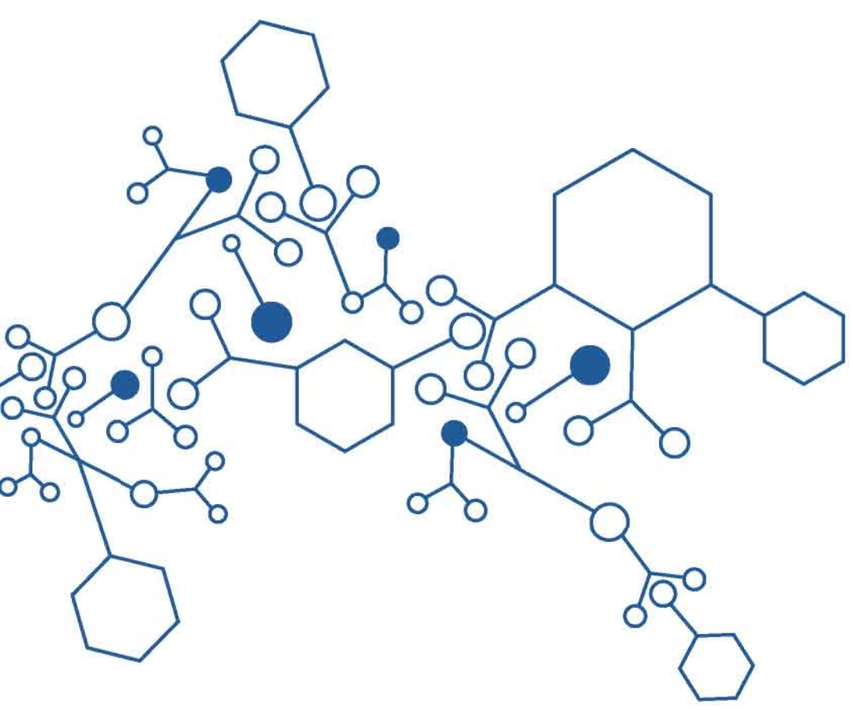
NACIONALNI INŠTITUT ZA BIOLOGIJO
NATIONAL INSTITUTE OF BIOLOGY

POROČILO O DELU 15
ANNUAL REPORT 15



POSLANSTVO MISSION

Ustvarjanje novega znanja s temeljnimi raziskavami na področju biologije in njej sorodnih naravoslovnih ved, varstva okolja, biotehnologije ter biomedicine za razumevanje življenjskih procesov;

Creating new knowledge through basic research in the field of biology and related natural sciences, environmental protection, biotechnology and biomedicine;

prenos ustvarjenega novega znanja v uporabo s ciljem izboljševanja kakovosti življenja;

Applying newly created knowledge in industry with the goal of improving the quality of life;

prenos ustvarjenega znanja na mlajše generacije z izobraževanjem na dodiplomski in podiplomski ravni.

Transfering knowledge to younger generations through education at undergraduate and graduate level.

VSEBINA CONTENTS

UVODNA BESEDA DIREKTORICE

Leto 2015 je zaznamovala 55-letnica Nacionalnega inštituta za biologijo, počastili pa smo jo s podelitvijo nagrad Miroslava Zeia, ki je polagal temelje tega inštituta.

Leta 1960 prav gotovo ni bil čas obilja in dobrin, ki nas obdajajo zdaj, in v raziskovalnih laboratorijih in kabinetih prav gotovo ni bilo tako dobrih možnosti, kot jih imajo zdaj (dobri) raziskovalci, da o mednarodni razsežnosti našega dela, takrat objektivno močno omejenega, ne govorim. Bil pa je čas ustvarjalne energije, ki je izhajala iz upanja in zaupanja, da znanstveniki skupaj z družbo ustvarjamo nekaj dobrega – za vse. Gospodarstvo, tovarne in podjetja so skupaj z državo ustanavljali znanstvene inštitute za reševanje svojih in družbenih problemov ter za pomoč razvijajoči se tehnologiji, na podlagi katere se je Slovenija še desetletja za tem razvijala. Zdaj na teh inštitutih zapiramo oddelke in v strahu pred rdečimi številkami ustavljamo delo v nekaterih naših laboratorijih, odpuščamo dobre, najboljše naše doktorande, ki se velikokrat razkropijo po svetu, in žal tudi tuje doktorande, ki prihajajo k nam.

Smo se spremenili mi, čeprav smo po dosežkih znanstvenega dela uspešnejši kot kdaj prej? Ali sta se spremenili država in družba, ki nas v nemoči, ki jo povzročajo svetovna in lokalna, tuja in domača kriza, marginalizirata in potiskata na rob družbenega dogajanja in obstoja? Vse pa nas lahko še najbolj skrbi, da družba v znanosti zelo redko prepoznava rešitve, ki jih ta ponuja – vsak dan, povsod, na več področjih, seveda v biologiji in na področjih, povezanih z njo. Te je mogoče s pametno in premišljeno strategijo ter ekonomskopolitičnimi orodji in veščinami izkoristiti za posodobitev sedanjih in postavitev novih prebojnih tehnologij, tudi v svetovnem merilu. Tako bi preskok v segment tehnologij z najvišjo dodano vrednostjo Sloveniji pomagal z zadnjih mest na raznih lestvicah, kamor je spadala še pred desetletjem, ko je padla v objem Evrope.

DIRECTOR'S INTRODUCTION

The year 2015 was marked by the 55th anniversary of the National Institute of Biology. We celebrated the anniversary by presenting the awards named after Miroslav Zei, who himself laid down the foundations for this Institute.

The year 1960 was certainly not a time of abundance and the research facilities were far from those that our laboratories and offices house today. Since then, the opportunities enjoyed by researchers significantly improved as well, particularly in terms of international cooperation, which was severely restricted at the time due to objective circumstances. Nevertheless, it was a time of great creative energy arising from the hope and trust that we, the scientists, are cooperating with society and contributing to the common good! The economy of the time was of course based on slightly different concepts than at present, yet it collaborated with the state in establishing research institutions to solve economic and social problems and to support the developing technologies that enabled the development of Slovenia during the following decades! Today we are closing departments at some of those institutions in fear of red numbers in annual reports, we are terminating work in our laboratories, turning down our best doctoral researchers and sending them abroad on a one-way track.

Have we, the scientists, changed since those days, though we are more successful in research now than ever before? Or is it the society that changed and the policies, powerless in the wake of local and global financial malpractice and the crisis, so they marginalize us and drive us to the very edge of existence? And perhaps even more worryingly, the society rarely recognizes the solutions we provide every day, everywhere, in numerous fields, including biology. But a sensible and deliberate strategy, proper economic and political tools and skills, can utilize these solutions to upgrade the existing and create new breakthrough technologies applicable on a global scale. Exploiting this potential would enable relevant branches of economy to leap into the technological sector with the highest added value. In this way Slovenia could ascend from the non-flattering positions it has been occupying in some international rankings of competitiveness at least to where it used to rank a single decade ago, before it was drawn into the EU embrace.

France Bučar, žal že pokojni veliki državnik in človek, je še lani ob predstavitvi svoje zadnje knjige Prelom, do katerega ni prišlo dejal: »Slovenija mora izstopiti iz mrtvila, če želi preživeti.« To velja tudi za prestrukturiranje okvirov znanstvenega delovanja. Kako? Kot prof. Zei, čigar kljubovalna življenjska pot je bila polna družbenih, finančnih, strokovnih in osebnih ovir, jih moramo premagati tudi mi in se opreti na svoje sile in ohraniti dinamičen odnos do družbenih in tehnoloških sprememb ter razmišljati drugače. K svojemu in družbenemu razvoju lahko najbolj pripomoremo z dialogom z gospodarstvom. Zato sodeluje NIB z več kot 60 manjšimi in tudi zelo velikimi podjetji. To počasi že prinaša želeno dodano vrednost in vsaj delno kompenzira primanjkljaj državnega financiranja raziskav. Biologi dejansko že prepoznavamo, da lahko prenos zamisli, znanja in izkušenj v (bio)tehnološke rešitve spremeni neki produkt ali storitev v precej bolje delujočega, z visoko dodano vrednostjo. V temelju so delo in vprašanja, ki si jih ob tem postavljamo, podobni kot pri temeljnjem raziskovanju, treba je le osvetliti problem s pravo valovno dolžino in že je mogoče videti nove razsežnosti njegove uporabnosti in nove možnosti ustvarjalnega dela, ki ustvarja tudi finančni dobiček.

Letošnji Zeievi nagrajenci s svojim delom izkazujejo odprtost in dolgoročno razmišljanje, tudi s svojo vizijo in dejanskim prenašanjem znanja v poslovno usmerjene organizacije. So tudi med nami, na NIB, in upamo, da jim bodo sledili še številni mlajši in mladi sodelavci – doktorandi, ki jih bomo predstavili kot upanje v lepšo prihodnost.

»Moramo se zavedati, da noben drug sektor ne obljublja tako velikega prispevka h kakovosti življenja, zmogljivosti in okoljski trajnosti z inovativno tehnologijo kot prav biologija in biotehnologija, hkrati pa zagotavlja tudi gospodarsko rast in bogatenje zakladnice znanja o temeljnih načelih, ki vladajo v naravi okoli nas,« je nedavno dejal Carlo Incerti, direktor korporacije Genzyme, ko je odprl tretje srečanje EuropaBio v evropskem parlamentu.

prof. dr. Tamara Lah Turnšek
direktorica

Presenting his last book "Prelom, do katerega ni prišlo" [The break that did not happen] earlier this year, Dr France Bučar, a great statesman and an admirable person said: "Slovenia must break away from stagnation if it wants to survive!" How? Like Prof. Miroslav Zei, who´s defiant life was strewn with social, financial, professional and personal obstacles, we need to overcome our own, rely on our strengths and change the way we think! Coming to this realisation, we have recently adjusted our focus at NIB and entered into collaboration with over 60 small enterprises and large companies. We have already started to provide the added value that these companies were looking for and simultaneously to compensate, at least in part, for the increasing lack of state funding for basic and applicative research. We - the Biologists, have recognized how the transfer of ideas, knowledge and skills into biotechnological solutions can significantly improve a product or a service - and provide it with high added value! In doing so, our work has not changed in its essence and we continue to ask similar questions. All we need to do is to illuminate the problem with the light of a proper wavelength and new dimensions of its applicability come into sight. New possibilities arise for creative work - such that can also create profit.

The works of this year´s winners of the Miroslav Zei award are marked by this sort of broad thinking and action – they already transfer their knowledge into business-oriented organisations. Researchers of this sort are also among us at NIB and we hope their examples will be followed by many younger colleagues – the doctoral researchers.

At a recent opening of the third meeting of EuropaBio in the EU Parliament, Carlo Incerti, the vice president of the Genzyme corporation stated: "No other sector holds the promise to enhance quality of life, productivity and environmental sustainability through innovation like biotechnology, while also benefitting Europe's economy and research base!" – enriching our knowledge about the basic principles that govern nature. There is nothing to add to this statement.

Prof. Dr Tamara Lah Turnšek
Director

VODSTVO INŠTITUTA / INSTITUTE'S MANAGEMENT

DIREKTORICA / DIRECTOR

Mandat / Mandate: 1. 1. 2015 - 31.12. 2019

prof. dr. Tamara Lah Turnšek (od / from 1996)

POMOČNIK DIREKTORICE / ASSISTANT DIRECTOR

Mandat / Mandate: 1. 1. 2015 - 31. 12. 2019

mag. Franc Potočnik (od / from 1999)

UPRAVNI ODBOR / BOARD OF GOVERNORS

Mandat / Mandate: 28. 5. 2014 - 28. 5. 2018.

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

ZNANSTVENI SVET / SCIENTIFIC COUNCIL

Mandat / Mandate: 26. 4. 2016 - 25. 4. 2020

izr. prof. dr. Valentina Turk
predsednica / president

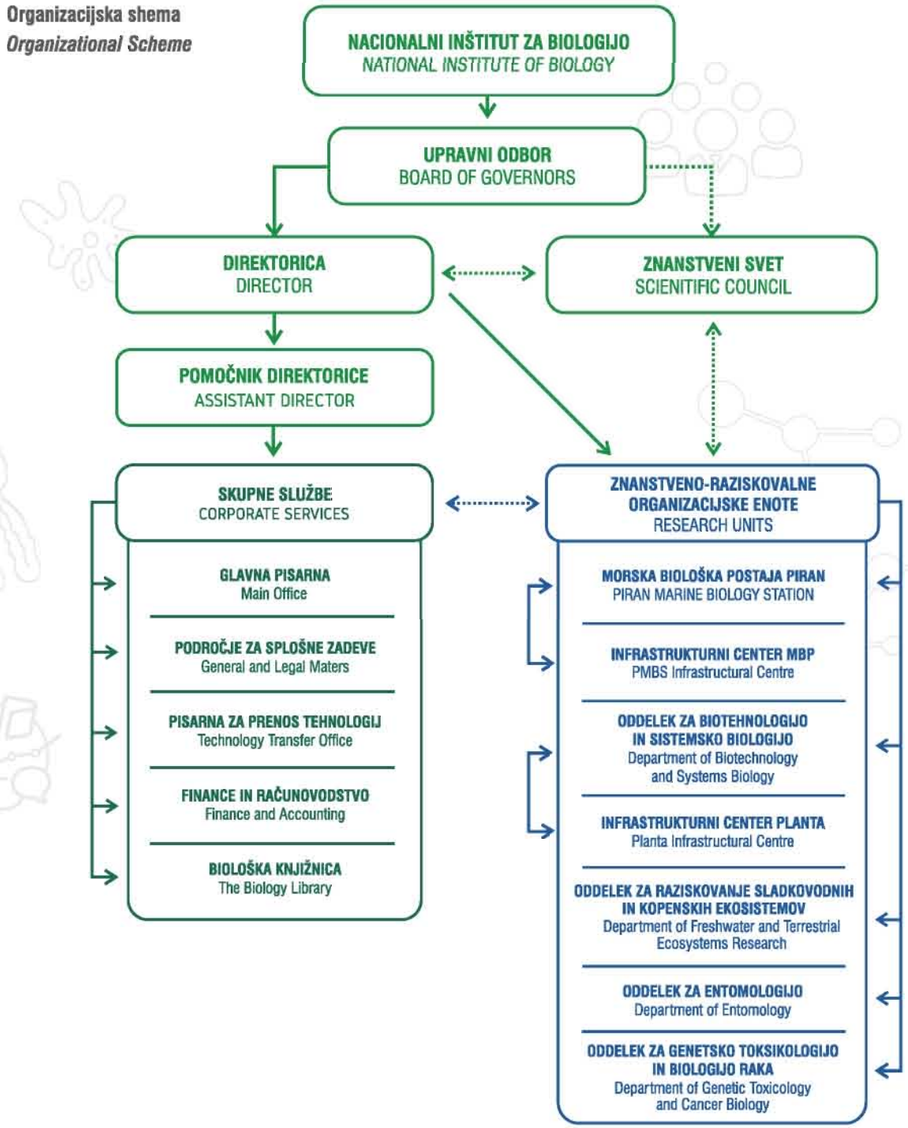
doc. dr. Meta Virant-Doberlet
podpredsednica / vice-president

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

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

Organizacijska shema
Organizational Scheme



PREGLED POSLOVANJA INŠTITUTA V LETU 2015

NIB je leta 2015 ustvaril prihodke v vrednosti 6.169.099 EUR in odhodke v vrednosti 6.141.138 EUR. Ustvarjeni presežek prihodkov nad odhodki pred obračunom davka iz dejavnosti je tako znašal 27.961 EUR oz. 24.367 EUR po obračunanem davku.

Poslovanje NIB je leta 2015 zaznamoval precejšen upad prihodkov v primerjavi z letom 2014 – za 616.487 EUR oz. 9,09 %, posledično se je zmanjšalo tudi število zaposlenih – za 10 sodelavcev.

Največji upad prihodkov je nastal pri projektih iz evropskih skladov, v sklop katerih spadajo 7. Okvirni program EU oz. Obzorje 2020, različni programi INTERREG, LIFE+, ERA-NET, EMPIR in podobni. V tej kategoriji so bili prihodki leta 2015 v primerjavi z letom 2014 nižji za 433.151 EUR oz. za 36,73 %. Razlog za tolikšno zmanjšanje prihodkov je v končanju več projektov iz navedenih programov. Pri tem so bile možnosti za pridobitev novih projektov iz navedenih programov oz. shem financiranja zelo omejene, delno zaradi najmanj enoletne vrzeli pri razpisih (večina shem), delno pa zaradi precej povečane konkurenčnosti in posledično uspešnosti prijav predlogov projektov.

Ob prizadevanju za čim večjo možno ohranitev kadrovskega potenciala, ki je njegovo najpomembnejše bogastvo, je bil NIB v navedenih finančnih okvirih leta 2015 prisiljen poslovati skrajno gospodarno in učinkovito.

NIB je bil leta 2015 uspešen pri prijavi predlogov projektov na razpisu ARRS: odobrenih je bilo pet projektov z njegovim nosilstvom, v štirih pa je nastopal kot sodelujoča organizacija. Zelo intenzivno je sodeloval v prijavah predlogov projektov v Obzorju 2020 in drugih evropskih shemah financiranja. Uspelo mu je pridobiti en projekt iz Obzorja 2020, enega iz programa EMPIR, enega iz ERA-NET in enega v sklopu mreže EMODNET. Razen projekta iz Obzorja 2020 se vsi drugi začenjajo izvajati leta 2016.

2015 BUSINESS REPORT – OVERVIEW

In 2015 the NIB created an income of 6.169.099 EUR and an outcome of 6.141.138 EUR. The profit thus amounted to 27.961 EUR before business tax and 24.367 EUE after tax.

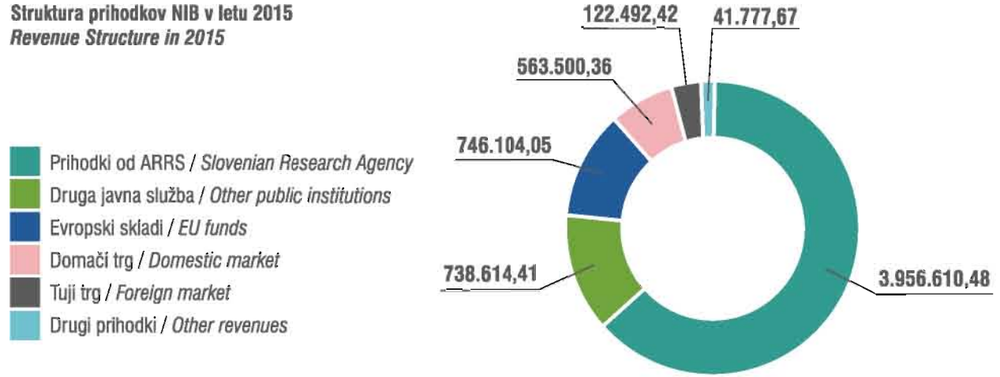
In comparison to that of 2014, the NIB business year 2015 was marked by a significant reduction of income amounting to 616.478 EUR or 9.09%. This resulted in staff reductions - termination of work contracts with 10 employees.

The most significant income reduction occurred in the area of EU project funding including the 7th EU Framework Programme or Horizon 2020, various INTERREG programmes, LIFE+, ERA-NET and EPIR programmes etc. In this particular category the income in 2015 was 433.151 EUR or 36.73% lower than that of 2014. The reduction resulted from the completion of several projects funded by the programmes listed above. Simultaneously, the opportunities to attract new project funds from EU programmes were severely limited, which was partly due to a one-year gap in publishing calls for applications (most schemes), and partly a result of greatly increased competition affecting the success rate of project proposals.

Making every effort to preserve the human resources, the NIB's most important asset, to a maximum extent in the financial circumstances of 2015, NIB was bound to operate in an extremely economical and efficient way.

In 2015, the NIB was successful at attracting project funding from the Slovenian Research Agency. Five (5) projects with the NIB as project coordinator were endorsed and a further four (4) where the NIB cooperated as partner organisation. Intensive efforts were devoted to submitting project proposals in the scope of Horizon 2020 and other EU financing schemes. The successful applications include one (1) project in the scope of Horizon 2020, one (1) from each, EMPIR and ERA-NET programmes and a further one (1) project in the scope of EMODNET network. All projects except the one financed by Horizon 2020 will commence in 2016.

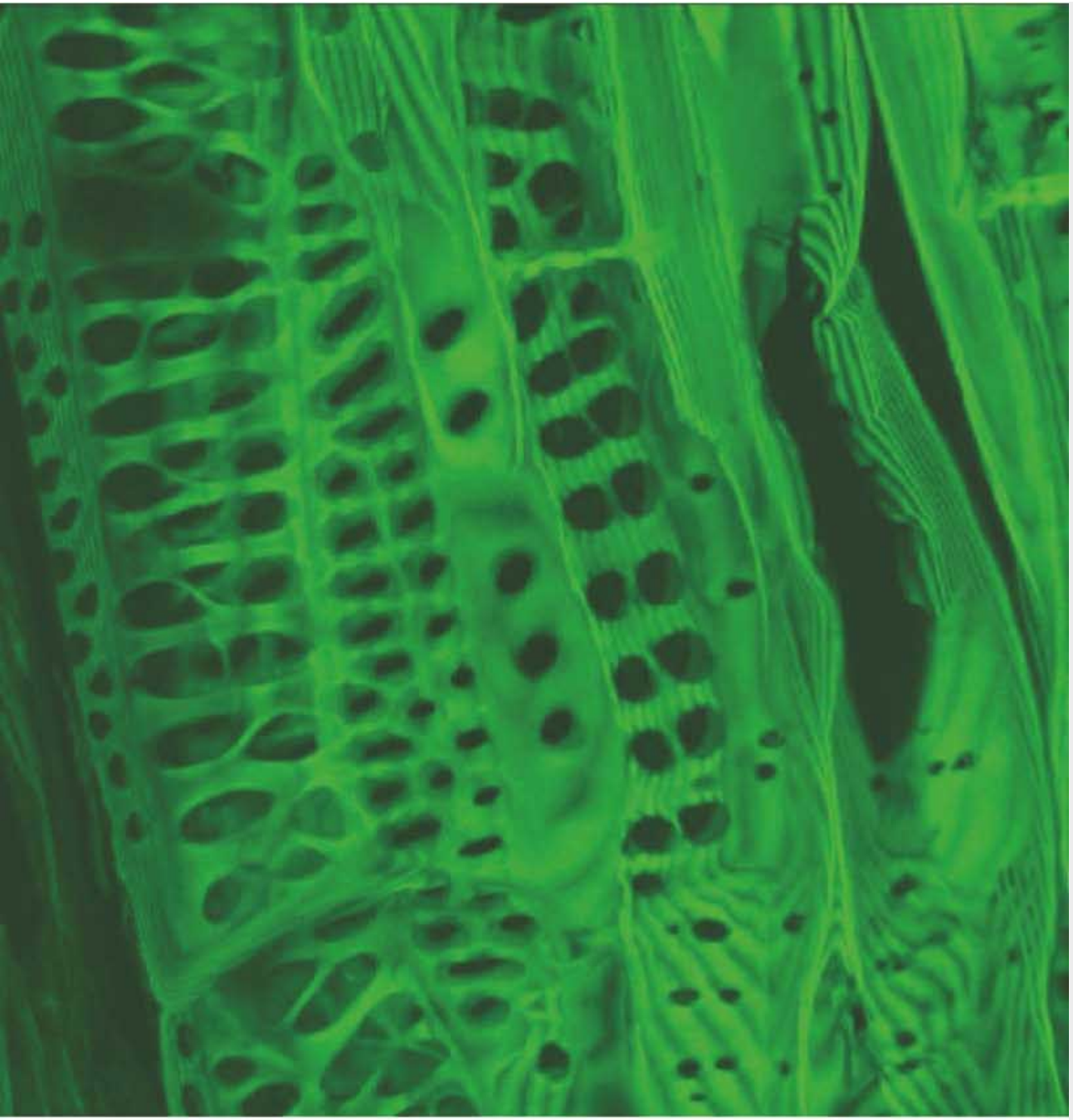
Struktura prihodkov NIB v letu 2015
Revenue Structure in 2015



PRIHODKI V EUR / REVENUES IN EUR	2015	2014	STRUKTURA 2015 (%) STRUCTURE (%)	INDEKS 2015/14 INDEX 2015/14
Prihodki od ARRS / *Slovenian Research Agency*	3.956.610,48	3.877.214,40	57,14	102,05
Druga javna služba / *Other public institutions*	738.614,41	851.495,02	12,55	86,74
Evropski skladi / *EU funds*	746.104,05	1.179.254,81	17,38	63,27
Domači trg / *Domestic market*	563.500,36	567.228,19	8,36	99,34
Tuji trg / *Foreign market*	122.492,42	253.245,87	3,73	48,37
Drugi prihodki / *Other revenues*	41.777,67	57.147,52	0,84	73,10
Skupaj prihodki / *Total revenues*	**6.169.099,39**	**6.785.585,81**	**100,00**	**90,91**

ODHODKI V EUR / EXPENSES IN EUR	2015	2014	STRUKTURA 2015 (%) STRUCTURE (%)	INDEKS 2015/14 INDEX 2015/14
Stroški dela / *Labour*	3.657.506,23	3.881.638,43	59,57	94,23
Stroški amortizacije / *Amortization*	435.607,30	450.156,97	7,09	96,77
Stroški materiala / *Material*	630.943,27	794.247,97	10,27	79,44
Stroški storitev / *Services*	1.303.839,09	1.498.102,93	21,23	87,03
Drugi stroški in odhodki / *Other*	113.241,93	102.047,47	1,84	110,97
Skupaj odhodki / *Total expenditure*	**6.141.137,82**	**6.726.193,77**	**100,00**	**91,30**

REZULTAT POSLOVANJA / *BUSINESS RESULT*	**27.961,57**	**59.392,04**



▶ Rastlinski ksilem, kot je viden s konfokalnim mikroskopom. / *Plant xylem as seen under the confocal microscope.*

IZVAJANJE RAZISKOVALNIH PROGRAMOV IN PROJEKTOV V LETU 2015

Kot nosilec je NIB leta 2015 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, odnosi in komunikacije v ekosistemih**, ki poteka v organizacijski enoti EKO in ENTOMO (8,69 FTE) ter v sodelujoči organizaciji Prirodoslovnega muzeja Slovenija (0,1 FTE), obdobje financiranja 2014–2016;
- **P1-0245 – Ekotoksikologija, toksikološka genomika in karcinogeneza**, ki se 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 FTE 0,32 za NIB.

V primerjavi z letom 2014 je bil obseg financiranja raziskovalnih programov leta 2015 večji za 3,02 %.

NIB je leta 2015 izvajal tudi infrastrukturni program v obsegu 6 FTE.

NIB je leta 2015 izvajal 13 projektov ARRS v skupnem obsegu 12.366 raziskovalnih ur, in sicer:

- 5 temeljnih (1 kot nosilec),
- 6 aplikativnih (1 kot nosilec),
- 1 podoktorski projekt in
- 1 projekt, sofinanciran po komplementarni shemi (kot nosilec).

RESEARCH PROGRAMMES AND PROJECTS IN 2015

In 215 the NIB acted as coordinator of the following research programmes:

- ***P1-0237 – »Coastal sea research«** (7.78 FTE), carried out in PMBS 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, relations and communications in the ecosystem«** (8.69 FTE), carried out in EKO and ENTOMO organisation units in cooperation with Natural History Museum of Slovenia (0.1 FTE), duration 2014-2016;*
- ***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, PMBS 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 the NIB as partner organisation with 0.32 FTE.*

In comparison to 2014, the extent of financing of research programmes increased per 3.02%.

In addition, an infrastructure programme (6 FTE) was carried out at the NIB in 2015.

In 2015, 13 projects funded by the Slovenian Research Agency were carried out at the NIB, with research time amounting in total to 12,366 working hours in the scope of:

- *five (5) basic research projects (one (1) as coordinator)*
- *six (6) applicative research projects (one (1) as coordinator)*
- *one (1) postdoctoral project*
- *one (1) project co-financed in an ERC Complementary Scheme (as coordinator)*

Obseg projektov, ki jih je financiral ARRS, je bil leta 2015 za 13,66 % manjši v primerjavi s preteklim letom.

NIB je leta 2015 izvajal 4 projekte v sklopu CRP Zagotovimo.si hrano za jutri v skupni vrednosti 30.535 EUR, in sicer:

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

Obseg projektov CRP se je po obsegu sredstev leta 2015 v primerjavi s preteklim letom zmanjšal za 22,06 %.

Leta 2015 je NIB izvajal 8 projektov 7. Okvirnega programa EU in programa Obzorje 2020, od katerih so se leta 2015 končali 4, 1 pa se je začel izvajati. Vrednost ustvarjenih prihodkov pri teh projektih je znašala 272.144 EUR, kar pomeni 4,41 % vseh prihodkov NIB.

Leta 2015 je NIB izvajal 10 projektov iz drugih mednarodnih shem financiranja (Inter-Reg, ERANET, EURAMET, LIFE+ in drugih). Vrednost ustvarjenih prihodkov s temi projekti je bila 473.960 EUR in je pomenila 7,68 % vseh prihodkov.

In 2015 the financing of the NIB projects by the Slovenian Research Agency was 13.66% lower in comparison to the previous year.

Four (4) projects in the scope of the target research project »Ensuring food for tomorrow«, with total funds amounting to 30,535 EUR, were carried out at the NIB in 2015. In one (1) NIB acted as coordinator and in three (3) as participating research organisation.

The scale of financing from target research projects was 22.06% lower in comparison to that in the previous year.

In 2015 the NIB carried out eight (8) projects in the scope of the EU 7th Framework Programme and Horizon 2020, 2015 was the concluding year for four (4) of those projects and one (1) had started. The income from this segment amounted to 272,144 EUR and represented 4.41% of total NIB yearly income.

Ten (10) NIB projects were financed by other international funding schemes (INTERREG, ERANET, EURAMET, LIFE+ etc.). The income from this segment amounted to 473,960 EUR and represented 7.68% of total NIB yearly income.

INVESTICIJE V LETU 2015

Leta 2015 je inštitut realiziral investicijska vlaganja v vrednosti 861.585,92 EUR, od tega z lastnimi sredstvi za 334.371,77 EUR in s sofinanciranji za 527.214,15 EUR. Pretežni del sofinanciranj je bilo financiranje gradnje raziskovalnega rastlinjaka v vrednosti 485.714 EUR, in sicer 85 % iz sredstev Evropskega sklada za regionalni razvoj in 15 % iz sredstev Republike Slovenije.

Med novimi pridobitvami raziskovalne opreme višje vrednosti so predvsem:

- aparat za avtomatizirano pripravo in analizo kapljične digitalne verižne reakcije s polimerazo (ddPCR),
- aparatura za merjenje molekulskih interakcij na podlagi površinske plazmonske resonance,
- HF-radijski oddajnik za PI-zaliv (WERA).

INVESTMENTS IN 2015

In 2015 the NIB invested a total of 861,585.92 EUR, out of which 334,371.77 EUR originated from internal funds and 527,214.15 EUR was provided through co-financing. The most substantial proportion of co-financing funds was used to build a research greenhouse, the construction which cost 485,714 EUR out of which 85% were provided by the European Regional Development Fund and 15% by the Republic of Slovenia.

Major investments into research equipment, newly acquired in 2015, include:

- *automated system for sample manipulation and droplet digital polymerase chain reaction (ddPCR),*
- *surface plasmon resonance-based system for measuring molecular interactions,*
- *HF radio transmitter for Bay of Piran (WERA).*

ZAPOSLENI V LETU 2015

Inštitut je bil leta 2015 sestavljen iz petih raziskovalnih enot in Skupnih služb. Zaposleni v največjih dveh enotah pomenijo 60 % vseh zaposlenih na NIB. Oddelek za biotehnologijo in sistemsko biologijo (FITO) je zaposloval 37 sodelavcev, enota Morska biološka postaja Piran (MBP) pa 34. Preostale enote so imele manj zaposlenih, in sicer: Oddelek za raziskovanje sladkovodnih in kopenskih ekosistemov (EKO) 11, Oddelek za genetsko toksikologijo in biologijo raka (GEN) 13 sodelavcev, Oddelek za entomologijo (ENTOMO) 7, Skupne službe (SS) pa 16 sodelavcev.

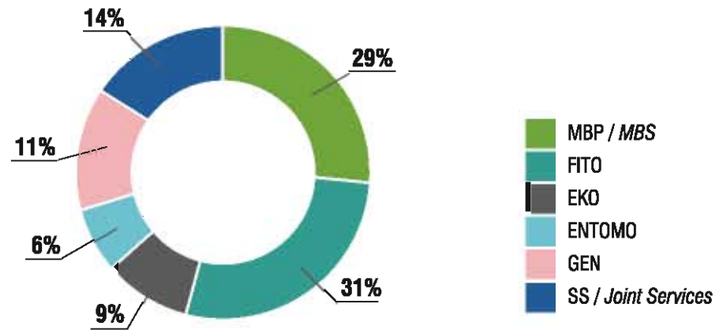
Na NIB je bilo tako 118 zaposlenih na dan 31. 12. 2015, od tega 61 raziskovalcev, 18 mladih raziskovalcev, 22 strokovno-tehničnih sodelavcev in 18 administrativnih sodelavcev.

Leta 2015 se je na novo zaposlilo 6 sodelavcev, 20 pa je delovno razmerje na NIB prenehalo.

HUMAN RESOURCES IN 2015

The NIB consists of 5 research departments and Joint Services. In 2015, the staff of the two largest departments, Department of Biotechnology and Systems Biology (FITO) with 37 employees and Piran Marine Biology Station (PMBS) with 34 employees, represented 60% of all the NIB employees. Other, smaller departments including Department of Freshwater and Terrestrial Ecosystems Research (EKO), Department of Genetic Toxicology and Cancer Biology (GEN), Department of Entomology (ENTOMO) and Joint Services had 11, 13, seven (7) and 16 employees respectively.

On 12 December 2015 NIB had 118 employees: 61 researchers, 18 early-stage researchers, 22 technicians and 18 administrative staff.



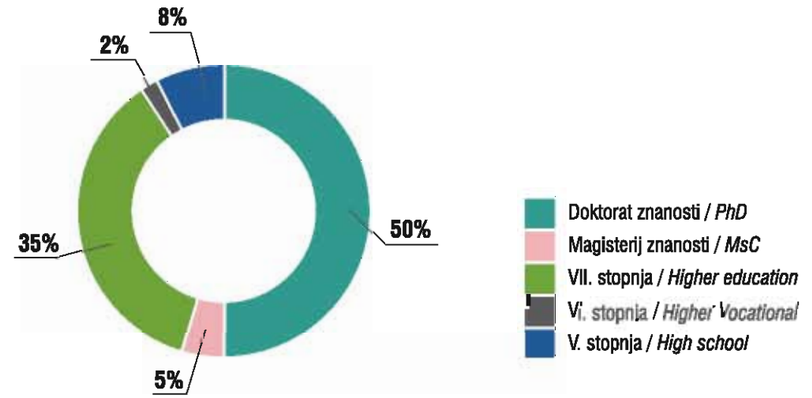
Stanje po organizacijskih enotah na 31. 12. 2015
Proportion of NIB employees in different departments on December 31, 2015.

Leta 2015 je doktoriralo 5 mladih raziskovalcev, usposabljati pa so se začeli 3 mladi raziskovalci.

Na 31.12. 2015 je imelo doktorat znanosti 59 zaposlenih, 6 jih je bilo zaposlenih z magisterijem znanosti, 41 je bilo visoko izobraženih, 3 višje izobraženi, 9 zaposlenih pa je imelo doseženo srednjo izobrazbo.

In 2015 six (6) employees were newly hired and 20 had finished their career at the Institute. Five (5) early-stage researchers finished their PhDs and three (3) early-stage researchers started their training.

On 31 December 2015, 59 employees had a PhD, six (6) had a MSc, 41 higher education, three (3) higher vocational education and nine (9) had finished high school.



Izobrazbena struktura
Educational structure of NIB human resources

DOKTORATI, MAGISTERIJI IN DIPLOME V LETU 2015

DOCTORAL DISSERTATIONS, MASTER'S THESES AND UNDERGRADUATE THESES IN 2015

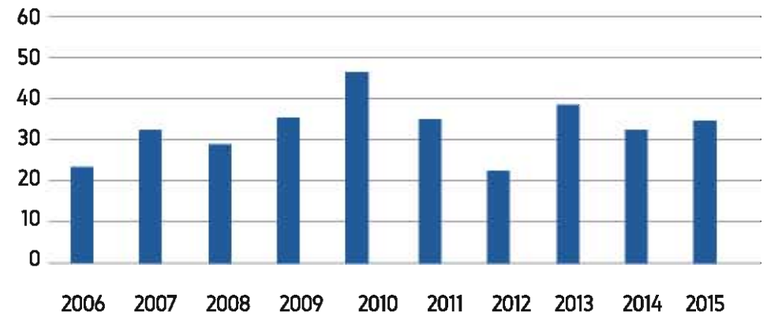
Svojo doktorsko disertacijo so pripravili pod (so)mentorstvom raziskovalcev z NIB in jo leta 2015 zagovarjali:

Doctoral dissertations under the (co)supervision of NIB researchers in 2015:

ŠTUDENTI / STUDENT	MENTOR, SOMENTOR (SUPERVISOR, CO-SUPERVISOR)
Blas, Marjanca	prof. dr. Kristina Gruden
Cigoj, Maja	izr. prof. dr. Maruša Pompe Novak, (izr. prof. dr. Paolo Sivilotti)
Erjavec, Jana (NIB)	izr. prof. dr. Maja Ravnikar
Herman, Ana	dr. Matjaž Jeras; (prof. dr. Kristina Gruden)
Jež, Anastazija	izr. prof. dr. Maruša Pompe Novak, (izr. prof. dr. Paolo Sivilotti)
Kuhelj, Ana	doc. dr. Meta Virant-Doberlet
Mencin, Nina	prof. dr. Kristina Gruden, (dr. Jan Mavri)
Penko, Ana	prof. dr. Lea Demšar, (doc. dr. Bojana Žegura)
Rački, Nejc (NIB)	izr. prof. dr. Maja Ravnikar, (dr. Ion Gutierrez-Aguirre)
Ramšak, Živa (NIB)	prof. dr. Kristina Gruden
Šmid, Ida (NIB)	izr. prof. dr. Jana Žel, (prof. dr. Kristina Gruden)

Število diplomskih, magistrskih in doktorskih nalog pod (so)mentorstvom raziskovalcev z Nacionalnega inštituta za biologijo v obdobju 2006–2015.

Number of Undergraduate Theses, Master's Theses and Doctoral Dissertations under (co)supervision of NIB researchers in years 2006-2015:



Število zagovarjanih magistrskih in doktorskih nalog ter mentorstev in somentorstev zaposlenih na NIB leta 2015.

Number of Master's Theses, Doctoral Dissertations, supervisions and co-supervisions by NIB employees in 2015.

magistska naloga / *Master's Thesis*	1
doktorska disertacija / *Doctoral Dissertation*	4
mentor pri doktorskih disertacijah / *Supervisor for Doctoral Dissertations*	9
mentor pri magistrskih delih / *Supervisor for Master's Thesis*	13
mentor pri diplomskih delih / *Supervisor for Undergraduate Theses*	14
somentor pri doktorskih disertacijah / *Co-Supervisor for Doctoral Dissertations*	4
somentor pri magistrskih delih / *Co-Supervisor for Master's Thesis*	7
mentor pri diplomskih delih / *Co-Supervisor for Undergraduate Theses*	1

OBJAVE IN CITIRANOST V LETU 2015

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

Leta 2015 smo z 98 znanstvenimi članki nadaljevali pozitiven trend naraščanja števila objavljenih znanstvenih člankov. Povprečni faktor vpliva ostaja v okviru prejšnjih let, vendar umeščenost revij objave v področne četrtine po JCR kaže postopno pomikanje proti prvi četrtini. Število čistih citatov, ki so pomemben kazalnik znanstvene uspešnosti, se vsako leto povečuje.

PUBLICATIONS AND CITATIONS IN 2015

Published articles (Original Scientific Articles, Review Articles 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.

In 2015 we published 98 scientific articles and have thereby continued the positive increasing trend of the number of scientific publications. The average IF remained stable, compared to previous years, but the average journal quarter position by JCR shows a gradual transition towards the first quarter. Number of pure citations, which is an important indicator of scientific efficiency, is increasing from year to year.

LETO	ŠT. OBJAVLJENIH ZNANSTVENIH ČLANKOV	POVPREČNI IF (JCR)	POVPREČNA UMEŠČENOST REVIJE V ČETRINE PO JCR	ŠTEVILO ČISTIH CITATOV
YEAR	NO. OF PUBLISHED SCIENTIFIC ARTICLES	AVERAGE IF (JCR)	AVERAGE JOURNAL QUARTER POSITION (JCR)	NO. OF PURE CITATIONS
2011	81	2,687	2	1344
2012	102	2,511	2	1644
2013	90	2,682	2	1780
2014	92	2,735	2	2313
2015	98	2,604	2	2363

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

VERBOVŠEK, Urška, NOORDEN, Cornelis J. F. van, LAH TURNŠEK, Tamara.
Complexity of cancer protease biology: cathepsin K expression and function in cancer progression. Seminars in cancer biology, ISSN 1044-579X, 2015, vol. 35, str. 71-84, doi: [COBISS.SI-ID 3652943]
IF (JCR) =9,33

MOTALN, Helena, KOREN, Ana, GRUDEN, Kristina, RAMŠAK, Živa, SCHICHOR, Christian, LAH TURNŠEK, Tamara.
Heterogeneous glioblastoma cell cross-talk promotes phenotype alterations and enhanced drug resistance. Oncotarget, ISSN 1949-2553, 2015, vol. 6, no. 38, str. 40998-41017, ilustr., [COBISS.SI-ID 3643471]
IF (JCR) =6,359)

TINTA, Tinkara, VOJVODA, Jana, MOZETIČ, Patricija, TALABER, Iva, VODOPIVEC, Martin, MALFATTI, Francesca, TURK, Valentina.
Bacterial community shift is induced by dynamic environmental parameters in a changing coastal ecosystem (northern Adriatic, northeastern Mediterranean Sea) - a 2-year time-series study. Environmental microbiology, ISSN 1462-2912. [Print ed.], 2015, vol. 17, no. 10, str. 3581-3596, ilustr. [COBISS.SI-ID 3156559]
IF (JCR) =6,201

DOBNIK, David, SPILSBERG, Bjorn, BOGOŽALEC KOŠIR, Alexandra, HOLST-JENSEN, Arne, ŽEL, Jana.
Multiplex quantification of 12 European Union authorized genetically modified maize lines with droplet digital polymerase chain reaction. Analytical chemistry, ISSN 0003-2700. [Print ed.], 2015, vol. 87, iss. 16, str. 8218-8226, [COBISS.SI-ID 3540559]
IF (JCR) =5,636

SITAR, Simona, KEJŽAR, Anja, PAHOVNIK, David, KOGEJ, Ksenija, TUŠEK-ŽNIDARIČ, Magda, LENASSI, Metka, ŽAGAR, Ema.
Size characterization and quantification of exosomes by asymmetrical-flow field-flow fractionation. Analytical chemistry, ISSN 0003-2700. [Print ed.], Sep. 2015, vol. 87, iss. 18, str. 9225-9233. [COBISS.SI-ID 5754138]
IF (JCR) =5,636

KOVÁCS, Róbert, CSENKI, Zsolt, BAKOS, Katalin, URBÁNYI, Béla, HORVATH, Akos, GARAJ-VRHOVAC, Vera, GAJSKI, Goran, GERIĆ, Marko, NEGREIRA, Noelia, LOPEZ DE ALDA, Miren, BARCELÓ, Damià, HEATH, Ester, KOSJEK, Tina, ŽEGURA, Bojana, NOVAK, Matjaž, ZAJC, Irena, BAEBLER, Špela, ROTTER, Ana, RAMŠAK, Živa, FILIPIČ, Metka.
Assessment of toxicity and genotoxicity of low doses of 5-fluorouracil in zebrafish (Danio rerio) two-generation study. Water research, ISSN 0043-1354. [Print ed.], 2015, vol. 77, str. 201-212. [COBISS.SI-ID 3417935]
IF (JCR) =5,528

KUTNJAK, Danis, RUPAR, Matevž, GUTIÉRREZ-AGUIRRE, Ion, CURK, Tomaž, KREUZE, Jan F., RAVNIKAR, Maja.
Deep sequencing of virus derived small interfering RNAs and RNA from viral particles shows highly similar mutational landscape of a plant virus population. Journal of virology, ISSN 0022-538X, 2015, vol. 89, no. 9, str. 4760-4769, [COBISS.SI-ID 3333711]
IF (JCR) =4,439

BLAŽIČ, Marko, KOSEC, Gregor, BAEBLER, Špela, GRUDEN, Kristina, PETKOVIĆ, Hrvoje.
Roles of the crotonyl-CoA carboxylase/reductase homologues in acetate assimilation and biosynthesis of immunosuppressant FK506 in Streptomyces tsukubaensis. Microbial cell factories, ISSN 1475-2859, 2015, vol. 14, no. 164, str. 1/12-12/12. [COBISS.SI-ID 4572536]
IF (JCR) =4,221

RAČKI, Nejc, KRAMBERGER, Petra, STEYER, Andrej, GAŠPERŠIČ, Jernej, ŠTRANCAR, Aleš, RAVNIKAR, Maja, GUTIÉRREZ-AGUIRRE, Ion.
Methacrylate monolith chromatography as a tool for waterborne virus removal. Journal of chromatography. A, ISSN 0021-9673, 2015, vol. 1381, str. 118-124, [COBISS.SI-ID 3299151]
IF (JCR) =4,169

RUŠČIĆ, Jelena, GUTIÉRREZ-AGUIRRE, Ion, TUŠEK-ŽNIDARIČ, Magda, KOLUNDŽIJA, S., SLANA, A., BARUT, Miloš, RAVNIKAR, Maja, KRAJAČIĆ, Mladen.
A new application of monolithic supports: the separation of viruses from one another. Journal of chromatography. A, ISSN 0021-9673, 2015, vol. 1388, str. 69-78, [COBISS.SI-ID 3344463]
IF (JCR) =4,169

VEZOČNIK, Valerija, REBOLJ, Katja, SITAR, Simona, OTA, Katja, TUŠEK-ŽNIDARIČ, Magda, ŠTRUS, Jasna, SEPČIĆ, Kristina, PAHOVNIK, David, MAČEK, Peter, ŽAGAR, Ema.
Size fractionation and size characterization of nanoemulsions of lipid droplets and large unilamellar lipid vesicles by asymmetric-flow field-flow fractionation/multi-angle light scattering and dynamic light scattering. Journal of chromatography. A, ISSN 0021-9673, Oct. 2015, vol. 1418, str. 185-191, [COBISS.SI-ID 3611727]
IF (JCR) =4,169

AL SAYEGH-PETKOVŠEK, Samar, KOPUŠAR, Nataša, TOME, Davorin, KRYŠTUFEK, Boris.
Risk assessment of metals and PAHs for receptor organisms in differently polluted areas in Slovenia. Science of the total environment, ISSN 0048-9697, 2015, vol. 532, str. 404-414, ilustr. [COBISS.SI-ID 1221078]
IF (JCR) =4,099

BIBLIOGRAFIJA INŠTITUTA V LETIH 2006 – 2015 (ANALITIČNI PODATKI)
NIB BIBLIOGRAPHY 2006 – 2015 (ANALYTICAL DATA)

ZVRST DOKUMENTA TYPE OF DOCUMENT	LETA / YEARS 2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	SKUPAJ
znanstveni članki z IF *scientific papers with IF*	52	46	58	71	68	72	68	[illegible]	78	[illegible]	[illegible]
znanstveni članki brez IF *other scientific papers*	21	33	24	26	21	8	18	7	13	18	[illegible]
strokovni in poljudni članki *professional and popular articles*	22	64	63	76	56	[illegible]	[illegible]	62	46	[illegible]	[illegible]
objavljeni prispevki s kongresov *published conference papers*	26	25	25	40	43	36	18	24	16	17	270
povzetki s kongresov *published conference paper abstracts*	106	140	115	161	145	159	101	186	108	158	1417
poglavja v knjigah *book chapters*	6	3	9	12	13	10	14	28	11	9	115
knjige *books*	5	5	5	1	3	4	4	3	6	1	37
poročila *reports*	31	23	31	30	30	27	28	34	23	35	292
doktorska dela *dissertation theses*	7	6	3	4	7	8	7	9	9	4	[illegible]
magistrska dela *master's theses*		2				1	1		2	1	7
patenti *patents*	1				2	4	3	2	2	2	16
razno *other*	27	53	78	78	93	128	121	207	128	151	[illegible]
SKUPAJ	**315**	**[illegible]**	**[illegible]**	**[illegible]**	**[illegible]**	**530**	**[illegible]**	**[illegible]**	**508**	**527**	**4797**

Prispevki soavtorjev z različnih oddelkov NIB so šteti enkrat.
Papers are counted according to affiliation of the first author.

▶ Direktorica NIB, prof. dr. Tamara Lah in prejemnica Zoisove nagrade, izr. prof. dr. Kristina Gruden. (foto: MIZŠ). / NIB Director, Prof. Dr Tamara Lah Turnšek, and Zois Award recipient, Assoc. Prof. Dr Kristina Gruden. (foto: MIZŠ)

USPEHI, NAGRADE IN PRIZNANJA V LETU 2015

ZOISOVO PRIZNANJE

Ljubljana, 29. 11. 2015

Izr. prof. dr. Kristina Gruden, vodja delovne enote Omski pristopi na Oddelku za biotehnologijo in sistemsko biologijo, je prejela Zoisovo priznanje za pomembne dosežke v sistemski in molekularni biologiji. Njeno raziskovalno delo je usmerjeno v molekulske mehanizme rastlinskih bolezni in s tem povezane biotehnološke aplikacije. V središču raziskovalnega dela dr. Kristine Gruden je razvoj novih metodologij, ki ji omogočajo celostno obravnavo bioloških problemov. Je ena izmed začetnic sistemske biologije v slovenskem prostoru. Uspešno povezuje sodobne biološke eksperimentalne pristope, s katerimi se pridobijo velike količine podatkov, in bioinformatske pristope, s katerimi se ti podatki analizirajo in povezujejo.

VELIKA NAGRADA MIROSLAVA ZEIA ZA ŽIVLJENJSKO DELO

Ljubljana, 11. 11. 2015

Veliko nagrado Miroslava Zeia za življenjsko delo na področju dejavnosti NIB je za leto 2015 prejel prof. dr. Radovan Komel.

NAGRADA MIROSLAVA ZEIA ZA IZJEMNE DOSEŽKE

Ljubljana, 11. 11. 2015

Nagrado Miroslava Zeia za izjemne dosežke na področju dejavnosti NIB sta za leto 2015 prejela doc. dr. Matjaž Kuntner in izr. prof. dr. Bojan Sedmak.

Doc. dr. Matjaž Kuntner, predstojnik Biološkega inštituta Jovana Hadžija, deluje na področju arahnologije, t. j. proučevanje pajkovcev, še posebej s skupine pajkov Nephilidae. S svojimi odličnimi objavami v mednarodni znanstveni literaturi je v zadnjem obdobju pomembno prispeval k razumevanju biologije in sistematike teh živali pri nas in v svetu. Nagrado Miroslava Zeia je prejel za izjemen dosežek – odkritje novih vrst pajkov v tropih starega sveta, med njimi endemite oceanskih otokov Madagaskarja, Mavricija, Reuniona in Ryukyja, ter ogroženih ekosistemov v Avstraliji, Aziji in Afriki.

Izr. prof. dr. Bojan Sedmak, ki je v zadnjem obdobju zelo uspešen pri prenosu temeljnega znanja v gospodarstvo, je prejel nagrado za izum, ki sega na področje okoljskih tehnologij, z najvišjo stopnjo tehnološke novitosti. Rezultat timskega dela in sposobnosti izr. prof. dr. Bojana Sedmaka za komunikacijo in upravljanje med akademsko in poslovno-tehnično sfero je prijava izuma na evropskem patentnem uradu za metodo in sistem za hkratno neinvazivno zaznavanje, razlikovanje sestave, strukture in morfologije mikroskopskih naselij in združb, njihovih sprememb ter stanj s pulzno inducirano osvetlitvijo.

NAGRADA ZA IZJEMNO DOKTORSKO DELO

Ljubljana, 11. 11. 2015

Nagrado za izjemno doktorsko delo na področju dejavnosti NIB so za leto 2015 prejeli dr. Jana Erjavec, dr. Nina Prezelj in dr. Maja Rajšlič.

KRKINE NAGRADE IN PRIZNANJA

Novo mesto, 19. 10. 2015

Ena izmed prejemnic Krkinih nagrad za posebne dosežke na področju raziskovalnega dela je bila dr. Jana Erjavec, ki je nagrado prejela za doktorsko disertacijo Vpliv ekstraktov in čistih proteinov, izoliranih iz gliv (Basidiomycota), ter njihov vpliv na rastlinsko patogeno bakterijo *Ralstonia solanacearum*, pod mentorstvom izr. prof. dr. Maje Ravnikar.

NAGRADA ZA ŽIVLJENJSKO DELO NA PODROČJU VIBRACIJSKE KOMUNIKACIJE ŽUŽELK

Frankfurt, 3. 3. 2015

Prof. dr. Andrej Čokl in dr. Meta Virant-Doberlet z Oddelka za entomologijo sta na mednarodnem simpoziju Vibrational Communication in Arthropods prejela nagradi za življenjsko delo na področju vibracijske komunikacije žuželk. Nagradi, ki jo podeljujejo po izboru, v katerem sodelujejo najuglednejši raziskovalci na tem področju, sta prejela za svoje delo na področju vibracijske komunikacije stenic in škržatkov. V njem sta združila interdisciplinarni pristop, v katerem se prepletajo biofizikalne, vedenjske, ekofiziološke, nevrobiološke in molekularne raziskave. Njune raziskave so začrtale pot kompleksnim raziskavam sporazumevanja in vedenja žuželk in uvrstile Oddelek za entomologijo med vodilne raziskovalne

ACHIEVEMENTS, AWARDS AND ACKNOWLEDGMENTS IN 2015

ZOIS AWARD

Ljubljana, 29 November 2015

Assoc. Prof. Dr Kristina Gruden, head of the »omic approaches« work unit at the Department of Biotechnology and Systems Biology, received the Zois Award for important achievements in systems and molecular biology. Her research focuses on molecular mechanisms in plant diseases and the associated biotechnological applications. The core of research efforts of Dr Kristina Gruden lies in developing new methodologies that allow a holistic approach to biological research topics. She is one of the pioneers of systems biology in Slovenia and successfully links the biological experimental approach, which enables the production of large datasets, with bioinformatics, which enables data analysis and integration.

GRAND MIROSLAV ZEI LIFETIME ACHIEVEMENT AWARD

Ljubljana, 11 November 2015

The 2015 Grand Miroslav Zei Lifetime Achievement Award was awarded to Dr Radovan Komel for his work at NIB.

MIROSLAV ZEI SPECIAL ACHIEVEMENTS AWARD

Ljubljana, 11 November 2015

The 2015 NIB Miroslav Zei Special Achievement Awards were awarded to Assist. Prof. Dr Matjaž Kuntner in Assoc. Prof. Dr Bojan Sedmak.

Assist. Prof. Dr Matjaž Kuntner, head of the Jovan Hadži Biological Institute, is active in the field of arachnology, i.e. the study of arachnids, particularly spiders of the Nephilidae family. His excellent publications in international scientific journals have recently made significant contributions to our understanding of biology and systematics of these animals in Slovenia and worldwide. The award was presented to acknowledge his exceptional achievement – discovery of new spider species in the Old World tropics, including endemic species of oceanic islands of Madagascar, Mauritius, Reunion and Ryukyus and the endangered ecosystems in Australia, Asia and Africa.

Assoc. Prof. Dr Bojan Sedmak has recently achieved great success transferring basic scientific knowledge into economical practice. He received the award to acknowledge his invention in the field of environmental technology distinguished by the highest level of technological development. The result of team work and the ability of Dr Sedmak to communicate and mediate among the spheres of academia and business/technology is filing in a patent application at the EU Patent Office for a method and system of simultaneous non-invasive detection and determination of the state of microscopic assemblages and communities in terms of composition, structure and morphology as well as their changes by means of pulse-induced illumination.

OUTSTANDING DOCTORAL DISSERTATION AWARD

Ljubljana, 11 November 2015

In 2015 the NIB Outstanding Doctoral Dissertation awards were awarded to Dr Jana Erjavec, Dr Nina Prezelj and Dr Maja Rajšlič.

KRKA AWARDS AND ACKNOWLEDGEMENTS

Novo mesto, 19 October 2015

Dr Jana Erjavec, winner of the outstanding doctoral dissertation award, was also among the recipients of the special research achievements award of Krka Plc for her doctoral dissertation entitled Influence of protein extracts and pure proteins isolated from fungi (Basidiomycota) and their activity against plant pathogenic bacterium Ralstonia solanacearum, produced under the supervision of Assoc. Prof. Dr Maja Ravnikar.

LIFETIME ACHIEVEMENT AWARD IN THE FIELD OF VIBRATIONAL COMMUNICATION IN INSECTS

Frankfurt, 3 March 2015

Prof. Dr Andrej Čokl and Dr Meta Virant-Doberlet from the Department of Entomology received lifetime achievement awards at the international symposium entitled »Vibrational Communication in Arthropods«. The award was presented according to a selection made by some of the field's most acclaimed researchers, for their achievements in the field of vibrational communication in true bugs and cicadas, which they approach in an interdisciplinary manner, intertwining biophysics, ethology, ecophysiology, neurobiology and molecular research. Their work has paved the way for complex insect communication and behaviour studies and placed the Department of Entomology among the leading world research groups performing basic and applicative research in the field of vibrational communication in arthropods.

skupine na področju vibracijske komunikacije členonožcev v svetu na področju temeljnih in tudi aplikativnih raziskav.

LAPAJNETOVA PLAKETA

Portorož, 17. 9. 2015

Prof. dr. Marina Dermastia je prejela Lapajnetovo plaketo za zasluge pri uveljavljanju slovenske biokemije in molekularne biologije daleč onstran meja znanosti, podeljuje pa jo Slovensko biokemijsko društvo.

SREBRNA ZNAČKA ZA POSEBNE ZASLUGE NA PODROČJU VARSTVA RASTLIN

Ptuj, 3. 3. 2015

Prof. dr. Maja Ravnikar je prejela srebrno značko za posebne zasluge na področju varstva rastlin, ki jo podeljuje Društvo za varstvo rastlin Slovenije. Nagrado je prejela za svoje dolgoletno delo na NIB in v sklopu Društva za varstvo rastlin Slovenije, ki pušča trajne sledi na področju varstva rastlin v Sloveniji.

ODPRTJE RAZISKOVALNEGA RASTLINJAKA

Ljubljana, 18. 11. 2015

Novembra 2015 so slavnostno odprli raziskovalni rastlinjak, s katerim je NIB pridobil ustrezno delovno okolje za izvajanje raziskav in analiz na področju biologije in biotehnologije v nadzorovanih razmerah, ki so podobne tistim iz produkcijskih rastlinjakov in iz narave (polja, vinogradi, sadovnjaki). S tem se bodo raziskave približevale potrebam končnih uporabnikov, hkrati pa bodo z dejavnostmi v novem rastlinjaku nastajale tudi nove sinergije znanj. Raziskovalno delo v rastlinjaku, povezano z gojenjem rastlin, bo tudi podlaga za različne nove izobraževalne in promocijske dejavnosti.

MONOGRAFIJA PROF. DR. ANTONA BRANCLJA: JAMA VELIKA PASICA – ZGODOVINA, OKOLJE IN ŽIVLJENJE V NJEJ

November 2015

V založbi ZRC in NIB kot soizdajatelja je izšla monografija Jama Velika Pasica – zgodovina, okolje in življenje v njej, ki je pomemben prispevek k poznavanju ekologije epikaršega območja. V njej so opisani rezultati osemletnih nepretrganih sistematičnih raziskav abiotskih parametrov in zooloških vzorčenj.

LAPAJNE PLAQUE

Portorož, 17 September 2015

Prof. Dr Marina Dermastia *received the Lapajne Plaque, awarded by the Slovene Biochemical Society, for her accomplishments in the promotion of Slovenian biochemistry and molecular biology in the international scientific realm.*

SILVER BADGE FOR SPECIAL ACHIEVEMENTS IN THE FIELD OF PLANT CONSERVATION

Ptuj, 3 March 2015

The Society for Plant Conservation awarded the Silver Badge to prof. Dr Maja Ravnikar for her accomplishments in the field of plant conservation. She was acknowledged for her years of work at NIB and as member of the Society for Plant Conservation, which have left an enduring mark in the field of plant conservation in Slovenia.

RESEARCH GREENHOUSE OPENING

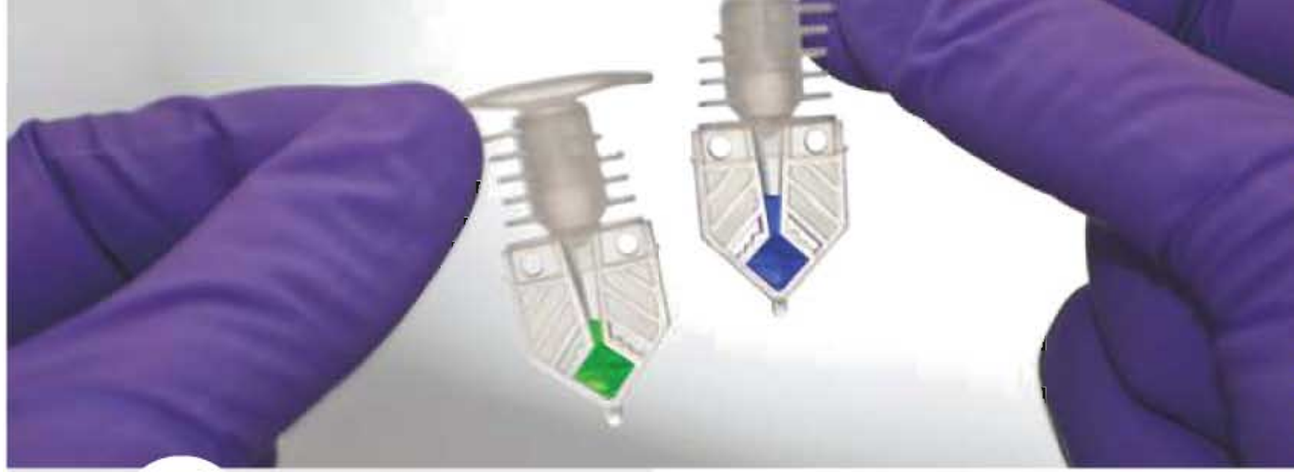
Ljubljana, 18 November 2015

In November 2015 a ceremony was held at the opening of the research greenhouse at NIB. The new acquisition provides suitable working environment to perform studies in the field of biology and biotechnology in a controlled environment with a capacity to simulate the conditions in economical greenhouses or in nature (fields, vineyards, orchards). This will allow for research to closely approach the requirements of end users, while activities performed in the new greenhouse will simultaneously produce new synergy of knowledge. Research linked to plant cultivaton, that will take place in the greenhouse, will also serve as the basis for various new educational and promotional activities.

MONOGRAPH THE VELIKA PASICA CAVE – THE HISTORY, ENVIRONMENT AND LIFE IN IT BY PROF. DR ANTON BRANCELJ

November 2015

ZRC Publishing and NIB co-published the monograph The Velika Pasica Cave – The History, Environment and Life in it, which represents an important contribution to our understanding of the ecology of the epikarst area. It discusses the results of a continuous systematic eight-year study of abiotic parameters and zoological sampling.



IZUMI IN INOVACIJE

Izumi in inovacije so za NIB izrednega pomena, saj pomenijo steber sodelovanja z gospodarstvom, ki je eden izmed dolgoročnih ciljev NIB, opredeljenih v *Programu dela NIB za obdobje 2014–2018*. Na NIB se z izumi in inovacijami ukvarjata Komisija za izume, ki jo vodi dr. David Dobnik, in Pisarna za prenos tehnologij, ki jo vodi mag. Mirjana Oblak.

Leta 2015 je NIB vložil 1 patentno prijavo na Evropski patentni urad (EPO):

Dr. Bojan Sedmak je v sodelovanju s partnerji (Arhel, d. o. o., Univerza v Ljubljani in Envit, d. o. o.) razvil Metodo in sistem za sočasno zaznavanje koncentracije mikrodelcev v suspenziji in njihovih morfoloških in fizioloških značilnosti. Izum omogoča neinvazivno razlikovanje sestave, strukture in morfologije mikroskopskih množic in združb, njihovih sprememb in stanj s pulzno inducirano osvetlitvijo. Ena glavnih prednosti izuma je neinvazivnost, saj izum temelji na uporabi svetlobe, ki omogoča proučevanje delcev in mikroorganizmov, ne da bi posegali v trenutne razmere, kar omogoča opazovanje obnašanja in spreminjanja stanja v specifičnem okolju. Izum je uporaben na vseh področjih raziskav, sledenja, diagnosticiranja in nadziranja mikrodelcev kot npr. pri spremljanju biološkega stanja voda, v industriji pri raziskovanju obnašanja mikro in nanodelcev v različnih razmerah, v medicini pri celični in tumorski biologiji ipd.

INVENTIONS AND INNOVATIONS

At NIB, inventions and innovations are of paramount importance, they represent one of the main pillars in collaboration with industry – which is one of the long-term objectives of NIB as set in NIB Work Programme for the Period 2014-2018. NIB innovations are managed by the Invention Committee, chaired by Dr David Dobnik, and the Technology Transfer Office, led my Mirjana Oblak, M.Sc.

In 2015 NIB filed in one (1) patent application at European Patent Office (EPO).

Dr Bojan Sedmak, in collaboration with partners (Arhel Ltd., University of Ljubljana and Envit Ltd.), developed a method and system for simultaneous detection of micro-particle concentration in suspension and determination of their morphological and physiological traits. The invented method and system device allow maintenance of particles in suspension without interference with their structure. The slow mixing in the detection chamber transforms the highly turbulent flow into a steady unidirectional flow that passes through the detection system. Photodiodes detect the average signal carrying additional information from the area of maximal detection. The detector forwards the average signal containing additional information on morphological and physiological characteristics of micro-particles. The method is applicable in all areas of research, detection, diagnosing and monitoring of aggregated micro-particles, such as water quality monitoring, cell and tumour biology etc.

PRENOS ZNANJA V GOSPODARSTVO

S trženjem produktov in storitev na NIB se sistemsko ukvarja Pisarna za prenos tehnologij, ustanovljena leta 2010. NIB na področju prenosa tehnologij sodeluje s Pisarnami za prenos tehnologij na Institutu Jožef Stefan, Kemijskem inštitutu, Univerzi v Ljubljani, Univerzi v Mariboru in Univerzi na Primorskem. Leta 2015 je bila v zvezi z dejavnostmi navedenih pisarn za prenos tehnologij izdana brošura Prenos tehnologij na javnih raziskovalnih organizacijah v Sloveniji. Prenos znanja in tehnologij v gospodarstvo na NIB je najintenzivnejši na področju zdravja in varne hrane, in sicer zlasti na področju modernih tehnik visokozmogljivih molekularnih tehnologij za določanje in kvantificiranje DNA v bioloških vzorcih, na področju raziskav učinkovin in pri kliničnih študijah, pri katerih se uporablja znanje NIB za nove terapije pri zdravljenju raka.

TRANSFER OF KNOWLEDGE TO THE INDUSTRY

The marketing of the NIB products and services is managed by the NIB Technology Transfer Office (TTO) established in 2010. In the field of technology transfer, the NIB also collaborates with TTOs at the Josef Stefan Institute, National Institute of Chemistry, University of Ljubljana, University of Maribor and University of Primorska; in 2015 the latter published a brochure entitled Technology Transfer at public research organizations in Slovenia. Transfer of knowledge and technologies at the NIB is most intensive in the field of health and food safety, particularly in the field of modern techniques in high-efficiency molecular technologies for determination and quantification of DNA in biological samples, in the field of substance research, and clinical studies, where the NIB knowledge is applied in new cancer therapies.

▶ Z bakterijami okužena božična zvezda. / *Poinsettia infected with bacteria.*

SKUPNE SLUŽBE

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

CORPORATE SERVICES

Corporate 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 the 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.

The Biology Library, part of the Corporate Services is managed jointly by the National Institute of Biology and the Biology Department of the Biotechnical Faculty, University of Ljubljana.

OSEBJE / STAFF

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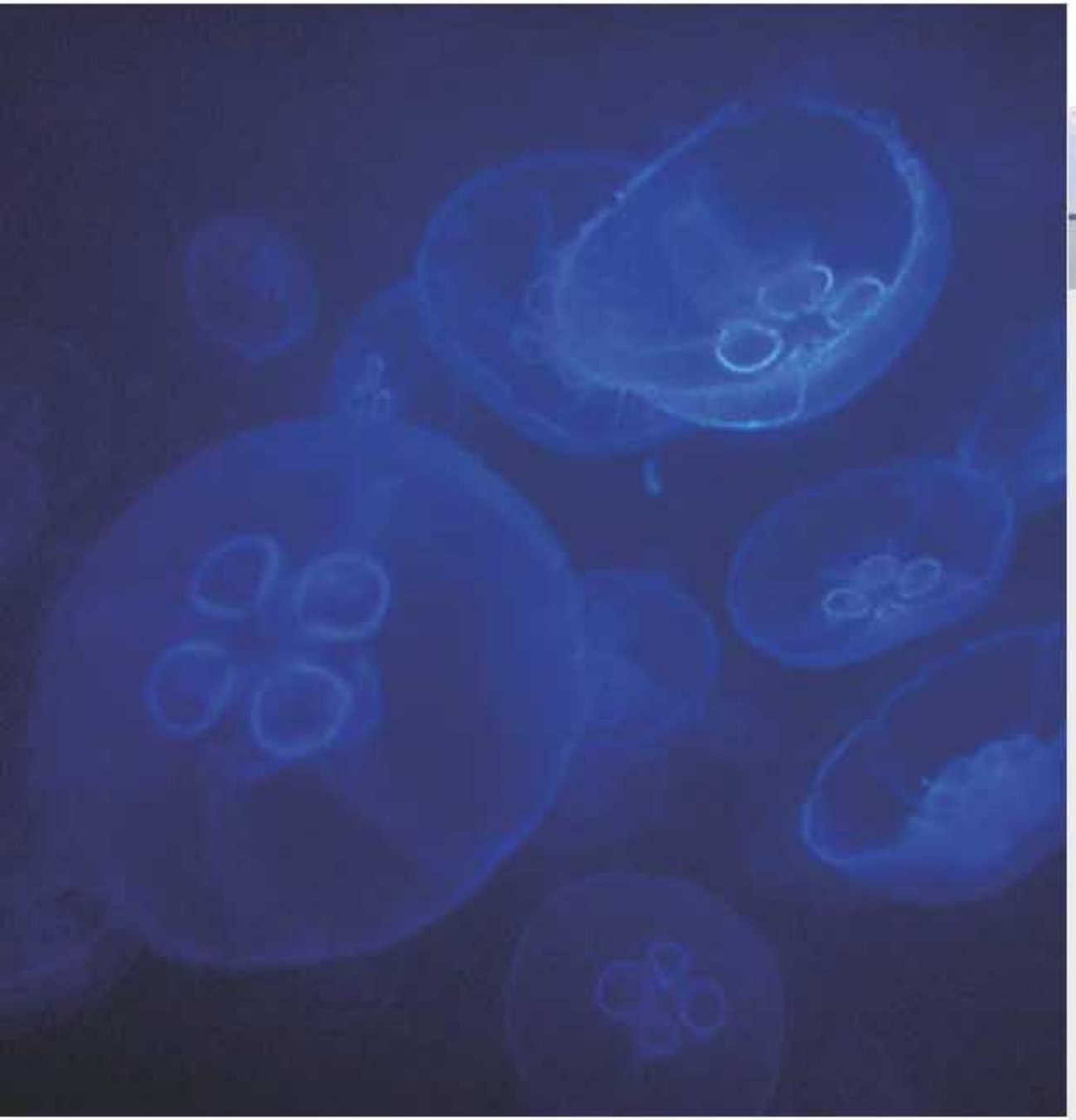
PRAVNA PISARNA / LEGAL DEPARTMENT
Tomšič, Alenka

KNJIŽNICA / LIBRARY
Čermač, Barbara
Glavač, Lučka



▶ Ulvati klobučnjak (Aurelia aurita) je vrsta klobučnjakih meduz, ki se redno pojavlja v slovenskem morju. Velikokrat se pojavljajo tudi v večjem številu in tvorijo t.i. cvetje. / *A Moon jellyfish (Aurelia aurita) is a commonly present scyphozoan jellyfish in the Slovenian sea. It is frequently present in higher numbers, forming so called jelly-clouds.*

MORSKA BIOLOŠKA POSTAJA PIRAN

SPREMENLJIVOST IN ODZIVNOST MORSKIH EKOSISTEMOV

Vodja: loc. prof. dr. Vlado Malačič

Raziskovalna dejavnost/Najpomembnejši dosežki

Leta 2015 je Morska biološka postaja (MBP) kot vodilna enota za raziskave morskih ekosistemov v Sloveniji nadaljevala multidisciplinarne, temeljne in uporabne raziskave v sklopu dveh raziskovalnih programov ter več mednarodnih in nacionalnih aplikativnih projektov. Raziskave v sklopu programov zagotavljajo temeljno znanje o ekosistemih obalnih morskih območij, na katerih se organizmi oz. ekosistemi izpostavljeni kombinaciji številnih dejavnikov, ki delujejo v različnih prostorskih in časovnih merilih.

Raziskovalni program P1-0237 Raziskave obalnega morja
V sodelovanju z Agencijo za okolje R Slovenije in raziskovalci iz tujine smo razvili prednost operativno sklopljenega modela cirkulacije Jadranskega morja z atmosferskim modelom, ki je bolje napovedal ohlajanje morja v obdobju ekstremne burje. Z metodo pokritovnega rudarjenja smo izvedli analizo disperzije meduz na severu Sredozemskega morja. Leta 2015 smo postavili prvo različico sklopljenega prostorsko-populacijskega modela ulvatega klobučnjaka. Na podlagi trirazsežnega zapora smo dobili preliminarne rezultate disperzije meduz z znanih naseljenih polipov in povezljivost med njimi.

Klobučnjaške meduze, ki so del želatinoznega planktona, so pomemben organski substrat za morske mikrobe.
V nadzorovanih laboratorijskih razmerah smo spremljali odziv izbranih vrst bakterij na organsko snov medúznega izvora in

PIRAN MARINE BIOLOGY STATION

VARIABILITY AND RESILIENCE OF MARINE ECOSYSTEMS

Head: Assoc. Prof. Dr Vlado Malačič

Research/key activities

Piran Marine Biological Station is the leading Slovenian unit for marine ecosystem research. In 2015, multidisciplinary, basic and applied research was carried out in the scope of two research programmes and several national and international applicative projects. Research performed within the two programmes produces basic knowledge on coastal marine ecosystems where organisms are exposed to a combination of many factors effective at different spatial and temporal scales.

Research programme P1-0237 "Coastal Marine Research"
In cooperation with the Slovenian Environment Agency and foreign researchers, we have exploited the advantage of the Adriatic Sea circulation model operationally coupled with the atmospheric model, which has proved more accurate at predicting sea-water cooling during a period of extreme bura (katabatic wind). We performed an analysis of jellyfish dispersion in the Mediterranean Sea using data-mining. In 2015 we set up the first version of a coupled spatial-population model of moon jellyfish. Results from three years of work allow insight into jellyfish dispersion from known polyp localities and their interconnectivities.

The moon jellyfish belong to gelatinous plankton and represent an important substrate for marine microbes. In controlled laboratory environment we monitored the response of selected species of bacteria to organic matter derived from jellyfish and observed micro-scale interactions using atomic-force microscopy. We analysed the composition of bacterial communities on jellyfish surface, which differs from that in the surrounding water, and continued our research on pathogen viruses of humane origin. We tested various methods of concentration using monolithic columns, elution procedures and detection of selected pathogens viruses using real-time polymerase chain reaction (qPCR) in samples of different salinity.

opazovali interakcije na mikro skali z mikroskopom na atomsko silo. Analizirali smo tudi sestavo bakterijske združbe na površinah meduz, ki se razlikuje od tiste v okolni vodi. Nadaljevali smo raziskave patogenih virusov človeškega izvora. Testirali smo različne metode koncentracije z monolitnimi kolonami, postopke izpiranja in detekcije izbranih patogenih virusov z metodo verižne reakcije s polimerazo v realnem času (qPCR) v vzorcih različnih slanosti.

Leta 2015 smo opravili filogenetsko analizo fotosintetskih simbiontov v nekaterih vrstah klobučnjakov, nabranih v Sredozemskem morju in Atlantskem oceanu, in zanjo uporabili jedrne ribosomalne gene simbiontov. Analize kažejo, da vrste simbiontov niso specifične za zgodnji razvojni stadij klobučnjakov, ampak ti privzamejo tiste, ki so v okolju. Dokončali smo filogenetsko analizo rodov iz družine Pelagiidae ter na podlagi morfoloških značilnosti in filogenetske analize opisali novi rod v tej družini. Analizirali smo gene z mtDNA in jedrne gene za rRNA.

S sodelavci projekta PERSEUS smo pripravili analizo fenologije klobučnjaških meduz v različnih obalnih predelih Sredozemskega morja. V preglednem članku o klobučnjakih smo predstavili klobučnjaške meduze v Sredozemskem morju, pojavljanje tujerodnih vrst in vlogo meduz v pelagialu.

V sklopu projekta BALMAS smo nadaljevali identifikacijo organizmov različnih ekoloških skupin (plankton, bentos, nekton), vključno z njihovimi razvojnimi stadiji (npr. ciste dinoflagelatov). Skupaj s hrvaškimi raziskovalci smo objavili prvo najdbo tujerodnega planktonskega ceponožca Pseudodiaptomus marinus v Luki Koper, kar je tretja najdba za Jadransko morje in četrta za Sredozemlje. Objavili smo rezultate metodologij za hitro kvantifikacijo živih planktonskih organizmov v balastnih vodah.

Raziskave o ekologiji in biodiverziteti fitoplanktona in bentosa so podpora okoljskim politikam, še posebno razvoju bioloških indeksov za oceno ekološkega in okoljskega stanja po evropskih direktivah (2000/60/ES in 2008/56/ES). Leta 2015 je bila metodologija vrednotenja ekološkega stanja obalnih voda v Jadranskem morju na podlagi fitoplanktona dokončno razvita in usklajena. Končali smo tudi razvoj metodologije za oceno stanja obrežnih travnikov kolenčaste cimodoceje (Cymodocea nodosa) in rezultate z uvedbo novega indeksa (Mediskew) objavili v reviji Marine environmental research.

V sklopu čezmejnega projekta TRECORALA smo pripravili dvojezični spletni knjigi o biogenih formacijah. S hrvaškimi raziskovalci smo vzorčili ihtiofavno v Velikem jezeru v Nacionalnem parku Mljet in končali primerjavo severnojadranskih in južnojadranskih populacij kamene korale. Opravili smo raziskave prehranjevalnih navad pri navadnem (Myliobatis aquila) in kljunatem morskem golobu (Pteromylaeus bovinus) ter pri zvezdasti raži (Raja asterias) ter raziskave o prehranjevalnih navadah sipe (Sepia officinalis) v severnem Jadranu.

In 2015 we also performed a phylogenetic analysis of photosynthetic symbionts in some species of jellyfish collected in the Mediterranean Sea and the Atlantic Ocean, using nuclear ribosomal genes of symbionts. Analyses show that symbiont identity is not specific to a particular jellyfish developmental stage, but rather determined by the environment. We completed the phylogenetic analysis of the Pelagiide and described a new genus of the family on the basis of morphological and genetic characters. We analysed mtDNA and nuclear rRNA genes.

In cooperation with partners working on the PERSEUS project we have prepared a phenological analysis of jellyfish in different coastal regions of the Mediterranean Sea. We published a review article presenting the jellyfish of the Mediterranean Sea, occurrence of allochtonous species and the ecological role of jellyfish in the pelagial.

In the scope of the BALMAS project we continued to identify organisms from various ecological groups (plankton, benthos, nekton) including their developmental stages (e.g., dynoflagellate cysts). Cooperating with colleagues from Croatia we published on the first detection of Pseudodiaptomus marinus, an allochthonous plankton copepod, in the Port of Koper. This was the third noted occurrence of the species in the Adriatic and the fourth in the Mediterranean. We published our results developing methodologies for fast quantification of living planktonic organisms contained in ballast waters.

Research on plankton and benthos ecology and biodiversity provide basic support for environmental policies, particularly in line of developing biological indices to assess the ecological and environmental status in accordance with EU directives (2000/60/ES and 2008/56/ES). In 2015 we finalized and unified the methodology for evaluating the ecological state of Adriatic coastal waters of using phytoplankton. We completed our work developing a methodology for assessing the status of coastal marine seagrass meadows of Cymodocea nodosa and published the results, including the introduction of a new index (Mediskew), in the journal Marine environmental research.

In the scope of the trans–border cooperation project TRECORALA we prepared bilingual web-books on biogenic formations. In cooperation with researchers from Croatia we sampled the ichtyofauna of the Large Lake in the National Park on the island Mljet and concluded our comparison of North and South Adriatic populations of stony coral. We studied the feeding habits of Myliobatis aquila, Pteromylaeus bovinus, Raja asterias and Sepia officinalis in the North Adriatic.

▶ Spalancanijev cevkar (*Sabella spalanzanii*) je eden največjih mnogoščetincev v našem morju, za katerega je značilna tudi barvita perjanica, ki se nahaja na vrhu telesa. /
A Mediterranean fanworm (Sabella spalanzanii) is one of the biggest polychaets in the Slovenian sea. It is characterised by a colorful crown of feeding tentacles protruding from the stiff sandy.

Research concerning Slovenian sea pollution and pollutant decomposition was divided into two parts. In the scope of the first we focused on studying the presence of metals and organic-tin compounds in various fish species from the Slovenian sea. The second part focused on monitoring the pollution of Slovenian sea with microplastic; we determined the presence of plastic particles in marine and coastal sediments as well as in marine organisms (shells and fish). The first results indicate a significant level of pollution with microplastic. Using Mytilus galloprovincialis as the target organism we studied the cumulative effects of pollutants that modulate the activity of oxidative stress-related enzymes and the effects of organic-phosphate pesticides in seawater. In cooperation with the Institute of Marine Biology in Kotar (Montenegro) we analysed the cumulative effects of pollution in the Kotar Bay.

In 2015 we studied the hyper-saline environment of the Sečovlje Saltworks from the perspective of heavy metal mobility in the salt-pan mud (hard phase)/brine (liquid phase), which is crucial when using selected muddy substrate in thalassotherapy.

Področje raziskav onesnaževanja slovenskega morja in razgradnje onesnaževal je bilo razdeljeno v dva dela. V prvem smo se posvetili študiju kovin in organokositrovih spojin v različnih vrstah rib, ulovljenih v našem morju. Drugi del raziskav je bil namenjen onesnaženosti našega morja z mikroplastiko, pri čemer smo določali vsebnost delcev plastike morskih in obalnih sedimentov ter tudi v morskih organizmih (školjke in ribe). Prvi rezultati kažejo na veliko onesnaženost z mikroplastiko. Na tarčnem organizmu Mytilus galloprovincialis smo proučevali kumulativne učinke

onesnažil, ki modulirajo encime oksidativnega stresa in učinke organofosfatnih pesticidov v morju. Z Inštitutom za biologijo morja v Kotorju (Črna gora) smo analizirali kumulativne učinke onesnaženja v Kotorskem zalivu.

Leta 2015 smo raziskovali hipersalino okolje v Sečoveljskih solinah s stališča mobilnosti težkih kovin v sistemu solinsko blato (trdna faza)/slanica (tekoča faza), kar je ključno za praktično uporabo izbranega substrata kot zdravilnega blata.

Glavni dosežki v letu 2015

Znanstveno-raziskovalni svet za naravoslovne vede je delo Bacterial community shift is induced by dynamic environmental parameters in a changing coastal ecosystem (northern Adriatic, NE Mediterranean Sea) - a 2 year time series study, ki je bilo objavljeno v reviji Environmental microbiology, uvrstil v izbor Odlični v znanosti 2015. ARRS in društvo SATENA sta 2. decembra 2015 v Kavarni Grand hotela Union organizirala javno predstavitev znanstvenih dosežkov pod imenom Odlični v znanosti, v sklopu akcije Znanost na cesti, znanje in ideje na prepihu. Na tem dogodku je svoje delo predstavila dr. Tinkara Tinta, ki je rezultat sodelovanja domačih in tujih raziskovalcev različnih strokovnih področij. V sodelovanju s STA je Tinkara Tinta posnela film o svojem raziskovalnem delu.

Leta 2015 se je v sklopu projekta HAZAD' (IPA Adriatic) uspešno končala postavitev HF-radarskega opazovalnega sistema površinskih tokov in valov v Tržaškem in Koprskem zalivu. S postavitvijo čezmejnega sistema nove merilne infrastrukture v Tržaškem zalivu se poveča učinkovitost ukrepanja na morju v primeru nesreč in razlitij oljnih madežev ter toksičnih snovi, kar je pomembno za delovanje institucij za posredovanje na morju. Trenutni in nekdanji podatki meritev se prikazujejo na testni spletni strani (http://www.nib.si/mbp/apps/wera.rest/).

V Piranu je od 28. septembra do 3. oktobra 2015 potekal 22. simpozij o okoljski biogeokemiji (http://www.iseb22.ijs.si) v organizaciji Odseka za znanosti o okolju, IJS in ob sodelovanju MBP NIB. Glavni namen simpozija je bil širiti spoznanja in izmenjati izkušnje s področja interdisciplinarnih biogeokemijskih raziskav.

Main Achievements in 2015

The article »Bacterial community shift is induced by dynamic environmental parameters in a changing coastal ecosystem (northern Adriatic, NE Mediterranean Sea) - a 2-year time series study«, published in the journal Environmental microbiology, was featured in the Excellent in Science in 2015 selection picked out by the Scientific Research Committee at the Slovenian Research Agency. The Slovenian Research Agency and the SATENA society organised a public presentation of their scientific achievements on December 2 2015 in the Café of the Grand Hotel Union entitled Excellent in Science in the scope of the action "Science on the street, knowledge and ideas on the go". At the event, Dr Tinkara Tinta presented her work, which is based on the collaboration between Slovenian and foreign researchers active in various expert fields. In association with the Slovenian Press Agency, she recorded a film about her work in research.

In 2015, the setup of HF radar monitoring system of surface currents and waves in the Trieste and Koper Bays was completed in the scope of the HAZAD' project (IPA Adriatic). Setting up a trans-border system of new measuring infrastructure in the Trieste Bay enhanced the efficiency of action in case of accidents and spillage of oil or toxic substances at sea, which is important for the activity of institutions involved in marine interventions. The current and past results of these measurements are available on the test web-page (http://www.nib.si/mbp/apps/wera.rest/).

Between September 28 and October 3 2015, the 22nd symposium on environmental biogeochemistry took place in Piran (http://www.iseb22.ijs.si). It was organised by the Department of Environmental Science at IJS in association with PMBS NIB. The main purpose of the symposium was to disseminate knowledge and exchange experiences within the field of interdisciplinary biogeochemical research.

BIBLIOGRAFIJA / BIBLIOGRAPHY

25	Izvirni znanstveni članek / Original Scientific Article
1	Kratki znanstveni prispevek / Short Scientific Article
1	Strokovni članek / Professional Article
5	Poljudni članek / Popular Article
5	Objavljeni znanstveni prispevek na konferenci / Published Scientific Conference Contribution
38	Objavljeni povzetek znanstvenega prispevka na konferenci / Published Scientific Conference Contribution Abstract
1	Samostojni strokovni sestavek ali poglavje v monografski publikaciji / Independent Professional Component Part or a Chapter in a Monograph
2	Recenzija, prikaz knjige, kritika / Review, Book Review, Critique
1	Predgovor, spremna beseda / Preface, Afterword
1	Polemika, diskusijski prispevek / Polemic, Discussion
5	Intervju / Interview
10	Drugi sestavni deli / Other Component Parts
2	Drugo učno gradivo / Other Educational Material
8	Končno poročilo o rezultatih raziskav / Final Research Report
2	Elaborat, predštudija, študija / Treatise, Preliminary Study, Study
1	Katalog razstave / Exhibition Catalogue
1	Raziskovalni ali dokumentarni film, zvočni ali video posnetek / Scientific or Documentary Film, Sound or Video Recording
6	Radijska ali televizijska oddaja / Radio or Television Broadcast
1	Druge monografije in druga zaključena dela / Other Monographs and Other Completed Works
14	Radijski ali TV dogodek / Radio or Television Event
1	Razstava / Exhibition
1	Predavanje na tuji univerzi / Invited Lecture at Foreign University
4	Prispevek na konferenci brez natisa / Unpublished Conference Contribution
2	Vabljeno predavanje na konferenci brez natisa / Unpublished Invited Conference Lecture
7	Druga izvedena dela / Other Performed Works
12	Uredništvo / Editorship

RAZISKOVALCI / RESEARCHERS

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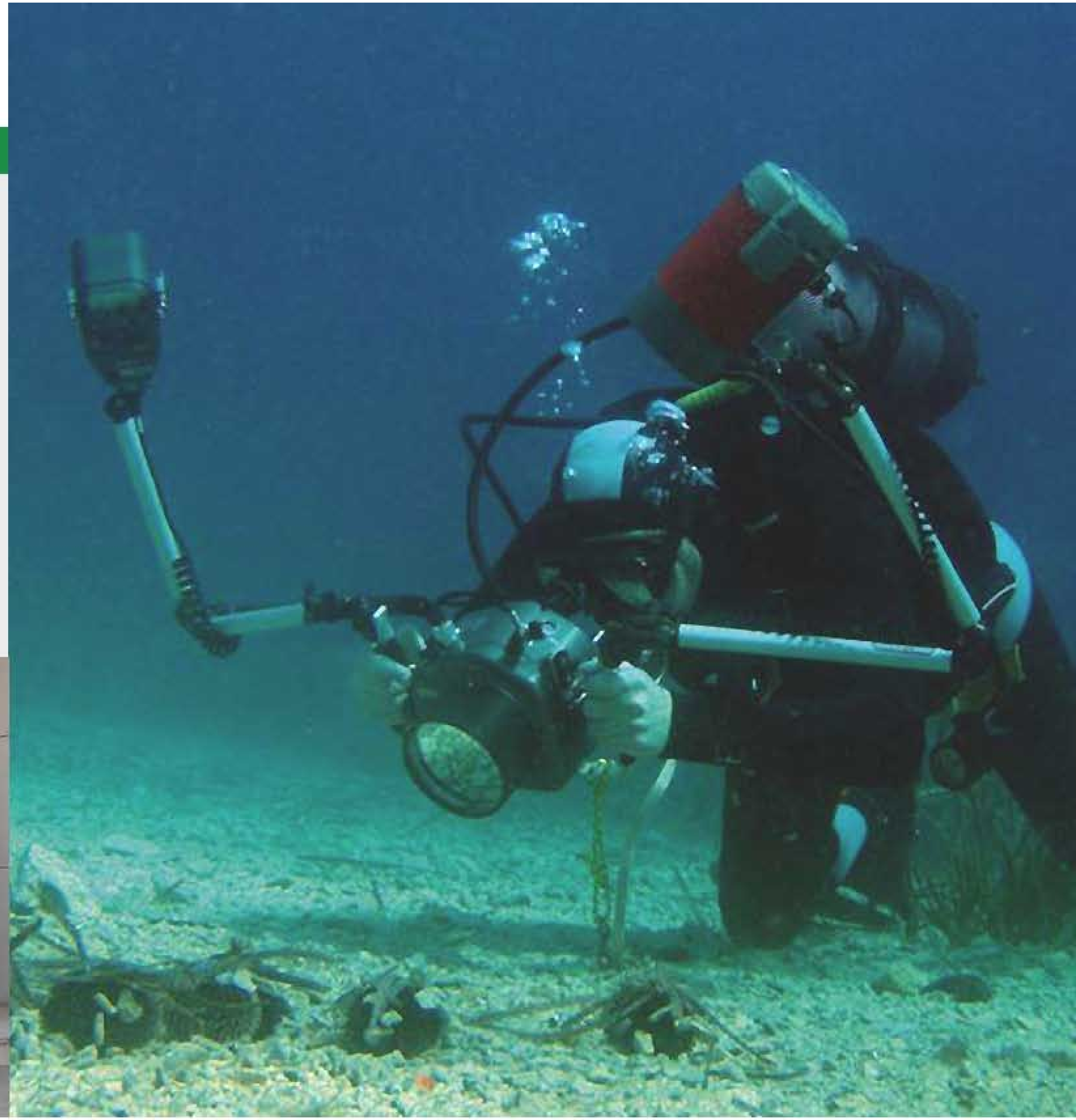

ODDELEK ZA RAZISKOVANJE SLADKOVODIH IN KOPENSKIH EKOSISTEMOV

NEOKRNJENI NARAVNI EKOSISTEMI SO NAŠE BOGASTVO

Vodja: doc. dr. Meta Virant-Doberlet

Ključne dejavnosti oddelka

Temeljne in aplikativne raziskave na Oddelku za raziskovanje kopenskih in sladkovodnih ekosistemov so osredotočene na ekološke procese.

Naše dejavnosti obsegajo:

- spremljanje meteoroloških razmer, sestave jamske vodne favne in raziskovanje hidroloških in hidrokemičnih razmer na sestavo jamskega živalstva v curkih prenikle vode;
- spremljanje pojava podzemne vodne favne v kraških izvirih na saturirani in nesaturirani coni;
- raziskave vpliva rabe prostora na ekosistemske procese v vodotokih;
- določanje prilagojenosti izbranih vrst na spremembe dejavnikov v okolju na podlagi ekofizioloških študij;
- raziskave odnosov med tujerodnimi in domorodnimi vrstami s podobnimi ekološkimi nišami;
- raziskave hroščev s seznama vrst evropskega varstvenega pomena;
- študije interakcije človeka z okoljem v travniškem in urbanem okolju.

Glavni dosežki v letu 2015

Z objavo v reviji Hydrological Processes smo pomembno prispevali k boljšemu razumevanju, kako lahko podnebne spremembe (ogrevanje in sprememba hidrološkega režima) modificirajo funkcijo poplavnih ravnic alpskih vodotokov, ki imajo pomembno vlogo tudi pri globalnem kroženju ogljika. Rezultati so pokazali visoko občutljivost procesov v poplavni ravnici za spremembo temperature in hidrološkega režima.

V prispevku, objavljenem v reviji Ground Water, smo predstavili rezultate interdisciplinarne raziskave, pri kateri smo testirali, ali je nevretenčarski drift, ki se pojavlja v kraških izvirih, uporaben indikator hidroloških poti podzemne vode oziroma ali je mogoče na podlagi vrstne sestave ugotoviti, ali izvirska voda izvira iz vadozne ali freatične cone. Rezultati so pokazali, da so lahko izbrane vrste, s poznano ekologijo in razširjenostjo, dobri indikatorji izvora izvirske vode.

DEPARTMENT OF FRESHWATER AND TERRESTRIAL ECOSYSTEMS RESEARCH

PRISTINE NATURAL ECOSYSTEMS ARE OUR ASSET

Head: Assist. Prof. Dr Meta Virant-Doberlet

Topic areas

Basic and applied research activities at the Department of Freshwater and Terrestrial Ecosystems Research are focused on ecological processes.

Our activities include:

- *monitoring meteorological conditions and composition of cave fauna, investigating impact of hydrological and hydrochemical conditions on composition of fauna in water drops in caves;*
- *studying groundwater fauna from karst springs at the contact of saturated and unsaturated zone;*
- *investigating impact of land use on river ecosystems;*
- *using ecophysiological studies to determine the adaptability of model species to changes in various environmental factors;*
- *research on relations between invasive and native species with similar ecological niches;*
- *studies of beetle species included in the EU Habitat Directive;*
- *studies of human interactions with the environment in hay meadows and urban areas.*

Important achievements in 2015

We published a paper that significantly broadens our understanding of how climate change (warming and changes in the hydrologic regime) can modify floodplain functioning and consequently affect global carbon cycling in the journal Hydrological Processes. The results show high sensitivity of respiration in floodplains to changes in temperature and hydrological regime.

We presented the results of interdisciplinary research, examining the potential of groundwater invertebrate drift, collected from spring outlets at the interface of vadose and phreatic zones, for identifying sources of discharge from a karst aquifer in the journal Ground Water. Certain species from the drift were found to be useful tracers for distinguishing between the phreatic, epikarst and vadose zones as the sources of spring water.

Vzorčenje kraškega izvira Lipnik v dolini Radovne pri Bledu.
Sampling of karstic spring Lipnik in the Radovna Valley near Bled.

22	Izvirni znanstveni članek / Original Scientific Article
10	Strokovni članek / Professional Article
1	Poljudni članek / Popular Article
2	Objavljeni znanstveni prispevek na konferenci / Published Scientific Conference Contribution
17	Objavljeni povzetek znanstvenega prispevka na konferenci / Published Scientific Conference Contribution Abstract
3	Samostojni znanstveni sestavek ali poglavje v monografski publikaciji / Independent Scientific Component Part or a Chapter in a Monograph
1	Samostojni strokovni sestavek ali poglavje v monografski publikaciji / Independent Professional Component Part or a Chapter in a Monograph
1	Recenzija, prikaz knjige, kritika / Review, Book Review, Critique
1	Intervju / Interview
2	Drugi sestavni deli / Other Component Parts
1	Znanstvena monografija / Scientific Monograph
1	Srednješolski, osnovnošolski ali drugi učbenik z recenzijo / Reviewed Secondary and Primary School Textbook or Other Textbook
2	Drugo učno gradivo / Other Educational Material
6	Končno poročilo o rezultatih raziskav / Final Research Report
1	Elaborat, predštudija, študija / Treatise, Preliminary Study, Study
1	Raziskovalni ali dokumentarni film, zvočni ali video posnetek / Scientific or Documentary Film, Sound or Video Recording
3	Radijski ali TV dogodek / Radio or Television Event
1	Razstava / Exhibition
1	Prispevek na konferenci brez natisa / Unpublished Conference Contribution
3	Druga izvedena dela / Other Performed WorksUredništvo
7	Uredništvo / Editorship

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Tome, Davorin
Vrezec, Al

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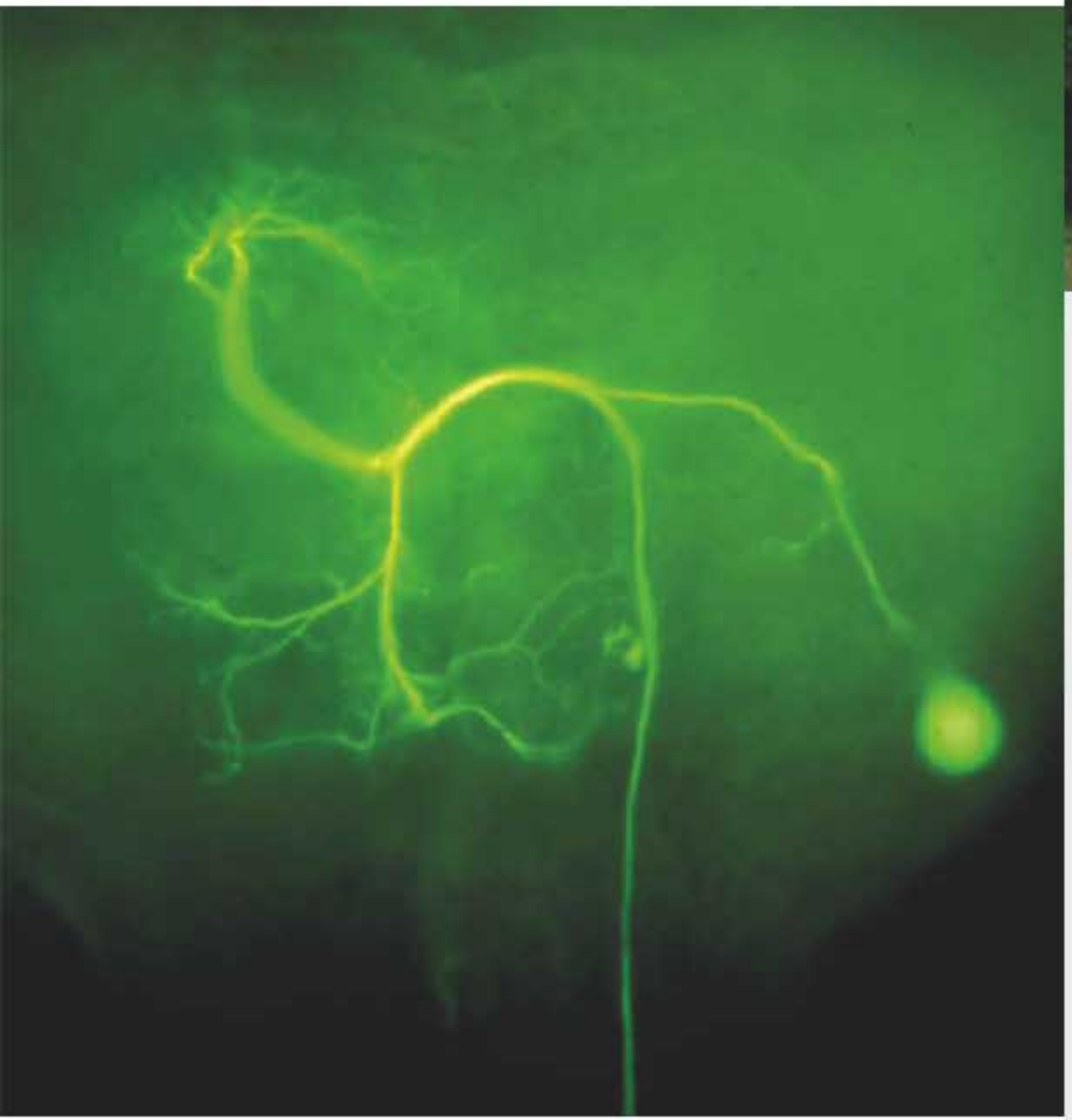

▶ Mikrografija vibracijskega internevrona, napolnjenega s fluorescentnim barvilom, v prvem opisanem segmentu trebušnjače pri samici kobilici. / *A photomicrograph of a vibratory interneuron, filled with a fluorescent dye, in the prothoracic segment of the ventral nerve cord in the case cricket.*

ODDELEK ZA ENTOMOLOGIJO

ŽUŽELKE – PRIJATELJICE IN SOVRAŽNICE

Vodja: doc. dr. Meta Virant-Doberlet

Ključne dejavnosti oddelka

Raziskovalno in razvojno delo na Oddelku za entomologijo je osredotočeno na živalske žuželke, pri katerih proučujemo biološke procese na različnih ravneh, od celic do združb.

Naša dejavnost obsega:

- raziskave vibracijske komunikacije, ki vključujejo analizo naravne vibracijske zvočne krajine, proučevanje komunikacijskih omrežij, analizo vibracijskih signalov in vedenjskih odzivov ter nevrobiološke in ekofiziološke študije;
- raziskave biodiverzitete, ki vključujejo integrativno taksonomijo in razvoj specifičnih molekularnih markerjev;
- raziskave vrsto-specifičnih feromonov hroščev vrst, ki so posebnega varstvenega pomena;
- raziskave medovorne čebele in divjih opraševalcev;
- razvoj alternativnih pristopov za nadzor žuželčjih škodljivcev in monitoring ogroženih vrst.

Glavni dosežki v letu 2015

V vabljenem preglednem članku v reviji Pest Management Science, ki je osrednja revija na področju kontrole škodljivcev, smo predstavili nov, alternativni pristop nadzora škodljivcev, prijazen do okolja, ki temelji na uporabi vibracijskih signalov. Članek je bil v letu 2015 drugi najbolj brani prispevek v tej reviji in posebej izpostavljen v uredniškem pregledu tega leta.

DEPARTMENT OF ENTOMOLOGY

INSECTS – FRIENDS AND FOES

Head: Assist. Prof. Dr Meta Virant-Doberlet

Topic areas

Basic and applied research activities of the Department of Entomology are focused on various aspects of insect biology, where we study biological processes across different levels – from cells to natural communities.

Our activities include:

- *research on vibrational communication, with focus on analysis of natural vibrational soundscape, studies of communication networks, analysis of vibrational signals and behavioural responses, as well as neurobiological and ecophysiological studies;*
- *research on biodiversity using integrative taxonomy approach and development of specific molecular markers;*
- *research on species-specific pheromones of longhorn beetles considered as conservation priority species;*
- *research on managed honey bee and wild pollinators;*
- *development of alternative approaches to managing insect pests and monitoring endangered species.*

Important achievements in 2015

An invited review paper published in Pest Management Science, the leading journal in the field of pest management, was the second most accessed paper in this journal in 2015, and received a specific mention in the editorial yearly review.

We investigated the sources of selection in evolution of vibrational communication and published a paper in which we showed that the production of vibrational signals is demanding and costly in terms of energy, since higher vibrational activity is associated with shorter longevity.

The analyses of species and sex-specific pheromones of the alpine longhorn beetle opened the door for the development of new approaches to monitor this endangered and protected species.

Raziskovali smo vire selekcije, ki delujejo na evolucijo vibracijske komunikacije. Objavili smo članek in v njem pokazali, da je proizvajanje vibracijskih signalov energijsko zahtevno in da je cena višje vibracijske aktivnosti krajša življenjska doba samcev.

Analizirali smo vrstno in spolno specifičen feromon alpskega kozlička, kar omogoča razvoj novih pristopov za monitoring te ogrožene in zavarovane vrste hrošča.

Za snovalce kmetijskih in varstvenih politik smo organizirali strokovni posvet Čmrlji in čebele samotarke – prazrti opraševalci, udeležila pa sta se ga tudi minister za kmetijstvo, gozdarstvo in prehrano RS ter direktor Kmetijsko-gozdarske zbornice.

We organized a meeting Bumblebees and wild bees – overlooked pollinators targeting policy and decision makers in the field of agriculture and environment.

BIBLIOGRAFIJA / BIBLIOGRAPHY

13	Izvirni znanstveni članek / Original Scientific Article
2	Poljudni članek / Popular Article
13	Objavljeni povzetek znanstvenega prispevka na konferenci / Published Scientific Conference Contribution Abstract
1	Recenzija, prikaz knjige, kritika / Review, Book Review, Critique
4	Intervju / Interview
1	Magistrsko delo / Master's Thesis
1	Druge monografije in druga zaključena dela / Other Monographs and Other Completed Works
9	Radijski ali TV dogodek / Radio or Television Event
2	Prispevek na konferenci brez natisa / Unpublished Conference Contribution
8	Druga izvedena dela / Other Performed Works
6	Uredništvo / Editorship

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Polajnar, Jernej
Stritih, Nataša
Žunič Kosi, Alenka

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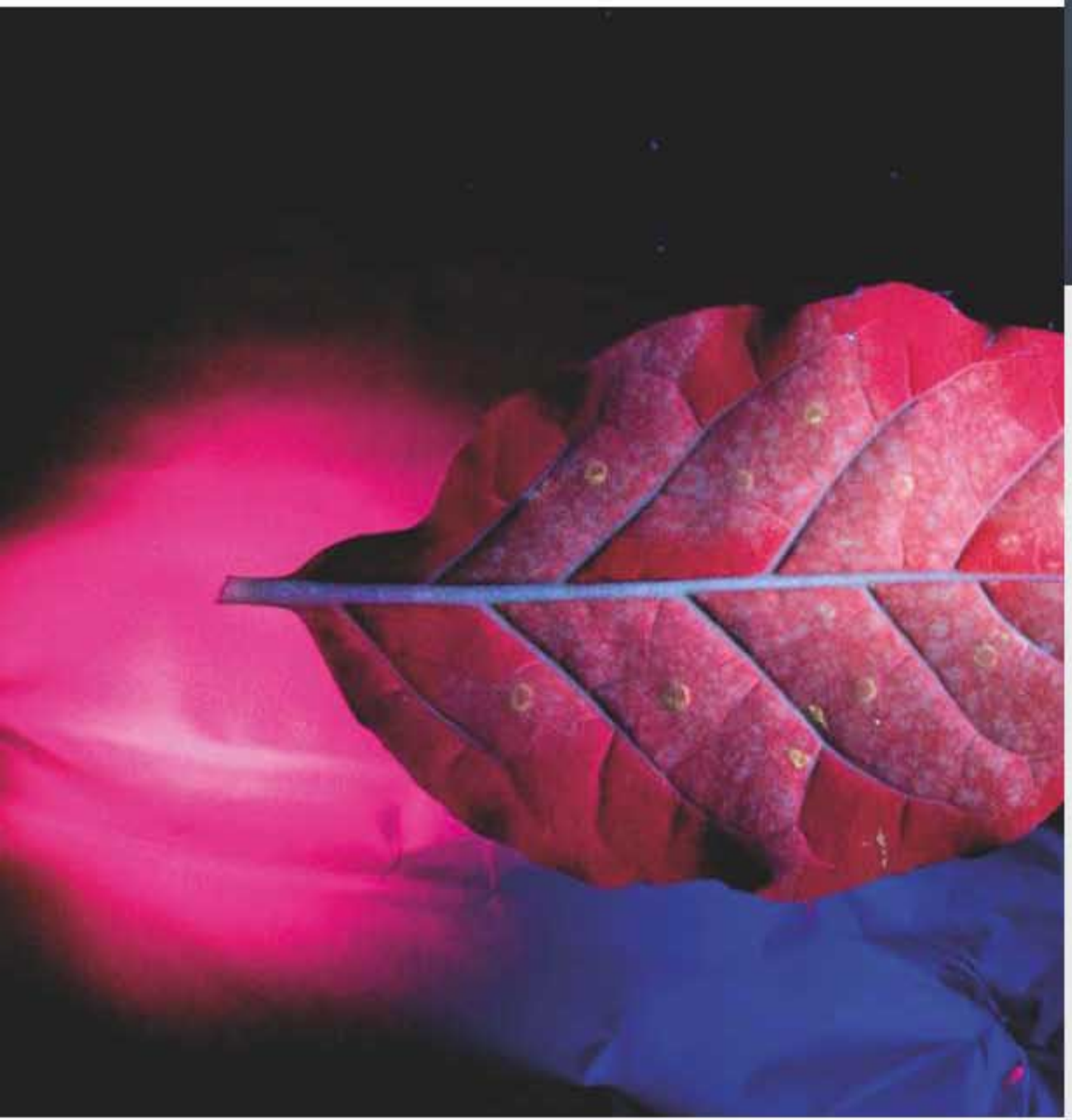
Štamm, Rok



Listi tobaka, infiltrirani z agrobakterijo s konstruktom za izražanje gena za zeleni fluorescentni protein (GFP), fotografirani pod UV svetlobo. / *Tobacco leaf infiltrated with the Agrobacterium construct for the expression of green fluorescent protein (GFP) as seen under the UV.*

ODDELEK ZA BIOTEHNOLOGIJO IN SISTEMSKO BIOLOGIJO

OD VIRUSOV DO RASTLIN IN NAPREJ

Vodja: izr. prof. dr. Maja Ravnikar

Ključne dejavnosti

- Ustvarjanje virusnega znanja za celostno razumevanje bioloških procesov s poudarkom na interakcijah med rastlinami in škodljivimi organizmi z uporabo kvantitativne in kvalitativne molekularne biologije ter razvijanje pristopov sistemske biologije;
- boljše razumevanje biologije, razširjenosti, patogenosti in epidemiologije mikroorganizmov ter na podlagi novega znanja razvoj boljših pristopov za njihovo detekcijo in zatiranje;
- razvoj novih biotehnoloških metodoloških pristopov za učinkovitejšo identifikacijo in detekcijo gensko spremenjenih organizmov glede na njihove prilagojevane povečano uporabo v prihodnjih letih;
- nadgrajevanje tehnološke platforme, ki podpira raziskave sistemske biologije in usmerjeno raziskave tarčnih organizmov;
- prenos ustvarjenega znanja o biologiji patogenih in gensko spremenjenih organizmov ter razvita metode za njihovo določanja na področje kmetijstva, farmacije, medicine in varovanja okolja (v sklopu Oddelka deluje tudi uradna diagnostična laboratorija za dokazovanje gensko spremenjenih organizmov in rastlinskih patogenih mikroorganizmov);
- partnersko sodelovanje z drugimi raziskovalnimi skupinami na NIB ali zunaj njega v Sloveniji in po svetu pri komplementarnih raziskavah za pridobivanje vrhunskega znanja;

DEPARTMENT OF BIOTECHNOLOGY AND SYSTEMS BIOLOGY

FROM VIRUSES TO PLANTS AND BEYOND

Head: Assoc. Prof. Dr Maja Ravnikar

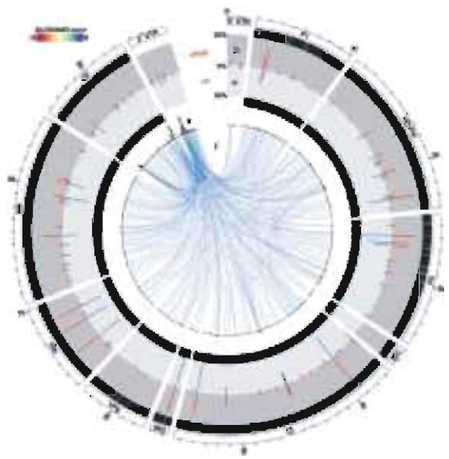
Tasks are:

- *generating knowledge concerning biological processes of the highest scientific quality with an emphasis on interactions between plants and harmful organisms using quantitative and qualitative molecular biology, and developing systems biology approaches;*
- *gaining insight into microorganism biology in order to understand their diversity, pathogenicity and epidemiology in the service of developing better approaches to their detection and control;*
- *developing new methodological approaches in biotechnology for more efficient identification and detection of GMOs in anticipation of their appearance on the world market in the coming years;*
- *upgrading the technological platform to support system biology research as well as meaningfully oriented research of target organisms;*
- *transferring newly created knowledge concerning biology of pathogenic and genetically modified organisms along with new methods for their determination to the fields of agriculture, pharmacy, medicine and environment*
  conservation (the Department includes two official diagnostics laboratories for detection of GMOs and pathogenic microorganisms);
- *establishing complementary research partnerships with other research groups at NIB, in Slovenia, Europe and the world, leading to the excellence in science;*
- *establishing partnerships with governmental and European organizations, academic institutions and industry, working together to solve practical problems related to our field of expertise.*
- partnersko povezovanje z državnimi in evropskimi institucijami, vladnoželeznimi organizacijami in industrijo za skupni prispevek k odpravljanju aktualnih težav s področja delovanja oddelka.

- partnersko povezovanje z državnimi in evropskimi institucijami, visokošolskimi organizacijami in industrijo za skupni prispevek k odpravljanju aktualnih težav s področja delovanja oddelka.

Glavni dosežki v letu 2015

RNA-virusi obstajajo v gostitelju kot populacija mutiranih sekvenc, imenovanih tudi kvazivrste, ki v gostitelju oblikujejo nepovezan nabor različnih RNA. V reviji Journal of Virology z dejavnikom vpliva 4,439 smo objavili do zdaj najpopolnejšo genomsko analizo populacije virusov krompirjevega virusa PVY znotraj gostiteljske rastline, pridobljeno z ultra globokim sekvenciranjem Illumina, in prvo primerjalno študijo različnih tehnik za obogatitev virusnih sekvenc. Pokazali smo, da tehnika sekvenciranja RNA iz virusnih delcev omogoča podobno določitev populacijske strukture virusov kot tehnika izolacije malih RNA, pa tudi rekonstrukcijo popolne virusne genomske sekvence de novo ter dodatno detekcijo rekombinantnih virusnih genomov. Raziskava je pomembno izhodišče za nadaljnje raziskave virusne populacijske dinamike, npr. med prilagajanjem novemu gostitelju in razvoju bolj patogenih virusnih izolatov.



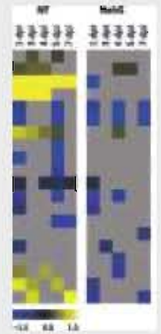
Krožna predstavitev mutacij in rekombinacij genoma PVY z dvema tehnikama obogatitve virusnih sekvenc.

Circular representation of mutations and recombination within the PVY genome with two approaches two the enrichment of virus sequences.

Nadaljevali smo naše raziskovanje interakcij med krompirjevim virusom PVY in sortami krompirja, ki so proti njemu odporne, ga tolerirajo ali so nanj občutljive. V raziskavi, objavljeni v BMC Genomics, smo proučevali mehanizme tolerance in se osredotočili na dinamiko sprememb primarnega metabolizma med okužbo na ravni transkriptomske analize, netarčne proteomike in fotosintezne aktivnosti pri sorti Désirée in iz nje izdelani transgeni rastlini, ki ne kopiči salicilne kisline. Nakazali smo na možnost, da je sprožitev nekaterih svetlobnih reakcij fotosinteze v zgodnjih stopnjah okužbe z virusom povezana s toleranco te sorte na virus.

Important achievements in 2015

RNA viruses exist within a host as a population of mutant sequences, often referred to as a quasispecies. Within a host, sequences of RNA viruses constitute several distinct, but interconnected pools. We published the most comprehensive whole-genome characterization of a within-plant virus population to date and the first study comparing diversity of different pools of viral sequences within a host, obtained by using ultra deep Illumina sequencing in the Journal of Virology (IF 4.439). Comparing two virus sequence enrichment techniques, we demonstrated that RNA from purified viral particles has the same potential for detection of recombinant viral genomes and reconstruction of complete consensus viral genome sequence as small interfering RNA. The study sets an important baseline for future studies of virus population dynamics, for example, during the adaptation to a new host and development of more pathogenic virus strains.



Transkripti encima RuBisCO so v odgovorih rastline na virus specifično regulirani. Prikazani so rezultati dveh genotipov: NT – netransgene rastline sorte Désirée in NahG – transgene rastline sorte Désirée, z nadizražanim genom NahG 1, 3, 4, 5, in 7 dni po okužbi (dpi).

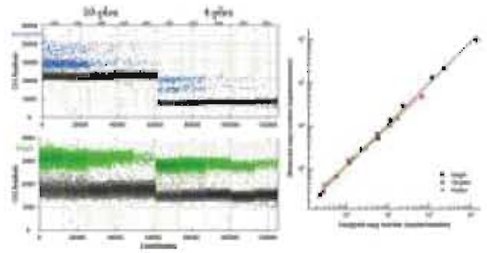
RuBisCO transcripts are specifically regulated in virus-induced responses. The results for two genotypes are shown: NT - nontransgenic plants of cv. Désirée, NahG – transgenic plants of cv. Désirée overexpressing NahG 1, 3, 4, 5, and 7 days after inoculation (dpi).

Število gensko spremenjenih organizmov (GSO) se povečuje, vendar pa obstoječe metode detekcije s qPCR niso več finančno vzdržne. Na podlagi tehnologije kapljične digitalne PCR (ddPCR) smo razvili dva testa za sočasno kvantifikacijo vseh 12 linij gensko spremenjene koruze, ki so bile do 1. 4. 2015 odobrene v EU. Z obema testoma smo dobili specifične rezultate, njuni parametri delovanja (meja kvantifikacije, ponovljivost, točnost in natančnost) so bili skladni z mednarodnimi priporočili za metode kvantifikacije GSO. Še več, njihova zmogljivost in finančna učinkovitost sta bili precej boljši kot pri uporabi qPCR. V primeru avtorizacije novih GSO se nove metode za njihovo določitev zlahka dodajo v razvit test sočasne analize, princip kvantitativnega multipleksiranja pa je mogoče uporabiti tudi na drugih področjih. Multipleksno kvantifikacijo smo objavili v reviji Analytical Chemistry z dejavnikom vpliva 5,636.

Sočasna kvantifikacija 12 linij gensko spremenjene koruze s kapljično digitalno PCR. Izmerjeno število kopij v reakciji se ujema s predvidenim številom kopij čez celotno dinamično območje (40 – 100000 kopij na reakcijo).

We continued our research on interactions between potato virus PVY and potato cultivars, which are susceptible, tolerant or resistant to the virus. We defined the mechanisms underlying tolerant responses of potato to infection in a study, published in BMC Genomics. We focused on the dynamics of primary metabolism-related processes during infection at the level of transcriptome analysis, non-targeted proteomics, and photosynthetic activity in potato cv. Désirée and its transgenic counterpart depleted for accumulation of salicylic acid. We suggested that detected induction of light-reaction components in the early stages of infection is possibly associated with tolerance of the investigated cultivar to virus infection.

As the number of GMOs has increased over time, standard qPCR analyses are no longer sufficiently cost-effective. On the basis of droplet digital PCR technology (ddPCR), two multiplex assays for quantification of all 12 EU authorized GM maize lines (1 April 2015) were developed. It was shown that both multiplex assays produce specific results and that performance parameters such as limit of quantification, repeatability, and trueness comply with international recommendations for GMO quantification methods. Moreover, for samples containing GMOs, the throughput and cost-effectiveness is significantly improved in comparison to qPCR. Thus, it was concluded that in case of new authorizations, events can easily be added to existing multiplex assays. The presented principle of quantitative multiplexing, published in the journal Analytical Chemistry with an impact factor of 5.636, can be applied to any other domain.



Multiplex quantification of 12 lines of genetically modified maize lines. Measured number of copies per reaction is in good correlation with assigned number of copies over whole dynamic range (40 – 100000 copies/reaction).

Ostanki protitumorskih spojin predstavljajo pomembna onesnažila v vodnih okoljih. Številne tovrstne spojine imajo genotoksično delovanje in naj bi imele neželene učinke na vodne ekosisteme. V raziskavi, ki so jo sodelavci FITO objavili skupaj z raziskovalci z Oddelka za gensko toksikologijo in biologijo raka v znanstveni reviji Water Research z dejavnikom vpliva 5,991, so na preživetveni, reprodukcijski, rastni in transkriptomski ravni raziskovali vpliv nizkih doz 5-fluorouracila na ribe zebrice (Danio rerio). Čeprav nizke kronične izpostavitve nizkim dozam niso vplivale na razmnoževanje zebric, ni izključeno, da lahko vodijo v degenerativne spremembe, vključno z rakavimi, kar bi dolgoročno lahko vplivalo na ribjo populacijo.

Število posebnih in skupnih diferencialno izraženih genov v vzorcih zebric generacije F1, ki so bile izpostavljene 0.01 in 1 µg/L of 5-FU v primerjavi s kontrolnimi vzorci.

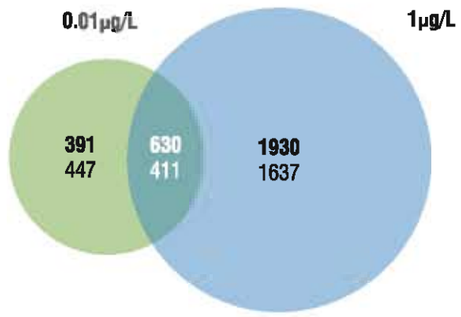
The number of unique and common differentially expressed genes in liver samples of F1 zebrafish exposed to 0.01 and 1 µg/L of 5-FU versus the vehicle control.

Leta 2015 smo izvedli različne domače in mednarodne izobraževalne delavnice: za uradne veterinarje in inšpektorje za hrano pri Uradu za varno hrano, veterinarstvo in varstvo rastlin; v sklopu projekta ELIXIR Data Carpentry; skupaj z našim odcepljenim podjetjem Biosistemika webinar o uporabi PCR v realnem času, za predstavnike Ministrstva za kmetijstvo, gozdarstvo in prehrano, inšpekcijskih služb, finančne uprave in predstavnico Hrvaškega Ministrstva za znanost, izobraževanje in šport o novostih na področju GSO, za nacionalne referenčne laboratorije za določanje GSO v živilih in krmi, imenovane po EC 882/2004, delavnico o digitalni PCR.

Na sedežu Organizacije za prehrano in kmetijstvo (FAO) pri Združenih narodih v Rimu smo predstavili najnovejše metodologije za diagnostiko mikrobnih povzročiteljev bolezni, izotermalno metodo LAMP in sekvenciranje naslednje generacije. Metodo LAMP smo predstavili tudi na razstavi EXPO v Milanu.

Kot soorganizatorji smo sodelovali pri Dnevu meroslovja in Dnevu očarljivih rastlin.

Residues of anti-neoplastic drugs represent new and emerging group of pollutants in aquatic environments. Many of these drugs are genotoxic, and it has been postulated that they can cause adverse effects in aquatic ecosystems. In a joined research of FITO and the Department of Genetic Toxicology and Cancer Biology the effects of low dosages of 5-Fluorouracil on zebrafish (Danio rerio) were studied at the survival, reproduction and transcriptome level. The results were published in Water Research journal with the impact factor of 5.991. Although chronic exposure of zebrafish to environmentally relevant concentrations of 5-FU did not affect their reproduction, it cannot be excluded that 5-FU can lead to degenerative changes, including cancers, which might affect fish populations over long-term exposure of several generations.



In 2015 we performed various national and international workshops:

- *a »Data Carpentry« workshop in the scope of the ELIXIR project for official veterinary service and inspectors of the Administration of the Republic of Slovenia for Food Safety, Veterinary Sector and Plant Protection;*
- *a webinar on use and applications of the real-time PCR in association with our spin-off company Biosistemika Ltd.;*
- *a workshop on the advancements on GMO for representatives of the Ministry of Agriculture, Forestry and Food, inspectorates, financial administration and a representative of the Croatian Ministry of Science, Education and Sports;*
- *a workshop on digital PCR for national reference laboratories for GMOs in food and feed according to EC 882/2004.*

Pri uradu RS za intelektualno lastnino smo prijavili patent.

Članice FITO so leta 2015 prejele več nagrad: Kristina Gruden Zoisovo priznanje za pomembne znanstvene dosežke na področju sistemske in molekularne biologije, Maja Ravnikar srebrno značko za posebne zasluge na področju varstva rastlin, ki jo podeljuje Društvo za varstvo rastlin Slovenije, Marina Dermastia prvo nagrado na natečaju Znanost na delu za najboljši poljudni prispevek o znanstvenem raziskovanju in Lapanjetovo plaketo za zasluge pri uveljavljanju slovenske biokemije in molekularne biologije daleč onkraj meja znanosti, ki jo podeljuje Slovensko biokemijsko društvo, Jana Erjavec pa glavno Krkino nagrado za posebne dosežke na področju raziskovalnega dela za doktorsko disertacijo.

At the FAO headquarter in Rome, Italy, we presented the LAMP technique, the newest methodology for isothermal amplification used in diagnostics of microbial pathogens and new generation sequencing. LAMP was additionally presented at EXPO in Milan, Italy.

As a co-organizer we participated at Metrology day and Fascination of Plants Day.

One (1) patent is pending at the Slovenian Intellectual Property Office.

In 2015 members of the FITO received several awards: Kristina Gruden was awarded the Zois Certificate of Recognition for significant achievements in scientific, research and development activities in the field of systems and molecular biology; Maja Ravnikar received the silver plaque of the Society for Plant Protection for special achievements in the field of plant protection; Marina Dermastia won the first prize in the national Science at work competition for the best popular scientific article and the Lapanje Plaque awarded by the Slovenian Biochemical Society for her achievements in popularizing Slovene biochemistry and molecular biology; Jana Erjavec received the Krka Award for special achievements in her doctoral dissertation.

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1	Strokovni članek / Professional Article
16	Poljudni članek / Popular Article
8	Objavljeni znanstveni prispevek na konferenci / Published Scientific Conference Contribution
5	Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje) / Published Scientific Conference Contribution Abstract (Invited lecture)
68	Objavljeni povzetek znanstvenega prispevka na konferenci / Published Scientific Conference Contribution Abstract
4	Samostojni znanstveni sestavek ali poglavje v monografski publikaciji / Independent Scientific Component Part or a Chapter in a Monograph
2	Polemika, diskusijski prispevek / Polemic, Discussion
1	Drugi sestavni deli / Other Component Parts
1	Srednješolski, osnovnošolski ali drugi učbenik z recenzijo / Reviewed Secondary and Primary School Textbook or Other Textbook
3	Drugo učno gradivo / Other Educational Material
4	Doktorska disertacija / Doctoral Dissertation
7	Končno poročilo o rezultatih raziskav / Final Research Report
2	Elaborat, predštudija, študija / Treatise, Preliminary Study, Study
1	Izvedensko mnenje, arbitražna odločba / Expertise, Arbitration Decision
1	Radijska ali televizijska oddaja / Radio or Television Broadcast
1	Patent / Patent
1	Druge monografije in druga zaključena dela / Other Monographs and Other Completed Works
8	Radijski ali TV dogodek / Radio or Television Event
1	Razstava / Exhibition
2	Predavanje na tuji univerzi / Invited Lecture at Foreign University
19	Prispevek na konferenci brez natisa / Unpublished Conference Contribution
5	Vabljeno predavanje na konferenci brez natisa / Unpublished Invited Conference Lecture
5	Druga izvedena dela / Other Performed Works
8	Uredništvo / Editorship

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ODDELEK ZA GENETSKO TOKSIKOLOGIJO IN BIOLOGIJO RAKA

KAKOVOST OKOLJA IN ZDRAVJE LJUDI STA NELOČLJIVA

Vodja: prof. dr. Metka Filipič

Ključne dejavnosti

Področje genetske toksikologije vključuje:

- Raziskave molekularnih mehanizmov genotoksičnega delovanja okoljskih in prehranskih onesnažil.
- Razvoj novih in vitro testnih sistemov v genetski toksikologiji.

Področje raziskav mehanizmov razvoja in napredovanja raka vključuje:

- Raziskave vloge proteolitičnih encimskih sistemov, vloge mikrookolja tumorjev in vloge različnih vrst matičnih celic.
- Raziskave uporabe mezenhimskih matičnih celic kot vektorjev za prenos zdravil.

Področje okoljskih raziskav obsega:

- Raziskave in razvoj metod nadzora in preprečevanja pojavljanja strupenih cianobakterijskih cvetov.
- Monitoring fitoplanktona za potrebe upravljanja celinskih voda.

Na vseh področjih sodelujemo s partnerji iz gospodarstva, državnih institucij in visokošolskih organizacij.

DEPARTMENT FOR GENETIC TOXICOLOGY AND CANCER BIOLOGY

QUALITY OF ENVIRONMENT AND HUMAN HEALTH ARE INSEPARABLE

Head: Prof. Dr Metka Filipič

Topic areas

Research in genetic toxicology includes:

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

Research in the mechanisms of cancer development and progression includes:

- *studies of the role of lytic enzyme systems, tumour microenvironment and different types of stem cells;*
- *research on applications of mesenchymal stem cells as vectors for drug delivery.*

Environmental research includes:

- *studies and development of methods for surveillance and prevention of the occurrence of toxic cyanobacterial blooms;*
- *monitoring phytoplankton and phytobenthos for the purpose of inland water management.*

We perform research in collaboration with partners and stakeholders from industry, governmental institutions and academic organizations.

Important achievements in 2015

In 2015 we successfully completed the four year EU 7 FP project Cytothreat (Fate and effects of cytostatic pharmaceuticals in the environment and the identification of biomarkers for an improved risk assessment on environmental exposure), which we also coordinated. Nine (9) partners from seven (7) European countries with complementary expertise collaborated in the

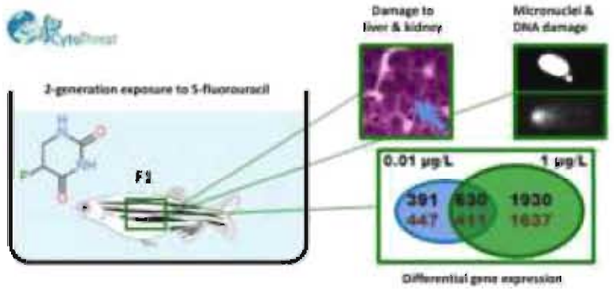
▶ Zarodek ribe cebrice (*Danio rerio*). / Zebrafish embryo (*Danio rerio*).

Glavni dosežki v letu 2015

Leta 2015 smo uspešno končali štiri leta trajajoči projekt 7 OP EC Cytothreat (Fate and effects of cytostatic pharmaceuticals in the environment and the identification of biomarkers for an improved risk assessment on environmental exposure), ki smo ga tudi koordinirali. Pri izvedbi projekta je s svojim komplementarnim znanjem s področij analitske kemije, (eko)toksikologije, genetske toksikologije, molekularne biologije in bioinformatike sodelovalo devet partnerjev iz sedmih evropskih držav. Glavni dosežki projekta so: razvoj novih kemijsko analitskih metod, ki omogočajo zaznavanje ostankov citostatikov in njihovih produktov razgradnje v različnih vzorcih okolja, kar je osnova za oceno izpostavljenosti, ter ekotoksikološki podatki, ki omogočajo oceno nevarnosti za okolje. Ekotoksikološke raziskave izbranih citostatikov so pokazale, da lahko pri kronični izpostavljenosti nekateri že pri izjemno majhnih koncentracijah pri okoljskih organizmih povzročijo negativne posledice. Tako je na primer dvogeneracijska raziskava z ribami cebricami (*Danio rerio*), objavljena v reviji Water research, pokazala, da izpostavljenost 5-fluorouracilu, ki je eno najpogosteje uporabljenih zdravil za zdravljenje raka, povzroči histopatološke spremembe jeter in ledvic, poškodbe DNA, tvorbo mikrojeder in povečano izražanje nekaterih genov, ki se odzovejo na poškodbe DNA in onkogenov (npr. jun, myca), pri koncentracijah, ki se pojavljajo v okolju. Rezultati znanstvenih raziskav projekta Cytothreat dajejo pomembna napotila za usmeritve nadaljnjih raziskav pa tudi zakonodaji, da prilagodi zahteve po nadzoru nad ostanki teh snovi tako, da bosta zagotovljena varnost okolja in zdravja ljudi.

implementation of the project in the areas of analytical chemistry, (eco)toxicology, genetic toxicology, molecular biology and bioinformatics. The main project achievements are: new chemical analytical methods that enable detection of residues of cytostatic drugs and their degradation products in different environmental samples, which is the basis for exposure assessment, and ecotoxicological data necessary for hazard assessment. The ecotoxicological studies of selected cytostatics demonstrated that at chronic exposure some of them can cause adverse effects in aquatic organisms at very low concentrations. The two generation toxicity study in zebrafish (Danio rerio), published in the journal Water Research, demonstrated that 5-fluorouracil, which is one of the most commonly used cytostatics in cancer treatment, induced histopathological changes in liver and kidneys, DNA damage and micronuclei formation, and up-regulation of DNA damage responsive genes expression as well as several oncogenes (i.e. jun, myca) at concentrations that occur in the environment. The results obtained in the scope of the Cytothreat project will certainly have an important impact on future risk assessment and water quality management programmes, as they provide objective arguments for revision of current recommendations and regulations. It can be expected that CytoThreat results will play a major role in safeguarding EU citizens from toxic residues of pharmaceuticals and their degradation products in the environment, which is currently a very »hot« topic of scientific and public interest.

Grafični prikaz članka. / *Graphic abstract.*



Nadaljevali smo večletne raziskave mehanizmov napredovanja in invazije izjemno agresivnega in neozdravljivega možganskega tumorja glioblastoma multiforme (GBM). Proučevali smo predvsem vlogo matičnih celic GMB in interacij GMB s tumorskim mikro okoljem.
Z analizo izražanja genov smo potrdili, da je med vsemi proteazami celic GBM v primerjavi z istovrstnim normalnim tkivom najbolj signifikantno zvišana proteaza katepsin K. Z nadaljnjimi raziskavami so pokazali, da je v rakavem možganskem tkivu ta encim najverjetneje v nišah matičnih celic GBM v bližini kemokina SDF-1. Ta z vezavo na svoj receptor (CXCR4) zadržuje matične celice GBM v niši, medtem ko katepsin K kemokin proteolizno cepi in ga inaktivira. S tem omogoča sprostitev matičnih celic GMB iz niš in njihovo diferenciacijo in namnoževanje v maligne tumorske celice in posledično bolj agresivno rast tumorja. Ti izsledki so bili objavljeni v reviji The Journal of histochemistry and cytochemistry in v preglednem članku v reviji Seminars in cancer biology.

S proteomskimi raziskavami najbolj značilnih biomarkejev matičnih celic GBM, ki bi služili za njihovo detekcijo (diagnoza) in kot potencialne tarče za zdravljenje, smo izpostavili tetraspanin (Cd9). Proučevanja njegove vloge v procesih, povezanih z napredovanjem GBM, so pokazala, da so celice z utišanim izražanjem CD9 manj invazivne od kontrolnih celic, izražajo manj genov, ki so potrebni za matični celični fenotip, in so dovzetnejše za tretiranje s kemoterapevtiki. Ugotovili smo tudi, da mezenhimske matične celice (MSC) precej vplivajo na te lastnosti matičnih celic GBM, kar je pomembno za potencialno celično zdravljenje s temi celicami. Izsledke smo objavili v dveh znanstvenih člankih v revijah Oncotarget in Cell transplantation.

Pri raziskavah interakcij GMB z mikro okoljem smo odkrili heterogenost odziva v stiku z MSC, ki izvira iz različnega fenotipa celic GBM, pri čemer je linija U87 neuronalne narave, medtem ko je linija U373 mezenhimskega fenotipa. S transkriptomskimi analizami smo pokazali, da medsebojni vpliv različnih vrst celic GBM lahko vpliva na procese proliferacije, invazije in genomske stabilnosti. Poleg tega lahko interakcije med heterogenimi celicami GBM pripomorejo k povečanemu oz. zmanjšanemu učinku kemoterapevtika (npr. temozolomida) na tumorske celice. Ti izsledki so objavljeni v reviji Oncotarget.

Eksperimentalni modeli z ribami cebricami (*Danio rerio*) postajajo čedalje pomembnejše orodje pri raziskavah procesov, povezanih z rakom. Pri študiju invazije GMB smo

We continued ongoing research on mechanisms of progression and invasion of extremely invasive incurable brain tumour, the glioblastoma multiforme (GBM). In particular, we focused on the role of GBM stem cells and interactions of GBM with tumour microenvironment. With gene expression analysis, we confirmed that in comparison to normal tissue catepsin K was the most significantly up-regulated protease in GBM cells. Further studies demonstrated that in the brain tumour tissue this enzyme most probably occupies the GBM stem cell niches where it is co-localized with chemokine SDF-1. The latter binds to its receptor (CXCR4) restraining GBM stem cells in their niche. Cathepsin K cleaves the chemokine and inactivates it, which allows the release of GMB stem cell from their niches, their differentiation and multiplication and, consequently, more aggressive tumour growth. These findings were published in The Journal of histochemistry and cytochemistry, and in the review article in the journal Seminars in Cancer Biology.

Our proteomic studies of the most specific biomarkers of GBM stem cells that could be used for detection (diagnosis) and as potential targets in cancer treatment identified the tetraspanin (Cs9). The studies of its role in the processes, associated with progression of GBM, demonstrated that cells with silenced expression of CD9 were less invasive than control cells, expressed fewer genes that are necessary for the parent cell phenotype and were more susceptible to treatment with chemotherapeutic agents. We have also found that mesenchymal stem cells (MSC) have significant impact on these properties of GBM stem cells, which is important for their potential use in cell therapy. The findings were published in two scientific articles in journals Oncotarget and Cell Transplantation.

In our studies of interactions of GBM with its micro environment we discovered a heterogeneous reaction of different types of GBM (U87 cells that are of neuronal nature and U373 cells that express mesenchymal phenotype) in contact with the MSC. With transtcriptomic analyses we have shown that the interactions between different types of GBM cells can influence the processes of proliferation, invasion and genomic stability. Moreover, the interaction between heterogeneous GBM cells may also contribute to increased or reduced effect of the chemotherapeutic agent (e.g., temozolomide) to tumour cells. These findings were published in the journal Oncotarget.

Experimental models with zebrafish (Danio rerio) are becoming increasingly important tools in cancer research. In the study of the GBM invasion we applied

▶ Salmonela mikrosomalni test povratnih mutacij (Amesov test). / *Salmonella mutagenicity Assay (Ames assay).*

uporabili ksenotransplantacijo fluorescentnih celic GMB (U87dsRed in U373) v zarodke rib cebric in opazovali njihovo porazdelitev v možganih in živčnem sistemu. Ugotovili smo, da se celice po injiciranju premeščajo in invadirajo osrednji živčni sistem, pri čemer je izrazito hitra invazija vzdolž hrbtenjače. Pogostnost invazije je pri obeh celičnih linijah različna, pri čemer celice U87 invadirajo pogosteje.
V možgane rib cebric smo vnesli tudi direktne kokulture človeških MSC kostnega mozga in celic GBM U373GFP ter ugotovili, da injiciranje direktne kokulture spodbudi invazijo celic GBM. Izsledke smo objavili v reviji The Journal of histochemistry and cytochemistry.

Leta 2015 smo v sodelovanju s partnerji na Evropski patentni urad oddali patentno prijavo za metodo, ki omogoča hkratno neinvazivno razlikovanje sestave, strukture in morfologije mikroskopskih množic in združb, njihovih sprememb ter stanj s pulzno inducirano osvetlitvijo. Princip zaznavanja in merjenja

xenotransplantation of fluorescent GMB cells (U87dsRed and U373GFP) to zebrafish embryo brain and observed their distribution in the brain and the nervous system. After the injection, the cells are moving and rapidly invade the central nervous system along the spinal cord. The frequency of invasion of the two cell lines was different; U87 cells invaded more often. When we injected direct co-cultures of human bone marrow MSCs and GBM cells (U373GFP cells) we observed the promotion of the invasion of GBM cells by MSCs. The findings were published in The Journal of histochemistry and cytochemistry.

In cooperation with our partners we submitted a patent application to the European Patent Office. The patent describes a method that permits simultaneous non-invasive differentiation of composition, structure and morphology of microscopic masses and communities, and their changes with the help of pulse-induced light exposure. The principle of detection and measurement is based on the maintenance of micro-particles in suspension that is moving uniformly

temelji na vzdrževanju mikro delcev v suspenziji, ki enakomerno počasi prehajajo mimo področja zaznavanja senzorja. Delce ohranjamo v suspenziji z mešanjem, ali ustvarjanjem enakomerno usmerjenega toka. Delce vzbujamo s hitro pulzirajočim svetlobnim snopom izbranih svetlobnih dolžin s sočasnim zajemanjem generiranega svetlobnega signala. Zaradi nehomogenega območja zaznavanja lahko ločimo dve značilnosti dobljenega signala; povprečje signala, ki predstavlja koncentracijo mikrodelcev in značilna odstopanja, ki nastanejo zaradi posameznih mikrodelcev, ki vstopajo v optimalno področje zaznavanja senzorja. Prednost te metode je njena neinvazivnost, saj omogoča proučevanje delcev in organizmov, ne da bi posegali v trenutne razmere, kar nam omogoča opazovanje njihovega obnašanja pri spremembah stanja v njihovem okolju. Uporabnost te metode smo preizkusili v sklopu demonstracijskega projekta LIFE Stop CyanoBloom, ki ga sofinancira finančni mehanizem Evropske komisije LIFE Okolje. Cilj projekta je bil predstaviti daljinsko vodeno plovilo, opremljeno z on line senzorji in vgrajeno elektrolitsko celico za preprosto in učinkovito ugotavljanje fizikalnih, kemijskih in bioloških parametrov vodnega okolja ter preprečevanje razraščanja cianobakterij. Rezultati, pridobljeni z uporabo našega fluorometričnega sistema za zaznavanje, so dokazali visoko korelacijo s podatki, pridobljenimi s tradicionalnimi metodami. Metoda ima več prednosti, kot so nizki stroški obratovanja, veliko prostorsko in časovno ločljivost in posredovanje informacij o spremembah v planktonskih populacijah v realnem času.

Leta 2015 smo po skoraj dveh letih intenzivnega dela prestali končno presojo za izvajanje testov mutagenosti pod pogoji Dobre laboratorijske prakse (DLP). Ministrstvo za zdravje, Urad Republike Slovenije za kemikalije je Oddelku za Genetsko toksikologijo in biologijo raka 13. 7. 2015 podelilo potrdilo o skladnosti za izvajanje študij mutagenosti skladno z načeli OECD Dobre laboratorijske prakse (DLP). To potrdilo je pomembno za naše sodelovanje in izvajanje storitev za naročnike iz gospodarstva ter državnih in mednarodnih institucij.

through the sensor field of detection. The particles are maintained in suspension by mixing or creating a uniformly directed flow. Particles are excited by fast pulsed light beam at selected light wavelengths with simultaneous capture of the generated light signal. Due to the inhomogeneous detection zone, two characteristics of the resulting signal can be distinguished; the average signal, which represents the concentration of microparticles, and the characteristic deviation caused by the individual microparticles entering the optimum detection field of the sensor. The advantage of this method is non-invasiveness because it allows the study of particles and organisms without interfering with their current state, which enables us to observe changes in their behaviour under environmental conditions. Applicability of this method was tested within the framework of the "LIFE Stop CyanoBloom" demonstration project funded by the financial mechanism of the European Commission's LIFE Environment. The aim of the project is to present a remote control vessel fitted with on-line sensors and a built-in electrolytic cell for easy and efficient determination of physical, chemical and biological parameters of the aquatic environment and for the prevention of the proliferation of cyanobacteria. The results obtained with our fluorometric detection system have demonstrated a high correlation with the data obtained using traditional methods. The method has several advantages, such as low operating costs, high spatial and temporal resolution, and transmission of information on the changes in plankton populations in real time.

In 2015 we underwent the final assessment for the implementation of mutagenicity tests according to Good Laboratory Practice (GLP) principles after almost two years of intensive work. On 13 July 2015 the Office of the Republic of Slovenia for Chemicals at the Ministry of Health granted to the Department of Genetic Toxicology and Cancer Biology the certificate of conformity for the implementation of mutagenicity studies in accordance with the OECD principles of Good Laboratory Practice (GLP). Obtaining this certificate is an important step forward for our collaborations and service implementation with clients from the industry, government and international institutions.

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3	Objavljeni znanstveni prispevek na konferenci / Published Scientific Conference Contribution
3	Objavljeni povzetek znanstvenega prispevka na konferenci (vabljeno predavanje) / Published Scientific Conference Contribution Abstract (invited lecture)
26	Objavljeni povzetek znanstvenega prispevka na konferenci / Published Scientific Conference Contribution Abstract
1	Objavljeni povzetek strokovnega prispevka na konferenci / Published Professional Conference Contribution Abstract
1	Polemika, diskusijski prispevek / Polemic, Discussion
3	Intervju / Interview
1	Drugi sestavni deli / Other Component Parts
10	Končno poročilo o rezultatih raziskav / Final Research Report
1	Patentna prijava / Patent Application
3	Druge monografije in druga zaključena dela / Other Monographs and Other Completed Works
8	Radijski ali TV dogodek / Radio or Television Event
1	Predavanje na tuji univerzi / Invited Lecture at Foreign University
1	Prispevek na konferenci brez natisa / Unpublished Conference Contribution
1	Vabljeno predavanje na konferenci brez natisa / Unpublished Invited Conference Lecture
1	Druga izvedena dela / Other Performed Works
8	Uredništvo / Editorship

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INFRASTRUKTURNI CENTER NIB

Vodja: izr. prof. dr. Maruša Pompe Novak

Infrastrukturni center NIB (IC NIB) sestavljata programsko in organizacijsko zaokrožena 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 omogoča uporabo opreme in storitve javnemu in zasebnemu sektorju.

Veliko infrastrukturno opremo IC Planta sestavljajo:

- presevni elektronski mikroskop (Philips CM100) s CCD-kamero, 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 VIA7),
- 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
- karantenska rastlinjaka.

Poleg tega je mogoča uporaba tudi:

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

NIB INFRASTRUCTURAL CENTRE

Head: Assoc. Prof. Dr Maruša Pompe Novak

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

The large infrastructural equipment of Planta IC consists of:

- *a transmission electron microscope (Philips Cm100) with a CCD camera co-owned by the National Institute of Biology (NIB) and the Department of Biology at the Biotechnical Faculty (BF) of the University of Ljubljana (UL),*
- *a cryo-ultramicrotome (Leica EM FC6) and ultramicrotome (Leica),*
- *a confocal stereomicroscope (Leica TCS LSI),*
- *real-time PCR instruments (ABI 7900HT Fast, Roche Light Cycler 480 and ABI PRISM VIA7),*
- *digital PCR instruments (Biorad QX100, Biorad Qx200 and Fluidigm BioMark HD),*
- *a robot for pipetting (Hamilton Microlab STARlet),*
- *growth chambers for plant and tissue culture breeding (Kambič),*
- *plant growth chambers for separate breeding (Kambič),*
- *two quarantine greenhouses.*

It is also possible to use:

- *spectrofluorimeters (SynergyMx, BioTek) and*
- *a system for the identification of microorganisms using fatty acid methyl ester analysis by Gas Chromatography (Sherlock Microbial Identification System) that is currently located at the Biotechnical Faculty (BF) of the University of Ljubljana (UL).*

Veliko infrastrukturno opremo IC MBP sestavljajo:

- raziskovalno plovilo PI-800 Sagita s sodobno navigacijsko in raziskovalno opremo, različnimi vzorčevalniki, akustičnim tokomerjem in sodobno, multiparametrično sondo,
- oceanografska boja Vida z meteorološkimi merilnimi instrumenti, multiparametričnimi sondami in akustičnim tokomerjem ter
- manjše plovilo namenjano manjšim in hitrim posegom na morju ter
- visoko frekvenčni radijski merilnik površinskih tokov in valov (HF Radar).

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 najsodobnejša 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.

Leta 2015 so veliko infrastrukturno opremo IP NIB uporabljali 103 različni uporabniki. S tem je IP NIB dosegel cilj, da mu je kljub zmanjševanju celotnih sredstev, namenjenih za znanost v Sloveniji v letu 2015, uspelo ohraniti izjemno veliko uporabnikov svoja velika infrastrukturne oprema.

Tematike raziskave in analize, za katere se je uporabljala velika infrastrukturna oprema IP NIB, so bile izjemno različne. To kaže na izjemen pomen vsebine IP NIB za slovenski prostor, in sicer na zelo raznovrstnih področjih raziskovalnega dela ter aplikacij za delo za podjetja, državne in vladne organe in resorje ter za pedagoško delo.

Velik prispevek IP NIB k izkoriščenosti infrastrukturne opreme kaže tudi podatek, da je bilo leta 2015 kar 29 % uporabnikov IP NIB iz drugih RO.

The large infrastructural equipment of PMBS IC consists of:

- *a PI-800 Sagita research vessel, which is equipped with sophisticated navigation and marine research equipment,*
- *a Vida oceanographic buoy, which is equipped with meteorological and oceanographic instruments (a multiparametric CTD and current meter),*
- *a smaller vessel suited for fast interventions at sea, and*
- *a high frequency radar (HF Radar).*

Planta IC's equipment supports research activities, ministries and their inspection bodies, enterprises and educational activities. All of Planta IC's large equipment is technologically advanced and carefully, regularly and professionally maintained. This large equipment is also used by other organisations. Training courses are arranged for frequent users, and services on the large equipment are offered to those preferring to order analyses.

The PMBS IC supports the research and applicative activities for ministries and other public institutions as well as the educational activities carried out at PMBS. The technologically advanced and sophisticated infrastructure in place enables state-of-the-art research activities to be conducted at sea and ranks the PMBS IC among the leading centres in the Mediterranean. The PMBS serves as the National Oceanographic Data Centre (NODC). The PMBS IC infrastructure ensures that the data on sea conditions is of high quality and that it is close to real time.

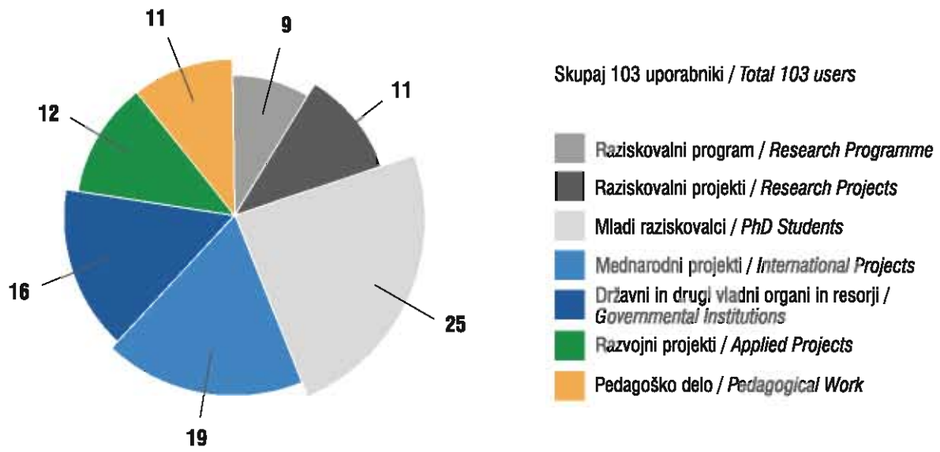
PMBS IC infrastructure ensures that the data on sea conditions is of high quality and that it is close to real time.

In the year 2015, the infrastructural equipment at the NIB IC was used in the scope of research activities of 103 different users. Our goal to maintain a large number of users despite budget cuts for science in Slovenia was achieved.

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

In 2015, 64% of the NIB IC major infrastructural equipment users came from our own research organization (RO) and 36% from other ROs.

Infrastrukturni program NIB 2015 / *NIB Infrastructural Programme in 2015*
Število uporabnikov / *Number of users*



IP NIB svojo veliko infrastrukturno opremo stalno dopolnjuje in posodablja. Leta 2015 je IC Planta svojo opremo dopolnil z Avtomatizirano aparaturo za kapljični digitalni PCR (Biorad Qx200). Gre za sistem za avtomatizirano pripravo in analizo kapljične digitalne verižne reakcije s polimerazo, ki je sestavljen iz avtomatiziranega/robotiziranega generatorja kapljic, čitalnika kapljic in računalnika z ustrezno programsko opremo. Sistem omogoča avtomatizirano pripravo in analizo nukleinskih kislin v različnih vzorcih s kapljično digitalno verižno reakcijo s polimerazo (ddPCR). Sistem za detekcijo omogoča uporabo hidrolizirajočih sond (npr. TaqMan) in interkalirajočih barvil (npr. EvaGreen). Avtomatski/robotiziran generator kapljic omogoča hitre analize, zmanjša možnosti napake in poveča ponovljivost rezultatov.

IC MBP je leta 2015 dopolnil glavni radijski oddajnik (radar HF), nameščen na pobočju pod piransko stolnico, z manjšim oddajnikom, ki pošilja signal tudi proti jugu, proti Piranskemu zalivu. Oddajnik, ki je z glavnim časovno uglašen prek GSP-signala, je nameščen na streho piranskega gledališča.
Tako je dosežena pokritost skoraj celotnega slovenskega teritorialnega morja.

The NIB IC carefully, regularly and professionally maintains its major infrastructural equipment. Special care is devoted to permanent modernization of equipment. In 2015 the Planta IC supplemented its equipment with QX200™ Droplet Digital™ PCR System (Biorad QX200) that consists of the automated QX200 droplet generator, the QX200 droplet reader, computer, and software. The system enables the preparation and analyses of nucleic acids in different samples with droplet digital PCR (ddPCR). The automated QX200 droplet generator provides analysis fast, reduces mistakes and increases reproducibility of results. The QX200 droplet reader enables the use of TaqMan hydrolysis probe and intercalating dyes (e.g., EvaGreen).

In 2015, the primary HF radar transmitting pair of antennas set up on the slope bellow the Piran cathedral was upgraded with a secondary pair that transmits the signal towards the south, to the Bay of Piran. This secondary pair is tuned to the master pair through GPS signal. It is set up on the roof of the Piran city theatre and hidden from view of the passers-by. By using both pairs of transmitting antennas we succeeded to get excellent coverage of the entire Gulf of Trieste, including

Na spletni strani (http://www.nib.si/mbp/sl/oceanografski-podatki/drugi-oceanografski-podatki/hf-radar-2) so v skoraj realnem času strokovni in laični javnosti na voljo podatki meritev površinskih valov v Tržaškem zalivu. Surovi podatki piranskega oddajnika in oddajnika na Nabrežini (Italija) so združeni in avtomatizirano obdelani, produkti pa predstavljeni v vektorski obliki na spletni strani. Vendar so surovi podatki namenjeni tudi asimilaciji v modelne rešitve, ki se izvajajo na Morski biološki postaji in jih izvajajo tudi na Agenciji RS za okolje. Zato smo postavili sistem pretoka podatkov v skoraj realnem času, ki koristi modelni uporabi obeh institucij.

IP NIB je tudi leta 2015 zagotavljal sodelovanje med raziskovalci različnih raziskovalnih programov, projektov in institucij, pa tudi povezovanje raziskovalcev z uporabniki raziskav iz vrst drugih proračunskih uporabnikov in industrije ter stik s pedagoškim procesom. IP NIB je tudi leta 2015 pomenil podlago za sodelovanje v evropskih in drugih mednarodnih projektih. S sodobno in dobro vzdrževano (skladno z ISO 17025) raziskovalno opremo IP NIB so se izvajali tudi projekti, katerih naročniki so bila podjetja, ki pričakujejo dokazila o kontroli kakovosti za izvajanje storitev. Oprema IP NIB pa je služila tudi za podporo tehnološkemu razvoju ter za razvoj metod in izvajanje specializiranih analiz.

Slovenian territorial waters. The web page (http://www.nib.si/mbp/sl/oceanografski-podatki/drugi-oceanografski-podatki/hf-radar-2) offers measurements of surface currents to the public in near to real time. Raw data gathering from the transmitting antennas in Piran and those in Aurisina (Italy) is done automatically, data are presented as vector image. Raw data are also used in the modelling of solutions performed at the Piran Marine Biology Station.

The NIB IC's equipment supports activities in research, work bodies of ministries, enterprises and education. The NIB IC ensures collaboration between researchers active in different research programmes, projects and institutions. It facilitates connections of researchers with users that include other budget users and various industries; it facilitates connections between research activities and educational processes as well. The NIB IC possesses up-to-date and well maintained research equipment (in accordance with the ISO/IEC 17025 system) which is an essential prerequisite for competitive research performance in life sciences and applicative projects in collaboration with enterprises.

Avtomatizirana aparatura za kapljični digitalni PCR (Biorad QX200).
Qx200™ Droplet Digital™ PCR System (Biorad QX200).

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