sredi lanskega leta sta se programski skupini pridružila dva mlajša doktorja, ki sta pridobila triletni projekt »Raziskovalci na začetku kariere«, ki ju preko vzvoda izvajanja evropske kohezijske politike v obdobju 2014–2020 v celoti financira MIZŠ. To je zelo pomembna pridobitev za program kot tudi za celo enoto, saj s tem širimo področja raziskav, v okviru projekta vzpostavljene povezave z gospodarskimi subjekti pa nudijo možnost trajnejšega sodelovanja z gospodarstvom. Projekt »Možnost uporabe biomase meduz kot trajnostni vir hrane v ribogojstvu« predvideva sodelovanje s podjetjem FONDA.SI d.o.o., v okviru drugega projekta »Odziv biokonstrukcij na toplotni stres in posledice za ekosistemske storitve« pa se je raziskovalec povezal s podjetjem Arctur d.o.o., ki nudi superračunalnik za visokozmogljive simulacije.

Podvodni gozdiček rjave alge cistozire (foto: Lovrenc Lipej). Underwater forest of brown algae of the genus *Cystoseira* (Photo: Lovrenc Lipej).

An important part of the programme is pollution-oriented research of the Slovenian sea, in which the studied matrix is either sediment or organisms. Thus, we published papers on the accumulation and biomonitoring of trace elements in Mediterranean seaweeds, the seasonal variation of mercury methylation potential, and the distribution and source of aliphatic hydrocarbons in surface coastal sediments of the Slovenian sea. We also studied the responses of biomarkers in the target organism (*Mytilus galloprovincialis*) to different concentrations of organic chemical compounds and metals. The study of the mineralogical, geochemical, and thermophysical characterization of healing saline mud for use in pelotherapy was completed and published.

In process-oriented modelling, we focused on two topics: modelling of the resuspension of sediments due to maritime traffic, waves and currents, and modelling of population dynamics, dispersion and connection of populations of the jellyfish *Aurelia aurita* s.l. The results of the latter were presented by an early-stage researcher in his doctoral dissertation and article, which was soon met with a wide scientific response after its publication in July 2017.

Two articles in which we evaluated the ecological state of the sea using phytoplankton metrics and various benthic indices represent a contribution to the implementation process of European water policy using the concept of the ecosystem-based management approach.

Last June, two young scientists joined the programme group in the framework of the three-year "Researchers at the Beginning of Career" project, which is fully financed by the Ministry of Education, Science and Sport. This is a very important achievement for the programme, as well as for the whole unit, as it expands the area of research and established connections with private companies, which may eventually grow into a perpetual co-operation with the industrial sector. The project "The Possibility of Using Jellyfish Biomass as a Sustainable Source of Food in Aquaculture" foresees co-operation with FONDA.SI d.o.o., while the second project "The Response of Bioconstructions to Heat Stress and Consequences for Ecosystem Services" will connect researchers with Arctur d.o.o., which offers a supercomputer for powerful simulations.

Polž gološkrgar *Felimare picta*, nova vrsta v slovenskem morju (foto: Borut Mavrič).
Nudibranch *Felimare picta*, a new species in the Slovenian sea (Photo: Borut Mavrič).

GLAVNI DOSEŽKI V LETU 2017

Organizacija kongresa **52nd EMBS European Marine Biology Symposium** v Piranu http://www.embs52.org/, ki je privabil 200 udeležencev iz 32 držav – kongres je prvič potekal v Sloveniji. Udeleženci so predstavili raziskovalno delo v naslednjih sekcijah: morske simbioze, mezofotski ekosistemi, slikanje v morski biologiji, bentoško pelagična sklopitev, morska metagenomika in splošna sekcija. Vabljeni predavatelji so bili iz ZDA, Nemčije, Italije, Hrvaške, Izraela in Slovenije. V programu kongresa je bilo 79 predavanj in 92 posterjev, ki so objavljeni v zborniku. Pridobili smo številne pokrovitelje (Marjetica Koper, Mestna občina Koper, Občina Piran, LifeWatch Italy, Mikro+Polo, Chemass, CGS Labs, Zeiss, Veleposlaništvo ZDA), ki so sofinancirali kongres.

V okviru projekta Bluemed smo skupaj z MIZŠ organizirali delavnico za deležnike iz regije (21. in 22. marca 2017), na kateri so bile ustanovljene nacionalne platforme za znanje, tehnologijo, gospodarstvo in politiko. Temu dogodku je bila priključena predstavitev poročila Evropske akademije z naslovom Marine sustainability in an age of changing oceans and seas (JRC-EASAC Report), ki je potekala pod okriljem Joint Research Centre (JRC) in SAZU.

V letu 2017 smo objavili 24 izvirnih znanstvenih člankov in dva pregledna. Od skupno 26 znanstvenih člankov jih je bilo 20 kategorije A1/2, od tega 11 A' in 2 A''. Na tem mestu izpostavljamo članek M. Vodopivca s soavtorji »Offshore marine constructions as propagators of moon jellyfish dispersal« [COBISS.SI-ID 4346191], objavljenega v reviji *Environmental research letters* s faktorjem vpliva (IF) 4,404. Avtorji so raziskovali vplive morskih konstrukcij v Jadranskem morju na disperzijo klobučnjakov. Postavljene platforme zagotavljajo klobučnjakom nov substrat v odprtih vodah, kjer pred tem ni bilo primernih podlag za pritrjevanje polipov. Ta vidik ekoloških posledic, kot je obsežno pojavljanje meduz, je bil pri dosedanjih študijah vplivov plinskih in naftnih ploščati ter polj vetrnic na morju spregledan. Članek si je od objave 21. 7. 2017 do začetka leta 2018 naložilo 1591 uporabnikov in je izzval številne odmeve: po ‚Altmetric page' je v zgornjih 5 % člankov, objavljenih v istem mesecu. Predstavljen je bil v reviji New Scientist, v poljudnoznanstveni elektronski reviji Quarz, ki ima več kot 19 milijonov obiskovalcev mesečno (40 % ZDA, 60 % druge države) in več drugih mednarodnih elektronskih medijih (npr. https://www.newscientist.com/article/2142322-jellyfish-blooms-linked-to-offshore-gas-platforms-and-wind-farms/).

Dolgonosi morski konjiček *Hippocamus guttulatus* pred kuliso makroalg (foto: Lovrenc Lipej).
Long-snouted seahorse *Hippocampus guttulatus* against a backdrop of macroalgae (Photo: Lovrenc Lipej).

MAIN ACHIEVEMENTS IN 2017

Organization of the **52nd EMBS European Marine Biology Symposium** in Piran http://www.embs52.org/, which attracted 200 participants from 32 countries. The congress was held in Slovenia for the first time. Participants presented research work in the following sections: marine symbiosis, mesophotic ecosystems, imaging in marine biology, benthic pelagic coupling, marine metagenomics and the general section. Invited lecturers were from USA, Germany, Italy, Croatia, Israel and Slovenia. There were 79 lectures and 92 posters published in the Book of Abstracts. We acquired numerous sponsors (Marjetica Koper, Municipality of Koper, Municipality of Piran, LifeWatch Italy, Mikro + Polo, Chemass, CGS Labs, Zeiss, US Embassy), which co-financed the congress.

Under the Bluemed project, together with the Ministry of Education, Science and Sport, we organized a workshop for stakeholders from the region (21 and 22 March 2017), where national platforms for knowledge, technology, business and policy were established. This event was accompanied by a presentation of the European Academy's report entitled Marine Sustainability and an Age of Changing Oceans and Seas (JRC-EASAC Report), which was held under the auspices of the Joint Research Centre (JRC) and SAZU.

In 2017, we published 24 original scientific articles and two review articles. Of the 26 scientific articles, 20 were of the A1/2 category, of which 11 were labelled A' and 2 A''. Here we would like to highlight the article by M. Vodopivec and co-authors "Offshore Marine Constructions as Propagators of Moon Jellyfish Dispersal" [COBISS.SI-ID 4346191], published in the journal *Environmental Research Letters* with the impact factor (IF) 4.404. The authors investigated the influence of offshore marine constructions on the moon jellyfish population in the Adriatic Sea, where the newly-set-up substrates enable the formation of a new population based in the formerly unpopulated open waters. According to this study, the platforms enhance connectivity between subpopulations of jellyfish polyps, contribute to jellyfish blooms in some areas, and play an important role in establishing a connection with the rest of the Mediterranean. This aspect is usually overlooked when evaluating the ecological impact of existing and future offshore wind farms, oil and gas platforms, etc. Since its appearance in July 2017 and until the beginning of 2018, the article has been downloaded 1591 times (in the top 5% of all research outputs scored by Altmetric) and evoked many reactions in international popular science journals. It was presented in the *New Scientist* magazine, in the electronic journal *Quarz*, which has more than 19 million visitors a month (40% from the US, 60% from other countries), and several other international media (e.g. https://www.newscientist.com/article/2142322-jellyfish-blooms-linked-to-offshore-gas-platforms-and-wind-farms/).

Podvodno raziskovanje in dokumentiranje (foto: Lovrenc Lipej). Underwater research and documenting (Photo: Lovrenc Lipej).

BIBLIOGRAFIJA
BIBLIOGRAPHY

30 Izvirni znanstveni članek Original Scientific Article
2 Pregledni znanstveni članek Review Article
4 Kratki znanstveni prispevek Short Scientific Article
2 Strokovni članek Professional Article
21 Poljudni članek Popular Article
2 Objavljeni znanstveni prispevek na konferenci (vabljeno predavanje) Published Scientific Conference Contribution (invited lecture)
3 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)
32 Objavljeni povzetek znanstvenega prispevka na konferenci Published Scientific Conference Contribution Abstract
2 Samostojni znanstveni sestavek ali poglavje v monografski publikaciji Independent Scientific Component Part or a Chapter in a Monograph
3 Predgovor, spremna beseda Preface, Afterword
10 Intervju Interview
16 Drugi sestavni deli Other Component Parts
1 Drugo učno gradivo Other Educational Material
1 Doktorska disertacija Doctoral Dissertation
6 Končno poročilo o rezultatih raziskav Final Research Report
2 Elaborat, predštudija, študija Treatise, Preliminary Study, Study
1 Izvedensko mnenje, arbitražna odločba Expertise, Arbitration Decision
5 Radijska ali televizijska oddaja Radio or Television Broadcast
3 Druge monografije in druga zaključena dela Other Monographs and Other Completed Works
12 Radijski ali TV dogodek Radio or Television Event
1 Razstava Exhibition
1 Predavanje na tuji univerzi Invited Lecture at Foreign University
2 Prispevek na konferenci brez natisa Unpublished Conference Contribution
7 Vabljeno predavanje na konferenci brez natisa Unpublished Invited Conference Lecture
10 Druga izvedena dela Other Performed Works
15 Uredništvo Editorship

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ODDELEK ZA RAZISKAVE ORGANIZMOV IN EKOSISTEMOV

DEPARTMENT OF ORGANISMS AND ECOSYSTEMS RESEARCH

Kozača *(Strix uralensis)* (foto: Al Vrezec).

Ural Owl *(Strix uralensis)* (Photo: Al Vrezec).

VODJA: doc. dr. Meta Virant-Doberlet

HEAD: Assist. Prof. Dr Meta Virant-Doberlet

Doc. 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.

Assist. 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.

Škofovska kapa *(Cybister lateralimarginalis)* (foto: Al Vrezec). Water beetle *(Cybister lateralimarginalis)* (Photo: Al Vrezec).

KLJUČNE DEJAVNOSTI

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 interakcij v ekosistemih. Naše interdisciplinarno znanje in izkušnje uporabljamo za predloge učinkovitejših in bolj trajnostnih posegov v okolje.

SPECIFIČNA PODROČJA RAZISKAV SO SLEDEČA:

- biodiverziteta kopenskih in sladkovodnih ekosistemov, vključno s podzemnimi ekosistemi;
- 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 tujerodnimi 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 ter 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.

Alpski kozliček *(Rosalia alpina)* (foto: Al Vrezec). Alpine Long-horn Beetle *(Rosalia alpina)* (Photo: Al Vrezec).

TOPIC AREAS

Basic and applied research activities at the Department of Organisms and Ecosystems Research are aimed to create state-of-the-art knowledge needed for in-depth understanding of organisms and their role in the environment, from neuronal mechanisms of environment sensing and communication between cells to interactions within ecosystems. We use our interdisciplinary knowledge and expertise to propose more efficient solutions for biodiversity conservation and sustainable use of renewable natural resources.

SPECIFIC RESEARCH AREAS INCLUDE:

- biodiversity; study of terrestrial and freshwater ecosystems, including subterranean ecosystems;
- vibrational communication, with focus on analysis of natural vibroscape, studies of communication networks, investigations of production mechanisms of vibrational signals, analysis of behavioural responses, as well as neurobiological and ecophysiological studies;
- adaptations of model species to changes in various environmental factors, where we use ecophysiological approach;
- relations between invasive and native species with similar ecological niches;
- biology and ecology of beetles included in the EU Habitat Directive, including species-specific pheromones;
- ecosystem services including studies of processes in aquifers and pollination ecology with special emphasis on wild pollinators;
- impact of land use on river ecosystems;
- human interactions with the environment in hay meadows and urban areas;
- development of alternative approaches in insect pest management and monitoring endangered species.

Strokovni posvet »BIOTSKA RAZNOVRSTNOST S KMETIJSTVOM IN ZA KMETIJSTVO« z ministrom mag. Dejanom Židanom.
Expert panel »BIODIVERSITY WITH AGRICULTURE AND FOR AGRICULTURE« with Minister MsC Dejan Židan.

3.0
ODDELEK ZA RAZISKAVE ORGANIZMOV IN EKOSISTEMOV

GLAVNI DOSEŽKI V LETU 2017

S sodelavci z inštituta EMBRAPA v Braziliji smo zasnovali knjigo Stink bugs: Biorational control based on communication processes, ki je izšla pri mednarodni založbi CRC Press (Taylor & Francis Group). V knjigi, za katero so 5 od 12 poglavij prispevali sodelavci Oddelka za raziskave organizmov in ekosistemov, je predstavljen pomen različnih modalitet sporazumevanja pri ščitastih stenicah (*Pentatomidae*) ter možnosti izkoriščanja vedenjskih odzivov v sporazumevanju pri nadzoru žuželčjih škodljivcev.

V članku, objavljenem v reviji Functional Ecology, smo izpostavili pomen funkcionalne morfologije pri razumevanju mehanizmov, ki omogočajo koeksistenco simpatričnih vrst kuščaric.

V članku, objavljenem v reviji PLoS ONE, smo opisali strukturo vrstno specifičnega feromona alpskega kozlička (*Rosalia alpina*), ki je uvrščen na seznam vrst hroščev evropskega varstvenega pomena. Uporaba tega feromona nam omogoča razvoj učinkovitejšega monitoringa te ogrožene vrste.

V letu 2017 smo pričeli z izvajanjem projekta LIFE NATURAVIVA: Biodiverziteta – umetnost življenja. 5-letni projekt, v skupni vrednosti 2,5. milijona EUR koordiniramo na Oddelku za raziskave organizmov in ekosistemov, izvaja pa ga 10 partnerjev. Projekt je namenjen osveščanju javnosti o izjemni biotski pestrosti v Sloveniji ter izobraževanju o pomenu biodiverzitete.

Za snovalce kmetijskih in varstvenih politik smo organizirali strokovni posvet Biotska raznovrstnost s kmetijstvom in za kmetijstvo. Posveta so se udeležili minister za kmetijstvo, gozdarstvo in prehrano z drugimi predstavniki tega ministrstva ter predstavniki Ministrstva za okolje in prostor, Zavoda RS za varstvo narave in Kmetijsko gozdarske zbornice. Namen posveta je bil predstaviti stanje biotske raznovrstnosti v Sloveniji in jim na osnovi najnovejših raziskav, ki jih izvajamo na NIB-u, podati predloge za učinkovitejše ohranjanje narave.

Močerad *(Salamandra salamandra)* (foto: Al Vrezec). Fire Salamander *(Salamandra salamandra)* (Photo: Al Vrezec).

3.0
DEPARTMENT OF ORGANISMS AND ECOSYSTEMS RESEARCH

IMPORTANT ACHIEVEMENTS IN 2017

Together with collaborators from EMBRAPA Institute in Brazil we developed the book Stink bugs: Biorational control based on communication processes published by CRC Press (Taylor & Francis Group). The book presents the up-to-date knowledge on different communication modalities in stink bugs (*Pentatomidae*), as well as highlights the possibilities how to exploit communication behaviour in pest management. Members of the Department contributed to five out of twelve chapters.

In the paper published in the journal Functional Ecology, we emphasized the importance of joint examination of morphological and functional traits for understanding the mechanisms enabling the coexistence of sympatric lizard species.

In the journal PLoS ONE we published the structure of species-specific pheromone of alpine longicorn (*Rosalia alpina*), the priority beetle species for conservation in Europe. This pheromone will be useful in development of more efficient monitoring of this endangered species.

In 2017 we started with the communication project LIFE NATURAVIVA – Biodiversity-Art of Life. 5-year project (total value 2.5. mio EUR) is coordinated by the Department and is carried out by 10 partners. The aim of the project is to reveal the exceptional biodiversity in Slovenia and highlight its importance.

For decision and policy makers we organized a workshop Biodiversity with agriculture and for agriculture. The meeting was attended by the Minister of Agriculture, Forestry and Food and other representatives of this Ministry, representatives of the Ministry of Environment and Spatial Planning, Chamber of Agriculture and Forestry of Slovenia and the Institute of the Republic of Slovenia for Nature Conservation. The aim of the workshop was to highlight the state of biodiversity in Slovenia and present the proposals for more efficient nature conservation measures based on our latest research.

Rogač (*Lucanus cervus*), samica (foto: Al Vrezec). Stag Beetle (*Lucanus cervus*), female (Photo: Al Vrezec).

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3 Samostojni strokovni sestavek ali poglavje v monografski publikaciji Independent Professional Component Part or a Chapter in a Monograph
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3 Intervju Interview
4 Drugi sestavni deli Other Component Parts
2 Strokovna monografija Professional Monograph
5 Končno poročilo o rezultatih raziskav Final Research Report
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11 Radijska ali televizijska oddaja Radio or Television Broadcast
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3 Vabljeno predavanje na konferenci brez natisa Unpublished Invited Conference Lecture
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14 Uredništvo Editorship

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3.0

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Kam so šle vse rožice?

Where have all the flowers gone?

(Pete Seeger, 1955)

4.0

ODDELEK ZA BIOTEHNOLOGIJO IN SISTEMSKO BIOLOGIJO

DEPARTMENT OF BIOTECHNOLOGY AND SYSTEMS BIOLOGY

Najmlajši udeleženci Dneva očarljivih rastlin.

The youngest participants of the Facination of Plant Day.

VODJA: Izr. prof. dr. Maja Ravnikar

HEAD: Assoc. Prof. Dr Maja Ravnikar

Izr. prof. dr. Maja Ravnikar, znanstvena svetnica, je vodja Oddelka za biotehnologijo in sistemsko biologijo ter izredna profesorica biotehnologije na Univerzi v Ljubljani, Univerzi Nova Gorica in na mednarodni Podiplomski šoli Instituta Jožef Stefan. 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 karakterizacijo virusov za različne biotehnološke aplikacije.

Assoc. Prof. Dr Maja Ravnikar, scientific councillor, is the Head of the Department of biotechnology and systems biology and professor of biotechnology at University of Ljubljana, University Nova Gorica and at Josef Stefan Postgraduate School. 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.

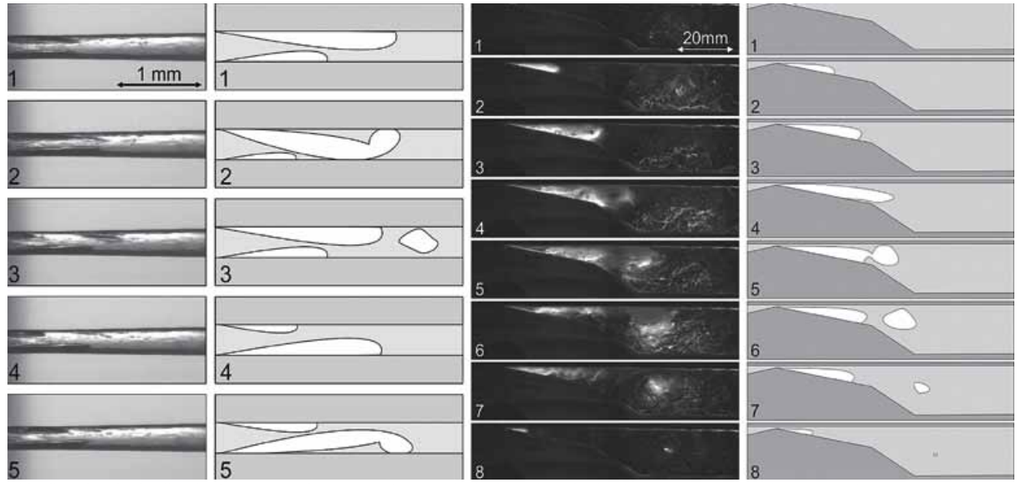
Tkivne kulture madagaskarskega zimzelena okuženega s fitoplazmami (foto: Žiga Živulovič jr./Bobo).
Tissue cultures of Madagascar periwinkle infected with different phytoplasmas (Photo: Žiga Živulovič jr./Bobo).

KLJUČNE DEJAVNOSTI

- Ustvarjanje vrhunskega znanja za celostno razumevanje bioloških procesov, ki izhaja iz dolgoletnih raziskav interakcij med rastlinami in patogenimi mikroorganizmi, s pomočjo uporabe kvantitativne in kvalitativne molekulske biologije ter razvijanjem pristopov sistemske biologije.
- Boljše razumevanje biologije, raznolikosti, patogenosti in epidemiologije mikroorganizmov ter na osnovi novega znanja razvoj boljših pristopov za njihovo detekcijo in zatiranje.
- Razvoj novih biotehnoloških metodoloških pristopov za bolj učinkovito identifikacijo in detekcijo gensko spremenjenih organizmov glede na njihovo pričakovano povečano uporabo v prihodnjih letih.
- Nadgrajevanje tehnološke platforme, ki podpira raziskave sistemske biologije in meroslovno naravnane raziskave tarčnih organizmov.
- Prenos ustvarjenega znanja o biologiji patogenih in gensko spremenjenih organizmov ter razvitih metod za njihovo določanje na področja kmetijstva, farmacije, medicine in varovanja okolja (v okviru oddelka FITO delujeta uradna diagnostična laboratorija za dokazovanje gensko spremenjenih organizmov in rastlinskih patogenih mikroorganizmov).
- Partnersko sodelovanje z drugimi raziskovalnimi skupinami na NIB-u ali izven njega v Sloveniji in po svetu pri komplementarnih raziskavah za pridobivanje vrhunskega znanja.
- Partnersko povezovanje z državnimi in evropskimi institucijami, visokošolskimi organizacijami in industrijo za skupni prispevek k reševanju aktualnih problemov s področja delovanja oddelka.

GLAVNI DOSEŽKI V LETU 2017

Raziskovalci Strojne fakultete Univerze v Ljubljani in FITO so prvič pokazali možnost deaktiviranja virusov s hidrodinamično kavitacijo – hitrim uparevanjem in ponovno kondenzacijo vode zaradi nenadne lokalne spremembe tlaka. Raziskava odpira možnosti novi metodologiji za energijsko učinkovito dezinfekcijo vode. Svoje rezultate so z visokim dejavnikom vpliva in po metodologiji ARRS označene kot A'' objavili v reviji Water Research. Uredniki in recenzenti revije so članek označili kot zgodovinski mejnik, ki bi potencialno lahko spremenil tehnologijo vodne dezinfekcije. Članek je bil uvrščen



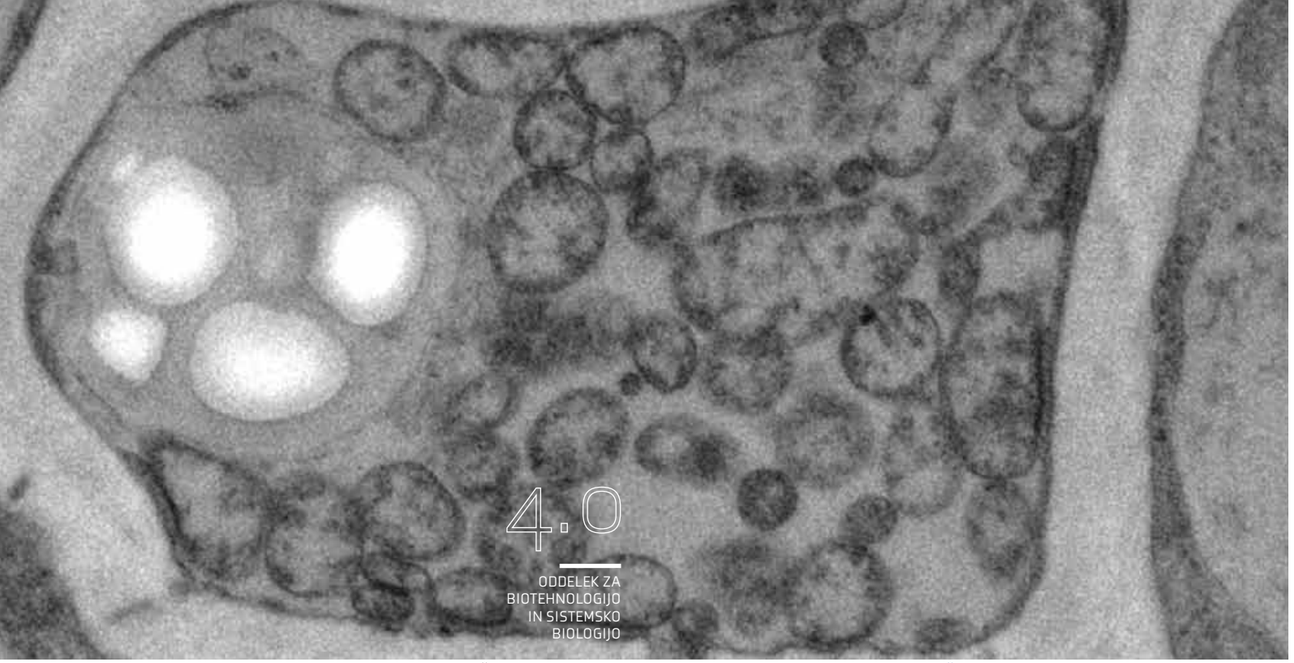
Hidrodinamična kavitacija. Vir: *Water research, 2017, 124, 465-471.* A hydrodynamic cavitation. Source: *Water research, 2017, 124, 465-471.*

TOPIC AREAS

- Generating scientific knowledge of the highest quality, which originates in our long-term research of interactions between plants and their pathogens concerning biological processes through the use of quantitative and qualitative molecular biology and development of systems biology approaches.
- Gaining better insight into the biology of microorganisms in order to understand their diversity, pathogenicity and epidemiology which can lead to the development of better approaches for their detection and control.
- Development of new methodological approaches in biotechnology as the background for more efficient identification and detection of GMOs in light of their expected increase in the global market in the coming years.
- Upgrading the technology platform supporting systems biology research as well as metrologically-oriented research of target organisms.
- Transferring newly-created knowledge of the biology of pathogenic and genetically modified organisms, along with new methods for their determination, to the fields of agriculture, pharmacy, medicine and environment conservation (FITO includes two official diagnostics laboratories for the detection of GMOs and pathogenic microorganisms).
- Establishing a partnership with other research groups at NIB, in Slovenia, Europe and the world, for complementary research leading to scientific excellence.
- Establishing a partnership with governmental and European organizations, academic institutions and industry, working together in solving practical problems related to FITO's fields of expertise.

IMPORTANT ACHIEVEMENTS IN 2017

Researchers from the Faculty of Mechanical Engineering of the University of Ljubljana and FITO were the first to show the possibility of the inactivation of viruses by hydrodynamic cavitation – rapid vaporization and recondensation of water as a result of sudden local change in pressure. The results were published in the Water Research journal, with a high impact factor and categorized as A'' according to the ARRS methodology. The research opens up the possibility of a new energy-efficient water disinfection methodology. The editors and reviewers of the journal labelled the article as a historical milestone



Fitoplazme v floemu paradižnika (foto: Magda Tušek Žnidarič). Phytoplasmas in the phloem of tomato (Photo: Magda Tušek Žnidarič).

med posebne publikacije Mednarodne organizacije za vode (IWA).

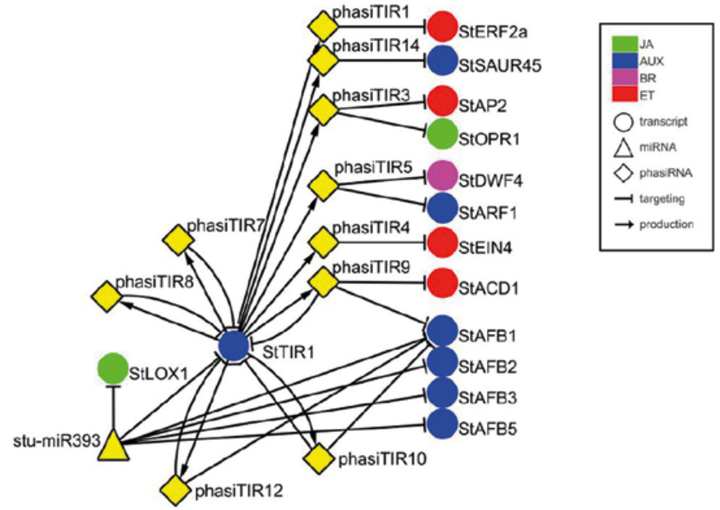
Pri založbi Springer je v formatu SpringerBriefs izšla znanstvena monografija Grapevine yelows diseases and their phytoplasmal agents: Biology and detection; dve od štirih glavnih urednic sta s FITO. Knjiga združuje naše trenutno vedenje na genomski, transkriptomski, proteomski in metabolomski ravni o biologiji fitoplazem, ki povzročajo trsne rumenice. V sklopu knjige so zbrani tudi pristopi za detekcijo teh fitoplazem. Fitoplazme so med najmanj raziskanimi fitopatogenimi bakterijami. V zadnjih nekaj letih pa smo z novimi pristopi biostatistike in bioinformatike na eni strani izboljšali naše razumevanje njihove biologije ter interakcij z gostiteljsko vinsko trto in na drugi strani izboljšali metode za njihovo detekcijo v laboratoriju in na terenu.

V reviji Frontiers in Plant Science smo objavili članek o vlogi malih RNA pri razvoju tolerance na ekonomsko najpomembnejši virus krompirja – PVY. Skonstruirali smo regulatorno omrežje malih RNA, ki le-te povezujejo z njihovimi tarčami. Na ta način smo povezali odgovore na ravni malih RNA s fiziološkimi procesi. Odkrita prepletenost različnih regulatornih omrežij nam je pokazala, kako so razvojno signaliziranje, razvoj bolezenskih znamenj in stresno signaliziranje lahko uravnoteženi.

Že šestič smo člani FITO sodelovali v organizacijskem odboru pri izvedbi slovenskega dela svetovnega Dne očarljivih rastlin. Organizacijski odbor je za svoje delo prejel priznanje Prometej znanosti za odličnost komuniciranje znanosti za leto 2017. Priznanje podeljuje Slovenska znanstvena fundacija.

Odlično raziskovalno ali razvojno delo številnih članov FITO so nagradila različna stanovska društva. Andrej Blejec je prejel priznanje Statističnega društva Slovenije, Maruša Pompe Novak priznanje Slovenskega društva za biologijo rastlin za prispevek k organizaciji Dneva očarljivih rastlin, Tanja Dreo pa priznanje Slovenskega mikrobiološkega društva za uspešen prenos znanja iz razvoja v diagnostiko.

Znanstveno delo mladih raziskovalcev FITO Špele Alič, Tjaše Stare, Arijane Filipič in Denisa Kutnjaka je bilo nagrajeno na slovenskih ali mednarodnih znanstvenih srečanjih.



Tarče miR393 med razvojem tolerance krompirja na PVY. Vir: *Front Plant Sci. 2017; 8: 2192.*
Targets of miR393 during potato development of tolerance against PVY. Source: *Front Plant Sci. 2017; 8: 2192.*

and a potentially revolutionary water disinfection technology. It was also placed among featured publications by the International Water Association (IWA).

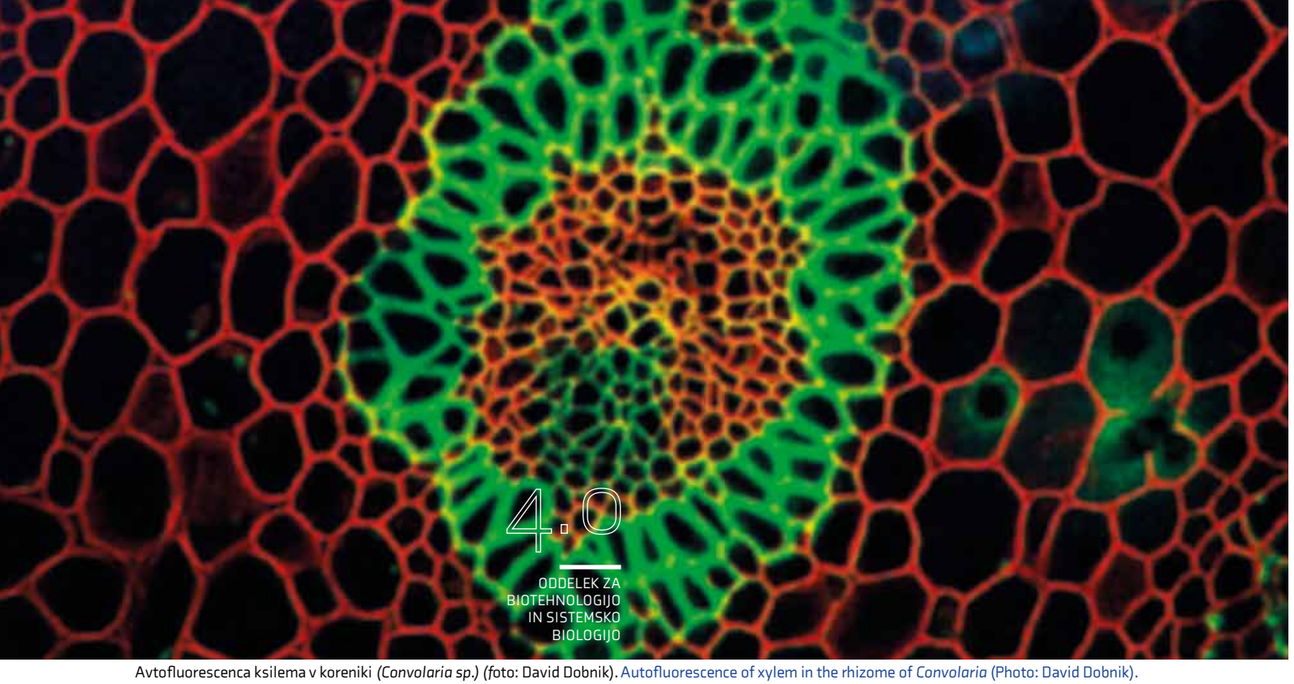
Two out of four editors of the new scientific monograph Grapevine Yellows Diseases and Their Phytoplasmal Agents: Biology and Detection published by Springer in the Springerbriefs format are from FITO. This work is meant to compile our current knowledge on grapevine yellows phytoplasma biology at the genomic, transcriptomics, proteomics and metabolomics level, as well as to summarize the approaches for their detection. Phytoplasma are the most poorly characterized plant pathogenic bacteria. In recent years, new biostatistics and bioinformatics approaches have improved our understanding of their biology and interactions with host grapevines, and a great improvement has been made toward their molecular detection, both in laboratories and on-site.

In the scientific journal Frontiers in Plant Science we published an article about the role of small RNA in the development of tolerance against the most economically important potato virus PVY. We constructed an sRNA regulatory network connecting sRNAs and their targets to link sRNA level responses to physiological processes. The revealed intertwining of different regulatory networks shows how developmental signaling, disease symptom development, and stress signaling can be balanced.

For the sixth time, members of FITO have participated in the organization of the Slovenian part of the international Fascination of Plants Day. The organizing committee was recognized for its work and received a Prometheus of Science recognition award for excellence in science communication, which is awarded by the Slovenian Science Foundation.

The excellent research and development work of several members of FITO was recognized by professional societies. Andrej Blejec received a recognition award from the Statistical Society of Slovenia. Maruša Pompe Novak received a recognition award from the Slovenian Society of Plant Biology for her input in the organization of the Fascination of Plants Day. Tanja Dreo received a recognition award from the Slovenian Microbiological Society for her successful transfer of knowledge from a developmental phase to diagnostics.

The scientific work of FITO's young researchers Špela Alič, Tjaša Stare, Arijana Filipič and Denis Kutnjak was recognized and awarded at several Slovenian or international scientific conferences.



Avtofluorescenca ksilema v koreniki *(Convolaria sp.)* (foto: David Dobnik). Autofluorescence of xylem in the rhizome of *Convolaria* (Photo: David Dobnik).

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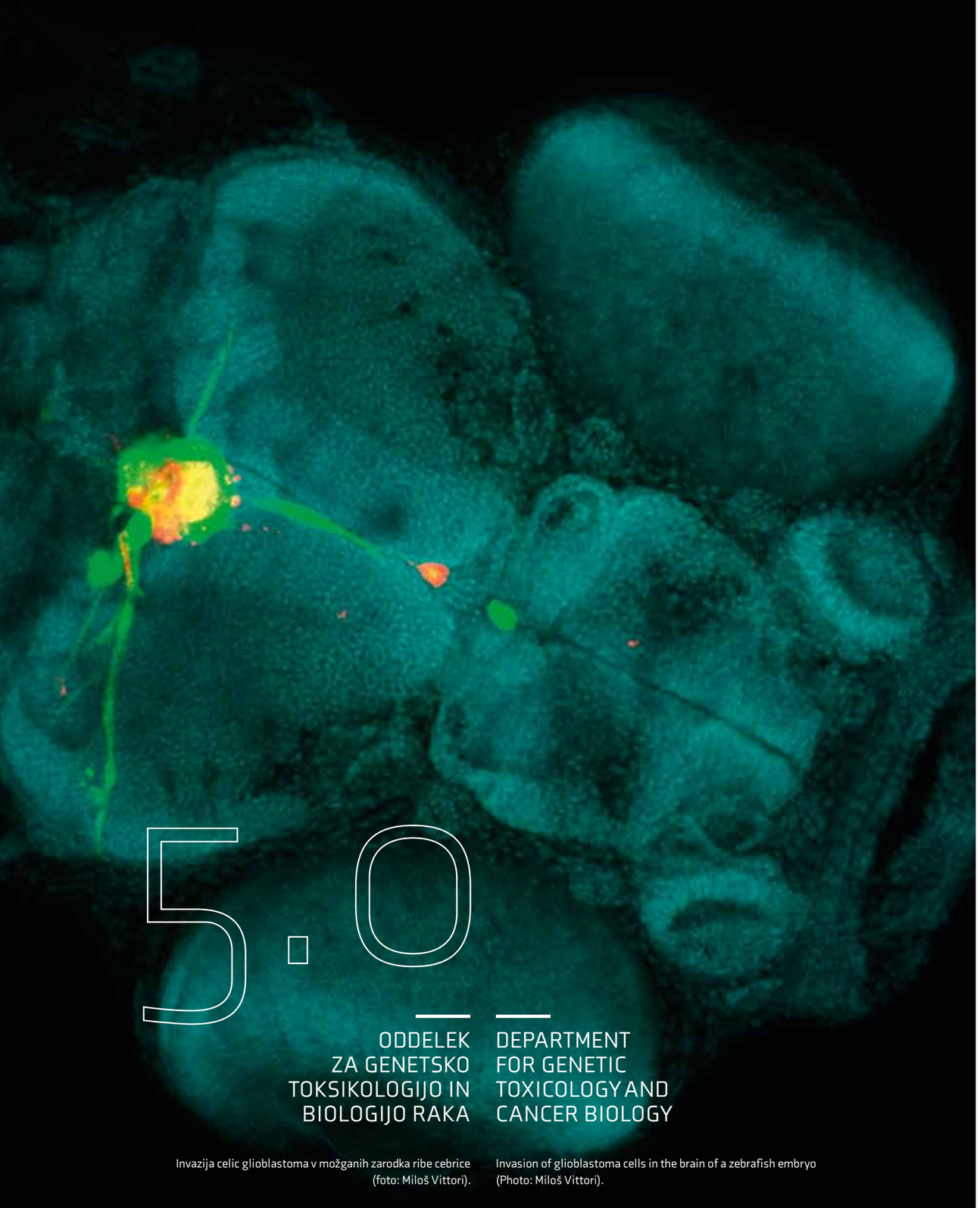


5.0

ODDELEK ZA GENETSKO TOKSIKOLOGIJO IN BIOLOGIJO RAKA

DEPARTMENT FOR GENETIC TOXICOLOGY AND CANCER BIOLOGY

Invazija celic glioblastoma v možganih zarodka ribe cebrice (foto: Miloš Vittori).

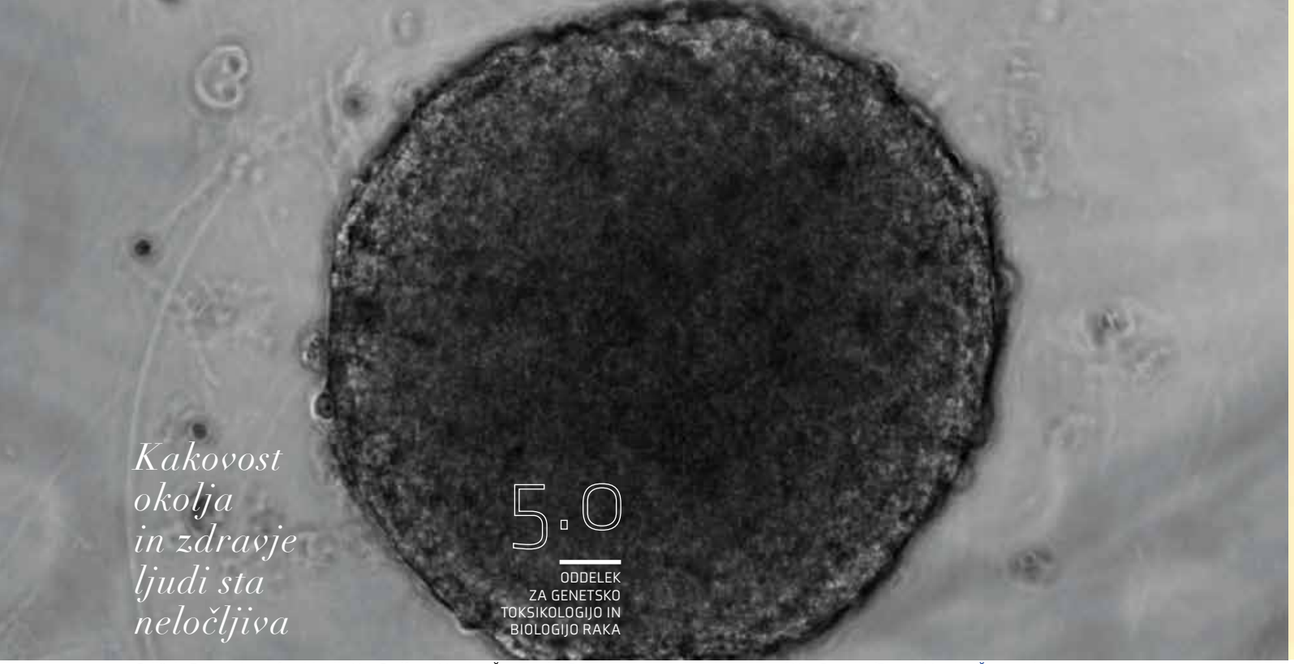
Invasion of glioblastoma cells in the brain of a zebrafish embryo (Photo: Miloš Vittori).

VODJA: Prof. dr. Metka Filipič

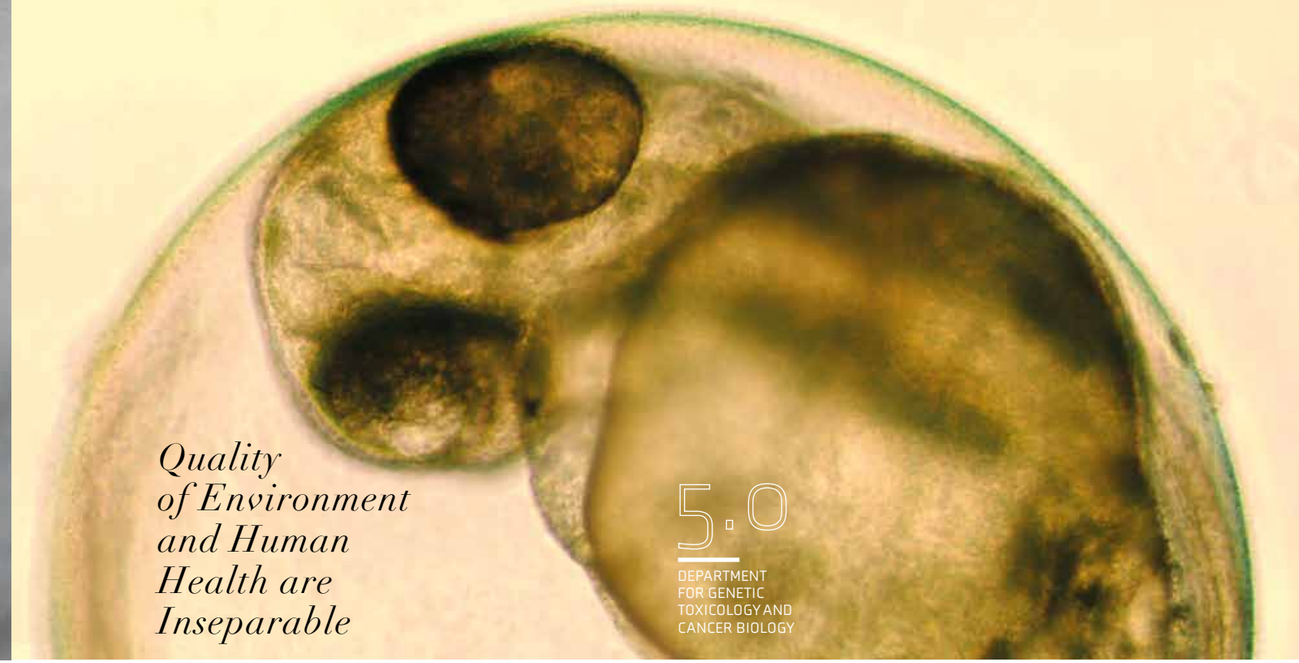
HEAD: Prof. Dr Metka Filipič

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.



Celični 3D model oz. sferoid celic HepG2 (foto: Martina Štampar). 3D cell model or spheroid model of HepG2 cells (Photo: Martina Štampar).



Zarodek cebrice pod mikroskopom (foto: Tina Eleršek). Zebrafish embryo under a microscope (Photo: Tina Eleršek).

KLJUČNE DEJAVNOSTI

Raziskave genetske toksikologije vključujejo:

- raziskave molekularnih mehanizmov genotoksičnega delovanja okoljskih in prehranskih onesnažil;
- razvoj novih *in vitro* testnih sistemov v genetski toksikologiji.

Raziskave biologije raka vključujejo:

- raziskave nastanka možganskih tumorjev – gliomov, glioblastomskih matičnih celic in njihove vloge pri napredovanju in odpornosti na zdravljenje;
- mehanizme delovanja proteolitičnih encimov v patobioloških procesih rakavih celic;
- raziskave mezenhimskih matičnih celic kot del tumorskega mikrookolja in vektorjev za vnos zdravil.

Bazične in uporabne raziskave obsegajo:

- raziskave in razvoj metod nadzora in preprečevanja pojavljanja strupenih cianobakterijskih cvetov;
- ekotoksikološke raziskave onesnaženj vodnega okolja.

Na vseh področjih sodelujemo s partnerji iz gospodarstva, vladnih teles in agencij, raziskovalnih institucij ter z univerzami in visokošolskimi organizacijami.

GLAVNI DOSEŽKI V LETU 2017

V letu 2017 smo uspešno zaključili projekt »HOPE«, ki je potekal v sodelovanju s skupino prof. dr. Siegfrieda Knasmüllerja z Medicinske univerze na Dunaju (Avstrija) in sta ga financirali ARRS (J1-6730) ter avstrijska znanstvena fundacija FWF. Trenutno veljavna zakonodaja zahteva testiranje genotoksičnosti za vse novorazvite kemikalije in proizvode, kot so zdravila, kozmetika, prehranski dodatki, pesticidi ipd. Smernice, ki urejajo testiranje genotoksičnosti, predvidevajo, da se to začne s setom ***in vitro*** testiranj na bakterijah in celicah sesalcev, čemur v primeru pozitivnih rezultatov obvezno sledijo še poskusi na glodavcih. Zmanjšanje uporabe poskusnih živali je po mnenju Referenčnega laboratorija Evropske unije za alternative poskusom na živalih (EURL ECVAM) mogoče doseči z razvojem bolj zanesljivih *in vitro* testov, ki bi jim sledilo manj *in vivo* preverjanj, kar je bil namen predlaganega projekta. Celične linije, ki se trenutno uporabljajo za testiranje genotoksičnosti, ne izražajo presnovnih encimov, kar je eden od pomembnejših razlogov za nezanesljive rezultate, ki morajo biti potrjeni v *in vivo* poskusih na glodavcih. Namen projekta je bil razviti jetrnim celicam podobe metabolno aktivne celične linije, ki bi bolje napovedovale *in vivo* pogoje in bi

TOPIC AREAS

Genetic toxicology research includes:

- molecular mechanisms of genotoxicity of environmental and foodborne contaminants;
- development of new *in vitro* test systems in genetic toxicology.

Cancer biology research includes:

- brain tumor research – glioma initiation, glioblastoma stem cells and their role in progression and resistance to therapy;
- mechanisms of proteolytic enzymes' functioning in the pathobiology of tumor progression;
- mesenchymal stem cells as part of the tumor microenvironment and as vectors for drug delivery.

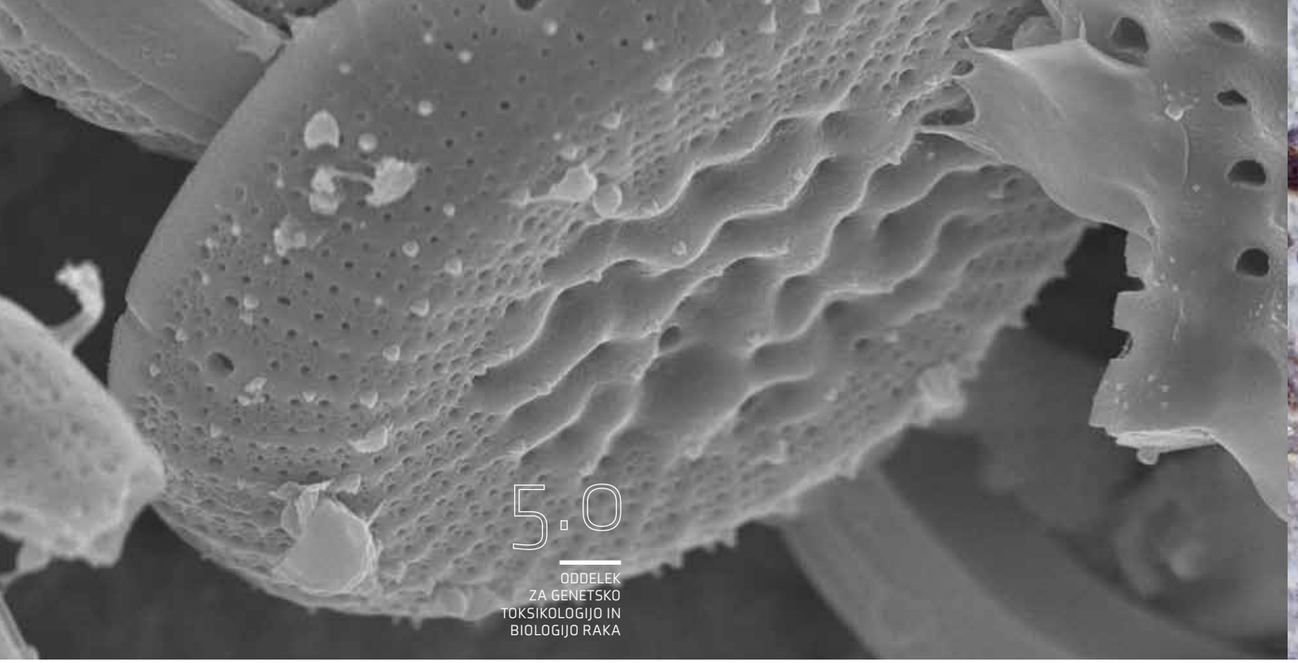
Environmental basic and applied research includes:

- studies and development of methods for surveillance and prevention of toxic cyanobacterial blooming;
- ecotoxicological studies of aquatic pollution.

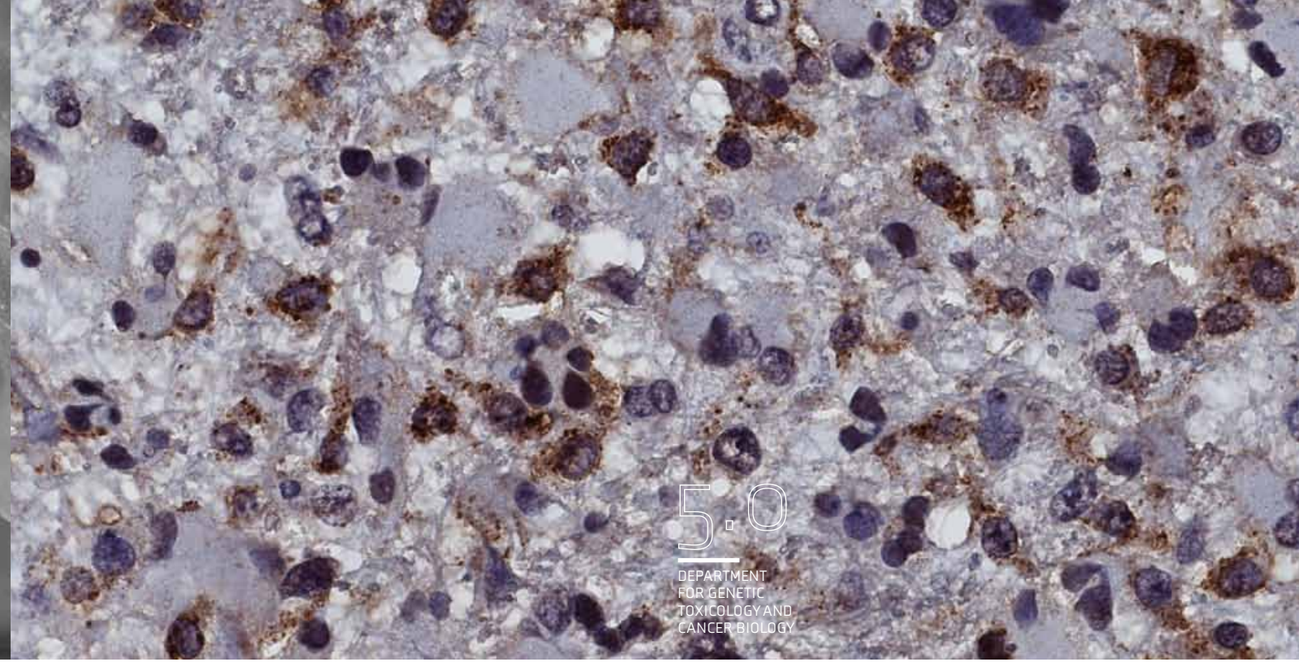
In all these fields we collaborate with partners from the industry, governmental bodies and agencies, research institutes, universities and higher education organizations.

MAIN ACHIEVEMENTS IN 2017

In 2017, we successfully completed the project "HOPE" that was conducted in collaboration with the team of Prof. Dr Siegfried Knasmüller from Medical University Vienna and was financed by ARRS (J1-6730) and the Austrian Science Fund (FWF). Current legislation requires genotoxicity testing of newly developed chemicals and of compounds such as drugs, cosmetics, food and feed additives, pesticides etc. The guidelines for genotoxicity testing require in the first stage a battery of *in vitro* tests with bacteria and mammalian cells, and when positive results are obtained follow-up experiments with rodents are conducted. According to the proposed strategy of the European Union Reference Laboratory for Alternatives to Animal Testing (EURL ECVAM) to "Avoid and Reduce Animal Use in Genotoxicity" a reduction of animals in genotoxicity/carcinogenicity testing can be achieved by the development of more reliable *in vitro* tests so that fewer *in vivo* follow-up tests are necessary, which was the aim of the project. The cell lines that are currently used in routine genotoxicity testing lack metabolic enzymes, which is considered to be one of the main reasons for unreliable results, which later have to be confirmed by *in vivo* experiments with rodents. The



Kremenasta lupinica alge pod elektronskim mikroskopom (foto: Tina Eleršek). Frustule of an alga under an electron microscope (Photo: Tina Eleršek).



Tkivo možganskega tumorja glioblastoma (foto: Barbara Breznik). Tissue of a glioblastoma brain tumour (Photo: Barbara Breznik).

na ta način doprinesle k zmanjšanju poskusov na živalih za določanje genotoksičnosti novih kemikalij. V raziskavi, ki smo jo objavili v reviji Archives of Toxicology s faktorjem vpliva IF 5.9 (Waldherr in sod. 2018, 92:921–934), smo analizirali občutljivost 12 jetrnih celičnih linij za zaznavanje modelnih genotoksičnih karcinogenov ter njihove značilnosti, ki so pomembne za njihovo uporabo pri testiranju genotoksičnosti (mitotska aktivnost, število kromosomov in stabilnost celic, status p53). Kot najobetavnejši smo identificirali celični liniji HepG2, ki se že uporablja v genetski tokiskologiji, in Huh6, ki se do sedaj še ni uporabljala za določanje genotoksičnosti. Obe celični liniji sta izkazali primerljivo občutljivost za zaznavanje genotoksičnih karcinogenov in imata primerljivo genomsko stabilnost.

V reviji Archives of Toxicology (Tomc in sod., 2018) smo objavili tudi članek, kjer poročamo o razvoju celičnega modela. **Iz mezenhimskih matičnih celic smo z metodo tristopenjske diferenciacije uspeli pridobiti celice, ki so podobne jetrnim celicam in so sposobne zaznavanja genotoksične aktivnosti posredno delujočih modelnih genotoksinov, kot sta benzo(a)piren (BaP) in aflatoksin B1 (AFB1).** Diferencirane celice smo imortalizirali s transfekcijo s hTERT ter dobili stabilno celično linijo, ki lahko v dveh tednih dozori v metabolno aktivne celice, primerne za testiranje genotoksičnosti spojin. Prednost imortaliziranih celic je njihova podaljšana življenjska doba in s tem trajno zagotavljanje metabolno aktivnih celic.

Na področju raziskav raka je rdeča nit raziskav možganski tumor glioblastom (GBM), ki je najbolj agresiven in najbolj pogost možganski tumor, katerega preživetje je le okoli 15 mesecev, moderni pristopi zdravljenja pa niso uspešni. Na osnovi raziskav zadnjih let se razvija teorija, da je iniciacija raka lahko posledica poškodb DNA diferenciranih somatskih celic, ki privedejo do nastanka celic z lastnostmi matičnosti, ali pa je le-ta posledica poškodb genetskega materiala matičnih celic. V vsakem primeru nastanejo rakave matične celice, ki so izredno odporne proti nadaljnjim DNA poškodbam, s tem pa tudi proti zdravljenju s kemo- in radioterapijo. Zato so tako same po sebi kakor tudi tkivno okolje, kjer se zadržujejo (tako imenovane niše), zanesljivo nove tarče raziskav in zdravljenja raka, kot je GBM. **V sodelovanju s skupino profesorja van Noordena smo raziskovali sestavo tkivnih niš in postavili hipoteze o vlogi lizosomalnih proteolitičnih encimov katepsinov, ki se v večjih količinah v njih tudi nahajajo** (Hira in sod. Biochimica et biophysica acta. BBA, Molecular cell research, 2017, 1864/3, 594–603, faktor vpliva 4.52).

aim of the project was to develop metabolically active liver-derived cell lines that will better predict genotoxicity ***in vivo*** and will contribute to a reduction in the use of experimental animals for the genotoxicity evaluation of new chemicals. In the study published in *Archives of Toxicology* with an impact factor of 5.9 (Waldherr et al., 2018), we analyzed the sensitivity of 12 liver-derived cell lines for detection of model carcinogens and their characteristics, which are relevant for their use in genotoxicity assays (mitotic activity, p53 status, chromosome number, and cell stability). **As the most promising, we identified the HepG2 cell line that is already being applied in genetic toxicology, and the HuH6 cell line, which has not been used in genetic toxicology so far. Both cell lines exerted comparable sensitivity for detecting genotoxic carcinogens and comparable karyotype stability.** In the journal *Archives of Toxicology* (Tomc et al., 2018) we published also an article in which we reported the generation of metabolically-active differentiated hepatic progenies from human adipose tissue-derived mesenchymal stem cells that detect the genotoxic activity of the indirect-acting genotoxins benzo(a)pyrene (BaP) and aflatoxin B1 (AFB1). The differentiated hepatic progenies were further immortalized with hTERT transfection, resulting in a stable cell line that can be matured to metabolically-active cells ready for genotoxicity testing in only 2 weeks. The advantage of these immortalized cells is their prolonged replicative life span and consequently limitless supply of differentiated hepatic progeny cells.

The common thread in the field of cancer research is glioblastoma (GBM), which is the most aggressive and common primary brain tumor. The survival time of GBM patients is only about 15 months despite modern treatment approaches, which are not effective. Based on recent research, a theory has been developed that cancer initiation may occur due to DNA damage of differentiated somatic cells that lead to the formation of cells with the characteristics of stem cells, or as a result of a genetic damage of normal stem cells. In any case, this leads to the development of cancer stem cells, which are extremely resistant to further DNA damage, and to treatment with chemo- and radiotherapy. Therefore, cancer stem cells, as well as the tissue environment where they are retained (niches), are new targets of the research and treatment of cancers such as GBM. In collaboration with the team of Prof. Dr van Noorden, we investigated the composition of the GBM tissue niches and questioned the role of lysosomal proteolytic enzymes, i.e. cathepsins, which are found in the niches in large quantities (Hira et al., *Biochimica et Biophysica Acta, BBA, Molecular Cell Research*, 2017, 1864 / 3, 594-603, impact factor 4.52).

Nadaljevali smo z raziskovanjem vloge katepsinov, ki smo jih v predhodnih raziskavah potrdili kot biomarkerje GBM. Potrdili smo našo hipotezo, da ima katepsin L vlogo kot antiapoptotski dejavnik, saj vpliva na aktivnost transkripcijskih faktorjev v jedru. Še več, v članku Monike Primon in sodelavcev (Experimental cell research, 2017, vol. 356, 1, 64–73, faktor vpliva) opisujemo, **da smo z utišanjem gena za katepsin L znižali apoptotski prag anaplastičnega astrocitnega pilocitoma in s tem nakazali, da bi genska terapija z znižanjem tega encima doprinesla k večji občutljivosti celic GBM na sevanje in s tem okrepila učinke radioterapije pri zdravljenju GBM.**

Mikrookolje celic GBM v tumorjih vsebuje tudi posebej pomembne mezenhimske matične celice (MSC), ki v stiku s tumorskimi celicami zaradi intenzivne komunikacije lahko zaviralno ali pospeševalno vplivajo na agresivnost GBM. V članku Barbara Breznik (Oncotarget, 2017, 8/15, 25482–99, faktor vpliva 5.17) ugotavlja raznolike vplive MSC na podvrste celic GBM, saj MSC zaustavijo invazijo celic GBM U87, medtem ko MSC pospešijo invazijo in inducirajo proteaze, kot je katepsin B v celicah GBM druge podvrste U373. Pojav dokazuje pomen heterogenosti genotipa in fenotipa celic GBM, ki znatno in celo v nasprotni smeri vpliva na učinke stromalnih celic. To opozarja na izredno previdnost pri celični terapiji raka z MSC. V tem delu smo uporabili živalski model rib cebric, kjer smo s ksenotransplantacijo fluorescentnih rakavih celic v možgane zarodkov rib cebric proučevali invazijo celic GBM v možganih in v osrednji živčni sistem ter s tem potrdil rezultate *in vitro*.

Na področju **ekotoksikologije** smo proučevali toksične in genotoksične učinke kompleksnih zmesi onesnažil in okoljskih vodnih vzorcev. Protirakava zdravila vstopajo v vodno okolje predvsem z bolnišničnimi in komunalnimi odpadnimi vodami, kjer lahko zaradi svojega genotoksičnega potenciala povzročijo škodljive učinke na okolje že pri zelo nizkih odmerkih. V študiji smo na modelu jetrnih celic rib cebric (ZFL) primerjali citotoksični in genotoksični potencial štirih protirakavih zdravil kot posameznih spojin z genotoksičnim potencialom njihove kompleksne zmesi pri koncentracijah določenih v odpadnih vodah onkološke bolnišnice. Posamezne spojine so povzročile genotoksične učinke pri relativno visokih koncentracijah, ki niso pomembne za onesnaženje vodnega okolja, medtem ko je mešanica povzročila genotoksične učinke pri okoljskih koncentracijah (Novak in sod. Science of the total environment, 2017, 601/60, 2293–300, faktor vpliva 4.9). **Rezultati kažejo, da zmesi protirakavih zdravil lahko ogrozijo vodne organizme pri okoljsko relevantnih koncentracijah in dodatno dokazujejo, da na podlagi toksikoloških podatkov za posamezne spojine ni vedno mogoče predvideti škodljivih učinkov kompleksnih zmesi.**

Odplake iz papirne industrije so kompleksne mešanice, ki vsebujejo različne toksične spojine, vključno z endokrinimi motilci (EDC) in genotoksičnimi spojinami. V študiji smo ocenili prisotnost EDC ter citotoksično in genotoksično aktivnost neobdelanih in biološko obdelanih odpadnih vod iz dveh papirnic z različnimi tehnologijami za proizvodnjo papirja: papirnice, ki uporablja neobdelana vlakna, in papirnice, ki uporablja reciklirana vlakna. Prisotnost EDC-jev smo zaznali v odpadnih vodah obeh papirnic. Genotoksično aktivnost smo zaznali le v odpadnih vodah iz papirnice, ki uporablja reciklirana vlakna za proizvodnjo papirja. Pokazali smo tudi, da kombinirani aerobni in anaerobni postopek obdelave odpadnih vod učinkovito zmanjšata količino onesnažil, ki so bakterijski mutageni, ne pa tudi tistih, ki povzročajo poškodbe DNA pri celicah človeškega hepatoma (Balabanič in sod Science of the total environment, 2017, 574, 78–89, faktor vpliva 4.9). **Ta študija poudarja, da so poleg kemijskih analiz potrebni biološki testi za celovito toksikološko oceno kompleksnih odpadnih vod.**

NAGRADE IN AKREDITACIJE

Prof. dr. Tamara Lah Turnšek je prejela **Zeievo nagrado za življenjsko delo:** za njeno znanstveno odličnost ter 22 let uspešnega vodenja Nacionalnega inštituta za biologijo. Prispevala je k njegovi uveljavitvi kot ene najbolj odličnih in prepoznavnih institucij na področju bioloških ved v Sloveniji.

Urad Republike Slovenije za kemikalije Ministrstva za zdravje je po uspešno opravljeni presoji oktobra 2017 Oddelku za Gensko toksikologijo in biologijo raka podaljšal **Potrdilo o skladnosti za izvajanje študij mutagenosti v skladu z OECD načeli Dobre Laboratorijske Prakse (DLP) za naslednji dve leti.**

We continued to explore the role of cathepsins, which had been confirmed as GBM biomarkers in previous studies. We confirmed the hypothesis that cathepsin L plays an anti-apoptotic role, because it affects the activity of transcription factors in the nucleus. Moreover, in the article by Primon and colleagues (*Experimental Cell Research*, 2017, Vol. 356, 1, 64-73 impact factor), we described that the silencing of the cathepsin L gene lowers the apoptotic threshold of the anaplastic astrocytic pilocytoma, **suggesting that anti-cathepsin L gene therapy would reduce the sensitivity of GBM cells to radiation by lowering the expression of this enzyme, thereby enhancing the effects of radiotherapy in the treatment of GBM.**

The microenvironment of GBM cells in tumors also contains particularly important mesenchymal stem cells (MSCs) that could inhibit or promote GBM aggressiveness when communicating with tumor cells. The article by Barbara Breznk (*Oncotarget*, 2017, 8/15, 25482-99, impact factor 5.17) identified the differential effects of MSCs on the different subtypes of GBM cells, i.e. MSCs inhibit the invasion of U87 GBM cells while the same cells enhance the invasion and induce the expression of proteases, such as cathepsin B, in another GBM subtype, U373 cells. **This phenomenon proves the importance of the heterogeneity of GBM cell genotype and phenotype, which are significantly affected by stromal cells and even in the opposite direction. It draws attention to the need for extreme caution in potential cancer cell therapy with MSC.** We also used GBM cells xenotransplantation to a zebrafish embryo model to confirm *in vitro* studies of a differential invasion of fluorescent GBM cells in the brain and the central nervous system of zebrafish embryo.

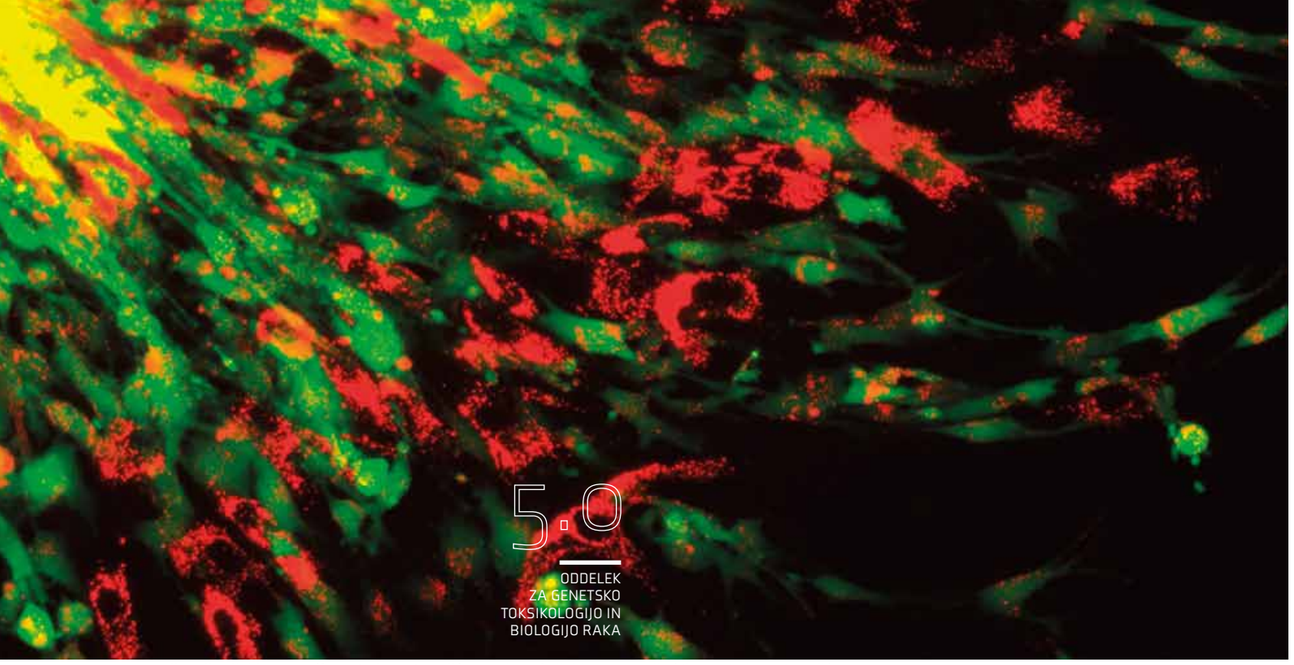
In the field of ecotoxicology, we studied the toxic and genotoxic effects of complex mixtures of pollutants and environmental aquatic samples. Anticancer drugs enter the aquatic environment predominantly via hospital and municipal wastewater effluents where, due to their genotoxic potential, they may cause adverse environmental effects even in very low doses. In this study, we used a zebrafish liver cell (ZFL) model to compare the cytotoxic and genotoxic potential of four anticancer drugs as individual compounds to the genotoxic potential of their complex mixture in concentrations detected in the effluents from an oncological hospital. The individual compounds induced genotoxic effects in relatively high concentrations that are not relevant for the contamination of the aquatic environment, whereas the genotoxicity of the mixture was detected in environmental concentrations (Novak et al., *Science of the Total Environment*, 2017, 601/602, 293-300, impact factor 4.9). **The results indicate that mixtures of anticancer drugs may pose a threat to aquatic organisms in environmentally relevant concentrations and contribute to the accumulating evidence that it is not always possible to predict adverse effects of complex mixtures based on the toxicological data for individual compounds.**

In the field of applied research, we studied paper mill effluents as complex mixtures containing different toxic compounds including endocrine-disrupting (EDC) and genotoxic compounds. In the study, we evaluated the presence of EDCs and the cytotoxic and genotoxic activity of raw and biologically treated wastewaters from two paper mills with different paper production technologies: a paper mill that uses virgin fibers, and a paper mill that uses recycled fibers. The presence of EDCs was detected in the wastewaters of both paper mills. Genotoxic activity was detected only in the wastewaters from the paper mill that uses recycled fibers for paper production. We also demonstrated that the combined aerobic and anaerobic wastewater treatment procedure efficiently reduces contaminants that are bacterial mutagens, but not those that induce DNA damage in human liver cells (Balabanič et al., *Science of the Total Environment*, impact factor 4.9). **This study highlights that, in addition to chemical analyses, bioassays are needed for a comprehensive toxicological evaluation of complex wastewater samples.**

AWARDS AND ACCREDITATIONS

Prof. Dr Tamara Lah Turnšek was awarded the **Zei Lifetime Achievement Award** for her scientific excellence and for 22 years of successfully leading the National Institute of Biology (NIB), and for contributing to the establishment of NIB as one of the most excellent and visible research institutions in the field of biological sciences in Slovenia.

After a successful external evaluation at the Department of Genetic Toxicology and Cancer Biology in October 2017, the Chemicals Office of the Republic of Slovenia of the Ministry of Health extended its certificate for conducting mutagenicity studies in accordance with the **OECD Principles of Good Laboratory Practices (GLP)** for the next 2 years.



Invazija celic glioblastoma (foto: Barbara Breznik). Invasion of glioblastoma cells (Photo: Barbara Breznik).

BIBLIOGRAFIJA
BIBLIOGRAPHY

17 Izvirni znanstveni članek Original Scientific Article

1 Pregledni znanstveni članek Review Article

1 Kratki znanstveni prispevek Short Scientific Article

4 Objavljeni znanstveni prispevek na konferenci (vabljeno predavanje) Published Scientific Conference Contribution (invited lecture)

6 Objavljeni znanstveni prispevek na konferenci Published Scientific Conference Contribution

10 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

6 Samostojni znanstveni sestavek ali poglavje v monografski publikaciji Independent Scientific Component Part or a Chapter in a Monograph

7 Intervju Interview

2 Drugi sestavni deli Other Component Parts

1 Doktorska disertacija Doctoral Dissertation

15 Končno poročilo o rezultatih raziskav Final Research Report

3 Radijska ali televizijska oddaja Radio or Television Broadcast

18 Radijski ali TV dogodek Radio or Television Event

6 Prispevek na konferenci brez natisa Unpublished Conference Contribution

1 Vabljeno predavanje na konferenci brez natisa Unpublished Invited Conference Lecture

12 Uredništvo Editorship

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INFRASTRUKTURNI CENTER NIB

NIB INFRASTRUCTURAL CENTRE

Potapljač med gorgonijami *(Paramuricea clavata)* (foto: Borut Mavrič).

Diver among gorgonians *(Paramuricea clavata)* (Photo: Borut Mavrič).

6.0

INFRASTRUKTURNI CENTER NIB

NIB INFRASTRUCTURAL CENTRE

Skupaj 96 uporabnikov
Total 96 users

INFRASTRUKTURNI PROGRAM NIB 2017
ŠTEVILO UPORABNIKOV

NIB INFRASTRUCTURAL PROGRAMMES IN 2017
NUMBER OF USERS

- 9 Raziskovalni program Research Programmes Financed by ARRS
- 13 Raziskovalni prijekti Research Projects Financed by ARRS
- 17 Mladi raziskovalci Young researchers
- 18 Mednarodni projekti International Research Projects
- 14 Državni in drugi vladni organi in resorji Projects for Bodies of Ministries
- 13 Razvojni projekti Developmental Projects
- 12 Pedagoško delo Educational Activities

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). Vsak del IC NIB nudi uporabo opreme in storitve javnemu in zasebnemu sektorju.

Veliko infrastrukturno opremo IC Planta sestavljajo:

- 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),
- kriomikrotom (Leica EM FC6) in ultramikrotom (Leica),
- konfokalni stereomikroskop (Leica TCS LSI),
- aparature za PCR v realnem času (ABI 7900HT Fast, Roche Light Cycler 480 in ABI PRISM ViiA7),
- 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 sestavljajo:

- raziskovalno plovilo PI-800 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 tokomerjem,
- manjše plovilo in
- visokofrekvenčni radar Wera.

IC Planta služi kot 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, možna pa je tudi uporaba opreme v obliki storitev in naročil analiz.

IC MBP služi kot podpora raziskovalni in aplikativni dejavnosti za ministrstva in druge državne organe ter izvajanju pedagoških aktivnosti 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 2017 je veliko infrastrukturno opremo IP NIB uporabljalo 96 različnih uporabnikov, s čimer je IP NIB dosegel cilj, da ohranja izjemno veliko število uporabnikov svoje velike infrastrukturne opreme.

Tematike raziskav in analiz, za katere se je uporabljalo veliko infrastrukturno opremo IC NIB, so bile izjemno raznolike. Tako veliko število uporabnikov in raznolikost 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 skozi podatek, da je v letu 2017 kar 28 % uporabnikov IP NIB prihajalo iz drugih RO.

The Infrastructural Centre at NIB comprises two integrated centres: Infrastructural Centre Planta (IC Planta), which is part of the Department of Biotechnology and Systems Biology, and Infrastructural Centre MBS (IC MBS) as part of the Marine Biology Station Piran (MBS). The NIB Infrastructural Centre is co-financed by the Slovenian Research Agency (ARRS) through the Infrastructural Programme NIB (IP NIB). Each part of IC NIB offers services and equipment to the public and private sector.

The major infrastructural equipment of IC Planta consists of:

- Transmission electron microscope (Philips CM100) with a CCD camera co-owned by NIB and the Department of Biology at the Biotechnical Faculty (BF), University of Ljubljana (UL);
- Cryo-ultramicrotome (Leica EM FC6) and ultramicrotome (Leica);
- Confocal stereomicroscope (Leica TCS LSI);
- Real-time PCR instruments (ABI 7900HT Fast, Roche Light Cycler 480 and ABI PRISM ViiA7);
- Digital PCR instruments (Biorad QX100, Biorad QX200 and Fluidigm BioMark HD);
- Pipetting robot (Hamilton Microlab STARlet);
- Growth chambers for plant and tissue culture breeding (Kambič);
- Plant growth chambers for separate breeding (Kambič);
- Two quarantine greenhouses; and
- Supplementary equipment, essential for the functioning of major infrastructural equipment.

Additionally, it is possible to use:

- Spectrofluorimeters (SynergyMx, BioTek); and
- System for identification of microorganisms using fatty acid methyl ester analysis by Gas Chromatography (Sherlock Microbial Identification System) currently located at BF, UL.

The major infrastructural equipment of IC MBS consists of:

- PI-800 Sagita research vessel equipped with sophisticated navigation and marine research equipment;
- Vida Oceanographic Buoy equipped with meteorological and oceanographical instruments (multiparametric CTD and current meter);
- smaller vessel;
- HF radar WERA.

IC Planta's equipment supports research activities, ministries and their inspection bodies, enterprises, and educational activities. All major equipment of IC Planta is technologically advanced and carefully, regularly and professionally maintained. Our major equipment is also used by other organizations. Training courses are organised for frequent users, and services involving major equipment are offered to customers who prefer to order analyses.

IC MBS supports research and applied activities for ministries and other public institutions, as well as educational activities at MBS. Technologically advanced and sophisticated infrastructure enables state-of-the-art research at sea and places IC MBS among the leading research centres in the Mediterranean. MBS serves as the National Oceanographic Data Centre. When recording conditions at sea, IC MBS infrastructure assures a high quality of data which are available in near real time.

In 2017, IC NIB's infrastructural equipment was used within the scope of research activities of 96 different users. Thus, the goal to retain a large number of users was achieved.

The subjects of research and analyses, carried out at IC NIB, were extremely diverse. A large number of users underlines the importance of IC NIB research equipment for Slovenia in a wide range of research areas, for various enterprises, bodies of ministries and educational activities.

In 2017, 72% of IC NIB's major infrastructural equipment users were from our own research organization (RO) and 28% from other ROs.

6.0

INFRASTRUKTURNI CENTER NIB

Kit grbavec *(Megaptera novaeangliae)* na obisku v Piranu (foto: Lovrenc Lipej).
Humpback whale *(Megaptera novaeangliae)* visiting Piran (Photo: Lovrenc Lipej).

IC NIB svojo veliko infrastrukturno opremo stalno dopolnjuje in posodablja. V letu 2017 je IC Planta svojo opremo dopolnil z napravo za naparevanje in nabijanje mrežic za elektronski mikroskop (Leica EM ACE200). Presevni elektronski mikroskop (Philips CM100) s CCD kamerama Orius SC200 (Gatan) in BioScan 792 (Gatan) namreč uporablja vse več projektov, za katere je potrebno mrežice za elektronski mikroskop napariti z ogljikom in/ali nabiti. Tako nabava aparature za naparevanje in nabijanje mrežic za elektronski mikroskop omogoča delo na teh projektih.

Poleg tega je IC Planta v letu 2017 svojo opremo dopolnil z dvema digitalnima mikroskopoma z osvetlitvijo z vidnim spektrom svetlobe (DinoLite AM7915MZTL) in dvema digitalnima mikroskopoma z IR osvetlitvijo (DinoLite AD7013MTL-FI2) s stojali. Digitalni mikroskopi omogočajo fenotipske študije na rastlinah v komorah za gojenje rastlin.

V začetku 2017 smo se v IC MBP morali soočiti z zelo neprijetno odpovedjo enega od najpomembnejših merilnih instrumentov na boji »VIDI«. Po dvanajstih letih praktično stalnega delovanja na morskem dnu, 22 metrov pod bojo, je dokončno odpovedal akustični tokomer. Potrebna je bila hitra zamenjava, ki bi od zaposlenih na IC MBP in zunanjih sodelavcev terjala čim manj sprememb v strojni in programski opremi. Zamenjava nam je v celoti uspela v 6 mesecih, od julija 2017 pa novi tokomer spet deluje brez prekinitev.

Čeprav je zamenjava tokomera zahtevala precej časa in truda, smo se poleg vzdrževanja preostale opreme posvetili tudi nadgradnjam in dopolnitvam storitev, ki jih obstoječa oprema omogoča. V okviru evropskega projekta »HAZADR« je v oktobru 2014 Infrastrukturni center na Morski biološki postaji postavil v Piranu 12-kanalni HF radarski sistem »WERA«. Ta v sodelovanju z enakim sistemom, nameščenim na italijanski strani (Nabrežina, Italija) omogoča neprekinjene meritve tokov in površinskih valov v Tržaškem in Piranskem zalivu. Podatki so v realnem času posredovani strokovni in laični javnosti v grafični in digitalni obliki. Od leta 2017 pa so ti podatki na voljo tudi celotni evropski skupnosti, ki je vključena v evropsko morsko podatkovno omrežje (EMODNET). Od lani zagotavljamo v skoraj realnem času podatke, ki jih meri HF radarski sistem in oceanografska boja »VIDA« (http://www.emodnet-physics.eu/Map/#).

6.0

NIB INFRASTRUCTURAL CENTRE

Vzorčenje na izlivnem delu reke Dragonje (foto: Borut Mavrič). Sampling at the mouth of the Dragonja River (Photo: Borut Mavrič).

IC NIB carefully, regularly and professionally maintains its major infrastructural equipment. Special care is devoted to perpetual modernization of the equipment. In 2017, IC Planta complemented its equipment with a Low Vacuum Coater (Leica EM ACE200). The transmission electron microscope (Philips CM100) with CCD cameras Orius SC200 (Gatan) and BioScan 792 (Gatan) is being used in a growing number of projects for which it is necessary to coat and/or charge the grids. Thus, the purchase of a Low Vacuum Coater makes it possible to work on these projects.

Moreover, in 2017, IC Planta complemented its equipment with two digital microscopes illuminated by the visible light spectrum (DinoLite AM7915MZTL) and two digital microscopes with IR lighting (DinoLite AD7013MTL-FI2) with stands. Digital microscopes allow phenotypic studies of plants in plant growth chambers.

At the very beginning of 2017, we at IC MBS were facing the failure of one of the most important measuring instruments bellow the VIDA buoy. The AWAC placed at the bottom of the sea stopped measuring after 12 years of continuous deployment. Repairing it was not cost effective, so the only option seemed to be to set up a new AWAC with the least possible changes in software and hardware. The acquisition and setup took 6 months and by the end of July 2017 the new AWAC was deployed and has been in operation to this day.

Despite the AWAC replacement, we performed all maintenance activities, but the majority of our efforts were concentrated in upgrading the products that we provide. Under the EU project "HAZADR" in 2014 we set up a 12-channel HF radar system WERA in the middle of the city of Piran. With our project partner, the Italian Institute of Oceanography and Experimental Geophysics (OGS), which has a similar system installed at Aurisina, Italy, we are supplying surficial current measurements throughout the Gulf of Trieste. The data is distributed in near real time to the public in digital and graphic form. Since 2017, these data are also being distributed to the EU EMODnet community, together with some relevant data measured at the VIDA oceanographic buoy (http://www.emodnet-physics.eu/Map/#).

7.0

BIOLOŠKA KNJIŽNICA
THE BIOLOGY LIBRARY

Ilustracija iz bogate zbirke arhivskega gradiva.

Illustration from a rich collection of archive material.

OSEBJE
STAFF

VODJA
HEAD

Černač, Barbara

SODELAVCI
STAFF

Bernetič, Vladimir (MBP)
Glavač, Lučka
Writzl, Petra

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 in pedagoške dejavnosti obeh ustanov. Naša knjižnična zbirka obsega preko 79.500 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, novinarjem, prevajalcem...). Delujemo na dveh lokacijah: v Biološkem središču v Ljubljani in na Morski biološki postaji Piran

STORITVE:

- **hranjenje, vzdrževanje in dopolnjevanje knjižnične zbirke**;
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- **vzdrževanje in dopolnjevanje knjižničnega kataloga** v sistemu COBISS;
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- **pomoč in informacijska podpora** našim uporabnikom
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- **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;
- **Digitalna knjižnica Biotehniške fakultete:** zagotavljanje enotne vstopne točke do polnega besedila diplomskih, magistrskih in doktorskih del naših študentov;
- **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 dogajanju v slovenski biologiji;
- **čitalnica**: 67 mest za tihi študij;
- **dostop do računalnikov, možnost povezave v brezžično omrežje** (Eduroam).

The Biology Library is special (research) and academic library. We work for National Institute of Biology and Department of Biology, Biotechnical Faculty, University of Ljubljana like the support service. In this way the Library participates in all the functions, research and educational processes of both institutions. The Library holds over 79.500 scientific books, journasl, theses... Our tipical users are researchers, profesors and students from the field of biology and related scientific fields. But we are also open to wide public (researchers and students from other scientific fields, journalists, translators...). The Library spreads out in two locations: in Ljubljana, The Biology Centre Building and in Piran, The Marine Biology Station

SERVICES

- **library collection keeping**;
- **online access to e-journals, e-books and databases:** arrangements, cooperation and participation in library purchasing consortium, online access setting, remote access to e-resources;
- **library catalogue in COBISS system keeping**;
- **loan**: borrowing, reserving, ordering library materials (also via online service "My library");
- **interlibrary loan**: ordering and access to literature from Slovenian and foreign libraries;
- **helpdesk**: collection and distribution of information to our users;
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- **researchers' bibliography and evaluation of scientific efficiency**: keeping the bibliography of publications in Cobiss system and the evaluation of scientific efficiency in SICRIS system for all the researchers employed in the National Institute of Biology and the Department of Biology;
- **information skills users training:** for library using and information searching in library collection and electronic information sources;
- **technical reviewing and examination with Turnitin (Academic plagiarism detector)** of M. Sc. Theses and doctoral dissertations, prepared by Department of Biology, Biotechnical Faculty, University of Ljubljana students;
- **technical reviewing of scientific books** in publishing process;
- **Digital Library of Biotechnical Faculty, Univerity of Ljubljana:** making a single entry point to full text graduation theses, M. Sc. theses and doctoral dissertations of our students;
- **entering full text publications in National institute of biology repository (DiRROS) and Repository of University of Ljubljana (RUL)**, considering copyrights and publisher contracts;
- **serials exchange** for our serials Acta Biologica Slovenica (formerly Biološki vestnik) and Natura Sloveniae with many exchange partners in Slovenia and abroad;
- **library web side and Facebook profile** to find more about the Biology Library and news in Slovenian biology;
- **reading room –** 67 places to study;
- **access to computers, wireless network connection** (Eduroam).

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3.0

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

IZVIRNI ZNANSTVENI ČLANEK
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SAMOSTOJNI ZNANSTVENI SESTAVEK ALI POGLAVJE V MONOGRAFSKI PUBLIKACIJI
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ODDELEK ZA BIOTEHNOLOGIJO IN SISTEMSKO BIOLOGIJO - FITO
DEPARTMENT OF BIOTECHNOLOGY AND SYSTEMS BIOLOGY – FITO

IZVIRNI ZNANSTVENI ČLANEK
ORIGINAL SCIENTIFIC ARTICLE

1 **BOGOŽALEC KOŠIR, Alexandra, DIVIETO, Carla, PAVŠIČ, Jernej, PAVARELLI, Stefano, DOBNIK, David, DREO, Tanja, BELLOTTI, Roberto, SASSI, Maria Paola, ŽEL, Jana.** Droplet volume variability as a critical factor for accuracy of absolute quantification using droplet digital PCR. *Analytical and bioanalytical chemistry*, ISSN 1618-2642, 2017, vol. 409, iss. 28, str. 6689-6697, doi: 10.1007/s00216-017-0625-y. [COBISS.SI-ID 4421711]

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5.0

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

IZVIRNI ZNANSTVENI ČLANEK
ORIGINAL SCIENTIFIC ARTICLE

1 ROZINA, Tinkara, SEDMAK, Bojan, ZUPANČIČ JUSTIN, Maja, MEGLIČ, Andrej. Evaluation of cyanobacteria biomass derived from upgrade of phycocyanin fluorescence estimation = Vrednotenje biomase cianobakterij na osnovi nadgradnje ocene fluorescence fikocianina. *Acta biologica slovenica : ABS*, ISSN 1408-3671. [Tiskana izd.], 2017, vol. 60, št. 2, str. 21-28. http://bijh-s.zrc-sazu.si/ABS/SI/ABS/Cont/60_2/Rozina%20et%20al_ABS_2_2017_21-28.pdf. [COBISS.SI-ID 4556111]

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SHORT SCIENTIFIC ARTICLE

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20 FILIPIČ, Metka, JERŠEK, Barbara. Ocena tveganj povezanih z aditivi v živilih = Assessment of risks related to food additives. V: *Aditivi v živilih - prednosti in tveganja = Food additives - benefits and risks*, 29. Bitenčevi živilski dnevi 2017 = 29th Food Technology Days 2017 dedicated to Prof. F. Bitenc, 15. junij 2017, Ljubljana. 1. elektronska izd. Ljubljana: Biotehniška fakulteta, Oddelek za živilstvo. 2017, str. 43-59, ilustr. [COBISS.SI-ID 4788088]

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OBJAVLJENI ZNANSTVENI PRISPEVEK NA KONFERENCI
PUBLISHED SCIENTIFIC CONFERENCE CONTRIBUTION

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SAMOSTOJNI ZNANSTVENI SESTAVEK ALI POGLAVJE V MONOGRAFSKI PUBLIKACIJI
INDEPENDENT SCIENTIFIC COMPONENT PART OR A CHAPTER IN A MONOGRAPH

30 **ELERŠEK, Tina, BLAHA, Ludek, MAZUR-MARZEC, Hanna, SCHMIDT, Wido, CARMELI, Shmuel**. Other cyanobacterial bioactive substances. V: MERILUOTO, Jussi (ur.), SPOOF, Lisa (ur.), CODD, Geoffrey A. (ur.). *Handbook of cyanobacterial monitoring and cyanotoxin analysis*. Chichester: J. Wiley & Sons. 2017, str. 179-195. [COBISS.SI-ID 4070479]

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34 **MAZUR-MARZEC, Hanna, ELERŠEK, Tina, BŁASZCZYK, Agata.** Extraction and chemical analysis of planktopeptin and anabaenopeptins. V: MERILUOTO, Jussi (ur.), SPOOF, Lisa (ur.), CODD, Geoffrey A. (ur.). *Handbook of cyanobacterial monitoring and cyanotoxin analysis*. Chichester: J. Wiley & Sons. 2017, str. 452-461. [COBISS.SI-ID 4070991]

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Morska obala v času vetra, valovanja in poplavljanja (foto: Borut Mavrič). The coast during winds, waves and floods (Photo: Borut Mavrič).

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