Questionnaire
Summary of the main activities of a research institute of the Slovak Academy of Sciences

Period: January 1, 2012 - December 31, 2015

1. Basic information of the institute:

1.1. Legal name and address

Institute of Zoology, Slovak Academy of Sciences
Dúbravská cesta 9, 845 06 Bratislava, Slovak Republic

1.2. URL of the institute web site

http://www.zoo.sav.sk

1.3. Executive body of the institute and its composition

Directoriat	Name	Age	Years in the position
Director	RNDr. Milan Kozánek, CSc. RNDr. Dušan Žitňan, DrSc.	63 57	2007-2015 2015-
Deputy director	RNDr. Stanislav Kalúz, CSc. Ing. Ladislav Roller, PhD.	64 46	2010-2015 2015-
Scientific secretary	Ing. Juraj Majtán, PhD. RNDr. Ľubomír Vidlička, CSc.	38 53	2011-2015 2015-

1.4. Head of the Scientific Board

RNDr. Dušan Žitňan, DrSc. (2010-2014)

Ing. Ladislav Roller, PhD. (2014 -

1.5. Basic information on the research personnel

1.5.1. Number of employees with university degrees (PhD students included) engaged in research projects, their full time equivalent work capacity (FTE) in 2012, 2013, 2014, 2015, and average number of employees in the assessment period

	2012		2013		2014		2015		total		
	number	FTE	number	FTE	number	FTE	number	FTE	number	averaged number per year	averaged FTE
Number of employees with university degrees	42,0	34,590	39,0	33,125	42,0	30,300	40,0	26,410	**163,0**	**40,8**	**31,106**
Number of PhD students	12,0	12,000	12,0	12,000	13,0	13,000	11,0	11,000	**48,0**	**12,0**	**12,000**
Total number	54,0	46,590	51,0	45,125	55,0	43,300	51,0	37,410	**211,0**	**52,8**	**43,106**

1.5.2. Institute units/departments and their FTE employees with university degrees engaged in research and development

Research staff	2012		2013		2014		2015		average	
	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE
Institute in whole	42,0	34,590	39,0	33,125	42,0	30,300	40,0	26,410	**40,8**	**31,106**
Section of Animal Ecology	15,0	12,760	13,0	11,360	10,0	9,100	10,0	8,350	**12,0**	**10,393**
Section of Medical Zoology	11,0	9,110	11,0	9,660	13,0	8,080	11,0	5,830	**11,5**	**8,170**
Section of Molecular and Applied Zoology	16,0	12,720	15,0	12,105					**15,5**	**12,413**
Section of Biocontrol and Biotherapy					16,0	10,790	13,0	9,850	**14,5**	**10,320**
Section of Molecular Physiology					3,0	2,330	6,0	2,380	**4,5**	**2,355**

1.6. Basic information on the funding of the institute
Institutional salary budget and others salary budget

Salary budget	2012	2013	2014	2015	average
Institutional Salary budget *[thousands of EUR]*	**0,48943**	**0,50749**	**0,4972**	**0,49403**	**0,497**
Other Salary budget *[thousands of EUR]*	**0,20319**	**0,25858**	**0,23649**	**0,12338**	**0,205**

1.7. Mission Statement of the Institute as presented in the Foundation Charter

Research activities of the Institute of Zoology SAS (IZ SAS) comprise the basic and applied research in zoology, physiology, hydrobiology, ecology and related biological disciplines. The main areas of interest are the following:

1. i) Taxonomy, phylogeny and ecology of invertebrate and vertebrate animals. These studies include natural history of animals, terrestrial and aquatic ecosystems, ecological disturbances by humans and nature conservation.
   ii) Physiology, molecular biology, genetics, biochemistry and animal behavior. This research is focused on identification, expression and function of bioactive molecules and their receptors in insects and ticks.
   iii) Parasitology and medical importance of animals. The goal is to elucidate complex interactions between vertebrate hosts, invertebrate parasites and various pathogens causing health problems in animals and humans.
   iv) Applied research in forestry, agriculture and medicine. The mission is development and application of biotherapeutical approaches to patients in hospitals, as well as utilisation of insect mass-rearing methods for agricultural and forestry purposes.
2. Results of these research activities are published in good quality scientific journals and books.
3. The Institute has been developing collaborations with institutions and universities sharing similar research activities at the national and international level.
4. The Institute promotes the doctoral programme according to the actual legislation.
5. The Institute provides consultant and expertise services related to its research activities.

1.8. Summary of R&D activity pursued by the institute during the assessment period in both national and international contexts, (recommended 5 pages, max. 10 pages)

(a) **Hormonal regulation of insect and tick physiology and development**

Our research group has been working on function of neuropeptides and their receptors using insect model species, the silk moth *Bombyx mori* and the fruit fly *Drosophila melanogaster*. In particular, we described mechanisms of expression, release and action of multiple neuropeptides and receptors that control various behaviors and physiological functions important for normal development, metamorphosis and reproduction. Results of our main topic - neuroendocrine regulation of insect ecdysis - have been reviewed in an extensive book chapter (Žitňan and Adams, 2012) and two handbooks (Adams et al., 2013; Žitňan and Daubnerová, 2014). These chapters summarized our data generated in collaboration with the University of California, Riverside during the last 20 years and included identification and functional characterization of several neuropeptides and their receptors in different insect model species. We also provided detailed description of expression and release of these bioactive molecules during development and analyzed mode of their action using Calcium imaging, electrophysiology and various bioassays. Based on our previous data published in prestigious scientific journals (Science, Neuron, PNAS, Current Biology), hormonal regulation of ecdysis has become a fundamental model for understanding of complex signaling cascades governing animal development and behaviors. The following studies included regulation of gene expression by steroid hormones and transcription factors that leads to competence of endocrine Inka cells to release ecdysis triggering hormone (ETH) and enables the advancement to the next developmental stages (Cho et al. 2014). Recent five-year collaboration with the Korean group located in the Gwanjiu Institute of Science and Technology resulted in publication of three high quality papers in PNAS, PLOS Genetics and Current Biology. This collaborative effort using advanced genetic approaches, molecular biology, imaging and sophisticated bioassays led to identification of novel neuropeptides and description of specific neuronal pathways that control various aspects of insect behavior associated with homeostasis and reproduction (Jiang et al. 2013; Oh et al. 2014; Lee at al. 2015).

We frequently use available insect genomes and cDNA databases to identify genes encoding bioactive molecules and their receptors. In addition, we used Illumina next generation sequencing for identification of transcripts from different stages of the brain and ventral ganglia, endocrine Inka cells, as well as other endocrine and reproductive organs. In particular, we screened for all the genes encoding neuropeptides and their receptors, cloned corresponding cDNA and used them as templates for in situ hybridization. So far, we identified and isolated ~50 neuropeptide genes and characterized numerous receptors. These sequences have been used for preparation of specific probes for in situ hybridization. We recently completed detailed description of neuropeptide expression in the CNS, gut, and Inka cells using in situ hybridization and immunohistochemistry. In collaboration with Japanese scientists who produced and provided numerous neuropeptide antibodies we will use all these data for "*Bombyx* neuropeptide atlas" which will be available online on the web page produced in collaboration with the bioinformatics group at the Institute of Molecular Biology.

To further advance our understanding of complex interactions between steroids, neuropeptides and their specific receptors, we recently developed techniques for transient and germ-line transformation in *Bombyx*. This moth became a very attractive model system with availability of its genome and the growing utility of transient transformation using the recombinant baculovirus expression system derived from *Autographa californica* nucleopolyhedrovirus (AcNPV). The neuropeptide promoter and EGFP reporter is inserted into AcNPV bacmid using Bac-to-Bac expression system (Invitrogen) for transient gene transfer into the CNS. This system has been successfully used for identification of upstream regulatory regions (promoters) from genes encoding neuropeptides and various bioactive proteins of interest. We have been using *Bombyx* strain N4 which is sensitive to baculovirus infection and shows a strong and specific expression of EGFP in several types of peptidergic neurons (Roller et al. 2016). To drive targeted expression of various molecular markers, receptors and

transcription factors, these promoters were then subcloned with these markers or factors into the piggyBac vector and used for germ-line transformation. So far, injection of eggs with various piggyBac constructs resulted in production of numerous transgenic lines which have been utilized for experiments to clarify mechanisms of action and physiological functions of neuropeptides, receptors and transcription factors. We are also experienced in genetic approaches established in the fruit fly (*Drosophila*) that include CRISPR/Cas9 system for targeted mutations of specific genes or insertions of various constructs and molecular markers. These approaches have been used for identification of genes involved in regulation of circadian clock and reproduction.

Ticks are medically very important haematophagous ectoparasites transmitting numerous dangerous pathogens (e.g. encephalitis virus, *Borrelia*, *Rickettsia*, *Babesia*), that seriously affect health of various animals and humans. It is generally known that the salivary glands, gut and gonads are important reservoirs of these pathogens, but regulation of their activity during tick feeding has not been elucidated. Also mechanisms required for successful transmission of pathogens from ticks into the host bloodstream are poorly understood. We were first to describe a very complicated neuroendocrine network connecting the brain with the salivary glands, gut and gonads of several tick species (Šimo et al., 2012, 2014; Roller et al., 2014). In this network of neurons and endocrine cells we identified a large number of neuropeptides closely related to those found in insects and even humans. Most importantly, we showed that some of the brain neurons form elaborate innervation of the salivary glands, hindgut and gonads to modulate their activity. In collaboration with the Kansas State University we described complex mechanisms of neuropeptide and dopamine-regulated paracrine secretion of the salivary glands from the tick into the host (Šimo et al., 2012). We were invited to review this work in a book chapter (Šimo et al., 2014). Moreover, our data have been utilized for development of peptide vaccines specific against ticks and tick-borne pathogens (Project: Development of diagnostic techniques for detection of tick-borne pathogens and approaches for preparation of vaccines against ticks; OPVV (ITMS-26240220044).

(b) **Ecology and epidemiology of ticks and tick-borne pathogens**

Our research has been focused on distribution and seasonal dynamics of the epidemiologically most important tick in Central Europe, *Ixodes ricinus* and its infection by *Borrelia burgdorferi* and *Anaplasma* spp. These bacterial pathogens are of medical and veterinary importance and cause serious health problems in animals and humans. Furthermore, we have screened ticks and hosts for the presence of newly emerging tick-transmitted bacterial agents such as *Borrelia miyamotoi* and *Candidatus (Neoehrlichia) mikurensis*. All detected bacteria were closely characterized by genetic methods to resolve the phylogenetic relationships and association with the vectors and reservoir hosts (Derdáková et al. 2014).

Lyme borreliosis is the most prevalent tick-borne disease in Europe. It is caused by spirochetes of the *Borrelia burgdorferi* sensu lato (s.l.) complex of which *Borrelia afzelii*, *B. garinii*, and *B. valaisiana* are the most common genospecies in Central Europe. These spirochetes are transmitted to humans by blood-feeding ticks of the genus *Ixodes*. In our previous research we studied infection of ticks with *B. burgdorferi* s.l. and their expansion in various types of habitats including higher altitudes and urban parks. We confirmed expansion of *I. ricinus* ticks to higher altitudes over 1000 m. The overall prevalence of *Borrelia* between different sites varied from 7 to 46%. *Borrelia afzelii*, *B. garinii*, and *B. valaisiana* were detected at each studied site as the most prevalent, but in montane area of central Slovakia *Borrelia lusitaniae* constantly predominated. Our discovery that the mountain study sites were natural foci of *B. lusitaniae* was unexpected because this genospecies was usually associated with lizards and xerothermic habitats. *B. burgdorferi* s.s. was not detected at every site, but it was commonly found in urban parks from both western and eastern Slovakia along with *B. bavariensis, B. spielmanii, B. garinii* and *B. valaisiana*. *Borrelia*-positive ticks in urban habitats harbored mostly the latter two genospecies assigning blackbird population an essential role for circulation of spirochetes in towns. Currently we are analysing the genetic structure of *Borrelia* species in Slovakia including *B. lusitaniae*, *B. spielmanii* and *B. bavariensis* by multilocus sequence typing analysis. On this project we are collaborating with Dr. Gabriele Margos from German National Reference Center for Borrelia. She is currator of the MLST database for

Borrelia. Using this approach we obtained novel information on the population structure of *B. lusitaniae* from sub-montane areas that represent an unique sequence type.

We also studied ecology of bacteria *A. phagocytophilum*. This research was accomplished in collaboration with the Parasitological Institute SAS in Košice and Dr. Rizzoli from FEM, Italy under EDENnext project. Genetic analyses of *A. phagocytophilum* strains can reveal ecological forces that have shaped their genetic diversity and specialization of specific pathogens, vectors and hosts. We have analyzed and compared the genetic variability of different *A. phagocytophilum* strains from questing and feeding ticks and different vertebrate hosts from several sites in Central Europe. *A. phagocytophilum* was detected in questing and host feeding *I. ricinus* ticks from all studied sites, as well as from feeding tick *I. trianguliceps* on rodents and rodents' ear and spleen biopsies. Phylogenetic analysis based on four genetic loci showed that *A. phagocytophilum* genotypes in questing and feeding *I. ricinus* from ungulates, birds and dogs were distinct from genotypes found in rodents and feeding tick *I. trianguliceps*. Our study confirmed that rodents in Europe were not reservoirs of *A. phagocytophilum* genotypes pathogenic for humans, as originally thought (Svitálková et al. 2015, Baráková et al. 2014).

Candidatus mikurensis is a newly emerging tick-borne bacteria from the family Anaplasmataceae. Its presence in *I. ricinus* ticks was reported from various European countries, however, its ecology and co-circulation with another member of the same family, *A. phagocytophilum* has not been rigorously studied*. C. mikurensis* was detected in all sampling sites that we analysed so far. In total, 4.5% of ticks were positive including larvae. The highest positivity was detected in Austria with a prevalence of 23.5%. The probability of *C. mikurensis* occurrence increased with the proportion of ticks infected with *A. phagocytophilum*. A positive association between the occurrences of *C. mikurensis* and *A. phagocytophilum* indicates that both bacteria share similar ecology for their natural foci in Central Europe (Blaňarová et al. 2014, Derdáková et al. 2014).

Rickettsia is another pathogen usually found in ticks that may cause rash and fever in humans. Using molecular biology techniques, we detected some rickettsiae in chiggers (arthropods related to ticks) in Slovakia. Presence of *Rickettsia helvetica* and *R. monacensis* was detected in the chigger *Hirsutiella zachvatkini* (Trombiculidae). *R. helvetica* was also recorded in the chigger *Kepkatrombicula štorkáni*. We also determined some new ecological relationships between newly described chiggers and their hosts (Miťková et al. 2015).

(c) Bioactive substances in the salivary glands and gut of arthropods

Larvae of flies *Lucilia sericata* have been used for maggot debridement therapy (MDT) because of their ability to remove necrotic tissue and eradicate bacterial pathogens of infected wounds. So far, very few antibacterial factors have been fully characterized in these flies (e.g. lucifensin). Using a molecular approach, some other putative antimicrobial compounds, including three novel lysozymes, have been previously identified and predicted to be involved in MDT. Nevertheless, expression of lysozymes in different tissues and their functions have never been elucidated. Therefore, we described the expression profiles of three lysozymes in *L. sericata* and found that they are produced by specific sections of the midgut. Moreover, we characterized the eradication process of bacteria in the digestive system of maggots and confirmed the antibacterial role of lysozymes in MDT. Recombinant lysozymes displayed comparable antibacterial activity against *Micrococcus luteus*. Furthermore, the majority of Gram-positive bacteria were destroyed *in vivo* within the particular section of the *L. sericata* midgut where lysozymes are produced. Our data indicate that antibacterial action of the midgut lysozymes is responsible for subsequent eradication of ingested wound pathogens during their passage through the intestine of maggots (Valachová et al. 2013, Valachová et al. 2014).

Larval gut and salivary glands of *L. sericata* produce a cocktail of proteolytic and antimicrobial substances called excretion/secretion (ES) products. We prepared a cDNA library from the salivary glands and identified novel putative serine proteases, metalloproteinase and signal peptide protease. In situ hybridisation revealed following expression profiles in all the three larval instars during the feeding stage: serine protease 1 – anterior gut, fat body and grease coupler of salivary glands; serine protease 2 – salivary glands and Malpighian tubes; serine protease 3 – salivary glands and anterior midgut; prenyl metalloproteinase and signal peptide protease were expressed in the salivary glands and fat body. We also investigated the expression of previously identified protease (chymotrypsin) and found that it was produced only

in the anterior part of the midgut. In conclusion, we identified five novel putative proteases of medicinal maggots and demonstrated that they could be secreted into the wound during the MDT (Valachová et al., 2014).

(d) Population and Evolutionary Ecology of insects and mites

The high mountain streams affected by windstorm damage in Slovakia were used as a model to evaluate influences of global climatic changes on fresh water ecosystems. Deforestation of stream basins increased average water temperature which was reflected in changes of the assemblages of water insects including Plecoptera (Krno et al., 2013; 2015) and Trichoptera (Kalaninova et al., 2014).

In alpine lakes we compared relationships between temperature of surface water in mountain lakes, ice-cover characteristics, lake morphometry, local topography and altitude. The effect of topographic shading was shown for the first time as a key factor influencing temperature characteristics of mountain lakes. The results confirmed importance of altitude and lake depth on surface water temperatures and ice-cover timing. We proposed to include the direct solar radiation as a model parameter that would considerably improve predictions of lake temperatures and ice-cover features (Novikmec et al., 2013).

We obtained a unique 10-year series of data on succession of mountain Carabid beetle assemblages in intact spruce forests and in managed stands in the Tatra National Park destroyed by the windstorm in November 2004. Our long set of data allowed separation of periodic changes in quantitative parameters of assemblages that are about one year delayed after the climate fluctuations, especially incidence of extreme drought, with about 3-4-year periodicity. The extreme drought reduces species diversity and cumulative abundance of all assemblages. The standardized precipitation and evaporation index (SPEI) was shown to be the best for description and prediction of these changes. The continuous tendency to warming of the climate in the Tatra Mts resulted in the spatial spreading of Carabid species having optimum of vertical distribution at lower altitudes gradually occupying dominant position in the assemblages in the damaged stands. Preservation of fallen timber in situ in the damaged stands was shown to be most beneficent for the soil surface fauna. In such circumstances fallen trees created only quantitative changes in structure of assemblages. In contrast, the timber extraction and subsequent fire resulted in a strong reduction of the original fauna and invasion of xenocoenous species. The differences between burned and non-burned areas with extracted timber disappeared after ~5 years (Šustek 2015, Vido et al. 2015).

We examined the influence of destructive wind storm on spruce forests in the Tatra Mts of North Slovakia on the structure of taxocenoses of soil mites. Various populations of the spruce bark beetle (*Ips typographus*) were studied in different localities of the Tatra Mts together with spectrum of phoretic mites associated with these beetles. This study revealed different size structure of beetles and their sexes, and various spectra of phoretic mites. Differences in species diversity reflect various soil conditions and rich mosaics of habitats created by the storm in this newly formed area (Kalúz et al. 2013).

(e) Reproductive strategies, maternal investment and habitat selection of birds

We examined relationships between eggshell colouration, egg quality and female condition in Eurasian bird (reed warbler – *Acrocephalus scirpaceus*). The eggshell pigmentation appeared to be independent of female condition and parasites, but reflected concentrations of egg bioactive compounds such as testosterone and lysozyme (Krištofík et al. 2013).

Maternal investment can play an important role in offspring fitness, especially in birds, as females have to provide their eggs with all the necessary nutrients for the development of the embryo. It is known that this type of maternal investment can be influenced by the quality of the male partner. We verified for the first time that male song is important in the mate choice of female Eurasian reed warblers, as males mate faster when their singing is more complex. Furthermore, female egg investment varies in relation to male song characteristics. Egg white lysozyme was positively correlated with male song complexity. In contrast, a negative correlation exists between song speed, syllable repetitiveness, egg yolk weight, as well as egg yolk testosterone concentration (Krištofík et al. 2014).

The function of behaviour for paternity assurance was experimentally examined. Introducing a potential extra-pair partner during the female fertile period showed immediate or long-term responses (e.g. increase mate guarding and copulation frequency) or (e.g. later parental investment and paternity uncertainty). The results revealed that occurrence of an intruder triggered aggression against the intruder, depending on the presence of the female. Paternal investment was independent of the actual paternity losses. In females, the experiment elicited both, immediate and long-term responses. Female copulation solicitations during the intruder experiment were only observed in females which later turned out to have extra-pair chicks in their nest. Extra-pair paternity also seems to be affected by female quality and body size (Hoi et al. 2013). Analysis of vegetation type for habitat choice, reproductive investment, survival and fitness of an individual and success within one population suggest clear differences in vegetation structure between territories of the reed (*Phragmites australis*) and the reed mace (*Typha* sp.). Reproductive success was significantly lower in reed nests (Darolová et al. 2012).

(f) Ecology of host-parasite interactions

Parasites of birds. Possible negative impact of two feather-eating louse species (*Meropoecus meropis* and *Brueelia apiastri*) on male and female European bee-eaters (*Merops apiaster*) was examined. Parasitization of these birds by the lice reduced body mass, sedimentation rate and haematocrit levels. The results further suggest differences in sex-specific susceptibility of bee-eater (Hoi et al. 2012). The aim of another study was to reveal new aspects of the role of flea vectors taken from the migratory bird, Eurasian reed warbler (*Acrocephalus scirpaceus*) by screening of individuals with molecular biological methods. *Rickettsia africae* and *Wolbachia* sp. were detected in fleas. This finding was the first record of *Rickettsia africae* and *Wolbachia* sp. in Central Europe in fleas collected from migratory birds returning from Africa (Sekeyová et al. 2012).

Bacteria and birds. Using both molecular and cell culture techniques, nest-associated bacterial assemblages were characterised throughout the entire nesting cycle of Eurasian reed warblers by sampling bacteria on eggs before and during incubation, from nestling faeces, and on the nesting material of post-breeding nests. The bacterial assemblages were clustered by nest component. Egg incubation was associated with changes in the structure of assemblages, including decrease in potentially-harmful Gram-negative bacteria. In addition, it was shown for the first time that egg incubation is associated with the complete eradication of the harmful hemolytic bacteria (Brandl et al. 2014).

(g) Taxonomy, phylogeny and phylogeography of invertebrates

Mites and ticks. We examined taxonomy, phylogeny and distribution of species from several invertebrate groups collected from different areas of the world. Within the assessment period, considerable progress was made in taxonomy of mites (Acarina). We recognized, described and illustrated 71 new species and 4 genera from Europe, Asia, Africa and South America (e.g. Fenďa & Mašán 2012, Plumary & Mašán 2014, Ermilov, Kalúz & Tolstikov 2013, Ermilov & Kalúz 2014). We made an extensive taxonomic revision of the European mites (Acari: Mesostigmata) originally described by other acarologists (Berlese, Evans, Halbert, Halliday, Hyatt, Karg, Oudemans, Schweizer and Willmann). In addition, new synonymies were introduced for 2 genera and one species, while more than 40 species were introduced as new combinations (Mašán & Halliday 2014). In Slovakia, we found 5 species for the first time, including two haematophagous ectoparasitic mites with medical and veterinary importance, namely *Dermanyssus americanus* (Ewing, 1923) and *Ornithonyssus bursa* (Berlese, 1888). The recorded species have been characterized on the basis of their regional geographic distribution and ecological requirements in terms of habitat preference and altitudinal distribution. Since many species have epidemiological and epizootological significance, our attention was focused on parasitic and nidicolous fauna of mites living in association with free living mammals and birds. For example, we reported a remarkable finding of an unusual mite species, *Neocoprozercon europaeus* gen. nov., sp. nov., restricted to the cavernicolous environment and associated with mammals, the European badger and the racoon dog (*Meles meles* Linnaeus, 1758; *Nyctereutes procyonoides* Gray, 1834). This mite is the first member of

the family Coprozerconidae (Acari: Mesostigmata) found in the Palaearctic Region (Fenďa and Mašán 2012).

We studied phoretic mites especially those associated with coprophilous, necrophilous and mycophilous arthropods, as well as mites associated with spiders found in the pet trade, or with important beetle pest of palm trees, *Rhynchophorus ferrugineus* Olivier, 1790 (Curculionidae) from the Mediterranean area and Asia (Dilipkumar et al. 2015). The mite *Proctolaelaps euserratus* Karg, 1994 (Acari, Melicharidae), exclusively known from the Galápagos Islands, was reported from decaying matter of animal and human decomposition in various countries of Europe (Slovakia, Spain, United Kingdom) (Mašán et al. 2013). In consequence of necrophilia, this species is considered to be ecologically unusual among the other melicharids, which are associated with different habitats, such as galleries of beetles, bumble bee nests, flowers, etc. *P. euserratus* was reviewed, re-described (with first diagnostic characters for males), and considered as a new potential marker for later stages of animal and human decomposition, namely butyric fermentation and dry decomposition as classified in modern concepts of forensic acarology. Moreover, in Slovak mountains we found 1 genus and 20 species of mites for the first time.

Insects and other invertebrates. We described one recent and four fossil species of cockroaches (Blattaria) and seven species of the water beetles (Coleoptera: Dryopidae and Elmidae) from tropical regions (Čiampor et al. 2012, 2014; Vidlička 2013; Vršanský et al. 2012, 2013, 2014). All these taxons are new to science and their findings illustrate our poor knowledge of invertebrate fauna worldwide. Within the study of insect assemblages in spruce forests in the Tatra National Park destroyed by the windstorm in November 2004, we found and described a novel neuropteran *Helicoconis tartricus*. This species is possibly endemic in the Tatra Mountains (Vidlička 2014). The Lauxanidae are small acalyptrate flies whose larvae are important decompositors of dead and decayed organic matter. Since their biology is poorly known, therefore we described life history and immature stages of 25 species of these flies (Diptera, Cyclorrhapha) for the first time (Semelbauer & Kozánek 2012, 2014a, b). Taxonomy and phylogeny of water beetles were analysed using various molecular markers (Goffová et al. 2015), while phylogegraphical study was conducted on the bark beetle *Ips typographus.* This study showed that the Carpathian Mountains are an important glacial and postglacial refugee for the bark beetles (Krascsenitsová et al. 2013).

Within aquatic fauna, the worm *Bothrioneurum vejdovskyanum* Štolc, 1886, (Oligochaeta) was recorded for the first time in freshwater streams in Serbia (Atanacković et al. 2012), while Ponto-Caspian amphipod *Corophium robustum* (Sars, 1895) was found in Slovak-Hungarian Danube stretch (Lipták et al. 2012). During the international project Joint Danube Survey 2007 (JDS2) 2800 km stretch of the Danube was monitored and a total of 52 species of Oligochaeta was recorded (Atanacković et al. 2013). To broaden our knowledge of Slovak fauna we conducted faunistic research in various terrestrial biotops. Twelve species of sawflies (Symphyta) and four species of lauxaniid flies (Diptera) were recorded in Slovakia for the first time (Roller, Olšovský 2012; Smetana et al. 2015). Moreover, two invasive insect species, the grass-carrying wasp *Isodontia mexicana* (Semelbauer 2015) and the cockroach *Ectobius vittiventris* were first recorded in Slovakia (Vidlička 2014).

(h) Applied zoology

The IZ SAS has a long tradition in applied research utilizing results of basic science for agricultural, medical and environmental practice.

We study biology of the tsetse flies and use sterile insect technique (SIT) to eradicate sleeping sickness and nagana in Africa. Our tsetse research and mass rearing facility provides breeding material for a large tsetse fly production facility in Ethiopia, Kenya, Burkina Faso and Senegal. At the same time we provide training of African scholars to improve breeding of tsetse colonies and optimize flight characteristics of sterile male tsetse *Glossina pallidipes* that are released to compete with wild males. Our research group also analyzed effects of various antibiotics and yeast extracts on intestinal bacterial symbionts and their impact on the overall fertility of tsetse flies. The endosymbionts provide nutritional supplements essential for the female fecundity. This dependence on obligate microbiota for reproduction may generate alternative control strategies. Endosymbionts are associated with

the metabolism of B-complex vitamins essential for tsetse survival. We examined the effect of yeast-based meals and different B-complex vitamin mix meals on fitness and fecundity of three species: *Glossina morsitans*, *G. pallidipes* and *G. palpalis gambiensis*. The results revealed positive effects of different diets on different species. In *G. morsitans* and *G. gambiensis* the highest positive impact had yeast diet, while by *G. pallidipes* the highest fecundity and fitness appeared by vitamin B mix diet. In *G. morsitans* flies we observed total proline levels, the major circulating hemolymph nutrient. Proline levels following removal of endosymbionts were reduced during periods of milk production associated with intrauterine larval development and could be recovered by yeast or vitamin B cocktail supplements. Proline levels after insulin injections revealed tendency of aposymbiotic flies for diabetes, whereas the flies fed on yeast or vitamin diet were able to stabilize the proline levels after insulin injection. These results confirmed importance of vitamin B production by endosymbionts as essential part of nutrition for tsetse flies (e.g. Michalková et al. 2014, Attardo et al. 2012, 2014, Benoit et al. 2012, 2014, 2015).

The key concept of biotherapy is to use living animals for the diagnosis and treatment of illnesses. The IZ SAS has a long-term experience in development of biotherapeutical methods. Examples of biotherapy include: hirudotherapy (leech therapy), maggot therapy (larval therapy), apitherapy (bee products therapy) and ichtyotherapy (fish therapy). Larval and ichtyotherapy has been successfully applied to patients in more than ten hospitals in Slovakia. Since 2004 Institute of Zoology cooperates with the first Surgical Clinic, Faculty Hospital in Bratislava on the development of larval therapy for the treatment of non-healing wounds and its introduction into clinical practice. The team of the Biocontrol and biomonitoring lab has been working on saprophagous and coprophagous flies and their possible use for biotherapeutic and biotechnology purposes. Maggot debridement therapy has become a well-established method of wound debridement. Despite its success, little information is available on optimal duration of the treatment cycle and larval growth in wounds. We examined the development of *Lucilia sericata* (Diptera: Calliphoridae) larvae under two conditions (bagged and free range) in simulated wound conditions. We also examined the biobags with larvae used to debride traumatic, ischemic, diabetic and venous ulcers. At the same time, we developed a new way of MDT, using the hydrogel with larval saliva. The hydrogel can be applied for the treatment of chronic non-healing wounds where conventional pharmacological treatment has failed. The hydrogel is capable of autolytic reduction of necrosis, maintains optimal moisture even in dry wounds and does not damage surrounding healthy cells. The therapeutic effect of hydrogels with larval saliva is comparable to biobags, but is slower. This new therapy seems particularly effective in the treatment of small superficial non-healing wounds (e.g. Valachová et al. 2013, Bohová et al. 2014, Čičková et al. 2013, 2015).

The Institute is also developing other biotherapeutical projects. In collaboration with Faculty of Medicine Slovak Medical University we characterized the antibacterial properties of Slovak natural honey and compared it with potential of medical-grade manuka honey. We found that honeydew honey from Čergov mountain (Bardejov) exhibited strong antibacterial, antibiofilm and wound healing properties. These i*n vitro* studies showed that this honey is suitable for treatment of non-healing infected wounds and selected the most effective honey for medical purposes (e.g. Majtán et al. 2013, 2014, Majtán 2014).

The key concept of biotherapy is to use living animals for the diagnosis and treatment of illnesses. The IZ SAS has a long-term experience in development of biotherapeutical methods. Examples of biotherapy include: hirudotherapy (leech therapy), maggot therapy (larval therapy), apitherapy (bee products therapy) and ichtyotherapy (fish therapy). Larval and ichtyotherapy has been successfully applied to patients in more than ten hospitals in Slovakia.

Extensive changes in the structure of forests and negative influence of human activities to the environment (polution, acid rains, climatic changes etc.) create suitable conditions for the development of forest pests, especially bark and wood-boring insects. Team of scientists from the IZ SAS participated on the research of the biology of bark beetle *Ips typographus* and the development of new methods to control population densitites of this most destructive forest pest in Europe. The attention was paid to development of new methods for the bark beetle biological control by their natural pathogens, parasitoids or predators. A system for the targeted application of spores of entomopathogenic fungus *Beauveria bassiana* was developed and successfully used in the lab and field conditions. Applied spores of the fungus

were embedded in polymerous matrix which supported their adhesion to cuticle of the bark beetle. To accelerate this research a lab for collaboration between the IZ SAS and two other partners was built in Tatranská Lomnica. This lab is dedicated for the development of rearing techniques for bark beetles, as well as for their parasitoids and predators (Michalková, Krascsenitsová & Kozánek 2012, Krascsenitsová et al. 2013).

The IZ SAS participated in the MoRe project (European Regional Development Fund) for the Morava river restoration along the Slovak-Austrian border. This project was conducted in accordance with the agreement with EC Water and Nature Protection Directives. The main objectives were to restore the original character of the meandering lowland river to achieve a dynamic equilibrium of the ecosystem and to improve the diversity of natural habitats in the floodplains. Impact of Gabčíkovo dam system was also monitored using bioindicative animal groups. Changes in the assemblages of fishes, molluscs and zooplankton were monitored throughout the assessment period.

2. Partial indicators of main activities:

2.1. Research output

2.1.1. Principal types of research output of the institute: basic research/applied research, international/regional (ratios in percentage)

basic research / applied research: 80 % / 20 %

international research / regional research: 95 % / 5 %

2.1.2 List of selected publications documenting the most important results of basic research. The total number of publications listed for the assessment period should not exceed the average number of employees with university degrees engaged in research projects. The principal research outputs (max. 5, including Digital Object Identifier - DOI) should be underlined

[1] PROKOP P. - MAXWELL M.R. Gift carrying in the spider *Pisaura mirabilis*: nuptial gift contents in nature and effects on male running speed and fighting success. In ***Animal Behaviour***, 2012, vol. 83, no. 6, p. 1395-1399 DOI: 10.1016/j.anbehav.2012.03.007. (3.493 - IF2011).

[2] MAŠÁN P. - SIMPSON Ch. - PEROTTI M.A. - BRAIG H.R. Mites Parasitic on Australasian and African Spiders Found in the Pet Trade; a Redescription of *Ljunghia pulleinei* Womersley. In ***PLoS ONE***, 2012, vol. 7, iss. 6, DOI: 10.1371/journal.pone.0039019. (4.092 - IF2011).

[3] ATTARDO G.M. - BENOIT J.B. - MICHALKOVÁ V. - YANG G. - ROLLER L. - BOHOVÁ J. - TAKÁČ P. - AKSOY S. Analysis of lipolysis underlying lactation in the tsetse fly, *Glossina morsitans*. In ***Insect Biochemistry and Molecular Biology***, 2012, vol.42, iss. 5, p. 360–370, DOI:10.1016/j.ibmb.2012.01.007. (3.246 - IF2011).

[4] BENOIT J.B. - ATTARDO G.M. - MICHALKOVÁ V. - TAKÁČ P. - BOHOVÁ J. - AKSOY S. Sphingomyelinase Activity in Mother's Milk Is Essential for Juvenile Development: A Case from Lactating Tsetse Flies. In ***Biology of Reproduction***, 2012, vol. 87, no. 1, p. 1-10 DOI:10.1095/biolreprod.112.100008. (4.009 - IF2011).

[5] ČIČKOVÁ H. - PASTOR B. - KOZÁNEK M. - MARTÍNEZ-SÁNCHEZ A. - ROJO S. - TAKÁČ P. Biodegradation of Pig Manure by the Housefly, *Musca domestica*: A Viable Ecological Strategy for Pig Manure Management. In ***PLoS ONE***, 2012, vol. 7, iss. 3, p. e32798 DOI: 10.1371/journal.pone.0032798. (4.092 - IF2011).

[6] VALACHOVÁ I. - BOHOVÁ J. - PÁLOŠOVÁ Z. - TAKÁČ P. - KOZÁNEK M. - MAJTÁN J. Expression of lucifensis in *Lucilia sericata* medicinal maggots in infected environments. In ***Cell and Tissue Research***, 2013, vol. 353, no. 1, p. 165-171. (3.677 - IF2012).

[7] MELNIČÁKOVÁ J. - DERDÁKOVÁ M. - BARÁK I. A system to simultaneously detect tick-borne pathogens based on the variability of the 16S ribosomal genes. In ***Parasites & vectors***, 2013, vol. 6, no. 1, article no. 269, 12pp. (3.246 - IF2012).

[8] JIANG H. - LKHAGVA A. - DAUBNEROVÁ I. - CHAE H-S. - ŠIMO L. - JUNG S-H. - YOON Y-K. - LEE N-R. - JAE Y. - ŽITŇAN D. - PARK Y. - KIM Y-J. Natalisin, a tachykinin-like signaling system, regulates sexual activity and fecundity in insects. In ***Proceedings of the National Academy of Sciences of the United States of America***, 2013, vol. 110, no. 37, p. E3526-34. (9.737 - IF2012).

[9] HAVLÍKOVÁ S. - LIČKOVÁ M. - AYLLÓN N. - ROLLER L. - KAZIMÍROVÁ M. - SLOVÁK M. - MORENO-CID J.A. - PÉREZ DE LA LASTRA, J.M. - KLEMPA B. - DE LA FUENTE J. Immunization with recombinant subolesin does not reduce tick infection with tick-borne encephalitis virus nor protect mice against disease. In ***Vaccine***, 2013, vol. 31, no. 12, p. 1582–1589. (3.492 - IF2012).

[10] HOI H. - KRIŠTOFÍK J. - DAROLOVÁ A. Experimentally simulating paternity uncertainty: immediate and long-term responses of male and female Reed Warblers *Acrocephalus scirpaceus*. In ***PLoS ONE***, 2013, vol. 8, iss. 4, article no: e62541. (3.730 - IF2012).

[11] BARÁKOVÁ I. - DERDÁKOVÁ M. - CARPI G. - ROSSO F. - COLLINI M. - TAGLIAPIETRA V. - RAMPONI C. - HAUFFE H. - RIZZOLI A. Genetic and Ecologic Variability among *Anaplasma phagocytophilum* Strains, Northern Italy. In ***Emerging Infectious Diseases***, 2014, vol. 20, no. 6, p. 1082-1085, DOI: 10.3201/eid2006.131023. (7.327 - IF2013).

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[13] MAŠÁN P. - FENĎA P. A new edaphic mite of the genus *Pachyseius* (Acari, Mesostigmata, Pachylaelapidae) from Făgăraş Mountains (Romania), with a key to world species. In ***Systematic and Applied Acarology***, 2014, vol. 19, iss. 2, p. 137–143. (1.115 - IF2013).

[14] MEMBERS OF THE INTERNATIONAL GLOSSINA GENOME INITIATIVE, Serap Aksoy, Attardo Geoffrey, Sanger M. B. et al. - MICHALKOVÁ V. Genome sequence of the tsetse fly (*Glossina morsitans*): vector of African trypanosomiasis. In ***Science***, 2014, vol. 344, no. 6182, p. 380-386. (31.477 - IF2013).

[15] MICHALKOVÁ V. - BENOIT J.B. - WEISS B.L. - ATTARDO G.M. - AKSOY S. Vitamin B6 Generated by Obligate Symbionts Is Critical for Maintaining Proline Homeostasis and Fecundity in Tsetse Flies. In ***Applied and Environmental Microbiology***, 2014, vol. 80, no. 18, p. 5844-5853,
DOI: 10.1128/AEM.01150-14. (3.952 - IF2013).

[16] MICHALKOVÁ V. - BENOIT J.B. - ATTARDO G.M. - MEDLOCK J. - AKSOY S. Amelioration of reproduction-associated oxidative stress in a viviparous insect is critical to prevent reproductive senescence. PLoS One, 2014, Vol. 9: e87554.

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[18] SEMELBAUER M. - KOZÁNEK M. Immature stages of *Meiosimyza* Hendel 1925 and related genera (Diptera, Lauxaniidae). In ***Organisms Diversity & Evolution***, 2014, vol. 14 iss. 1, p. 89-103. (3.365 - IF2013).

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[20] VALACHOVÁ I. - TAKÁČ P. - MAJTÁN J. Midgut lysozymes of *Lucilia sericata* – new antimicrobials involved in maggot debridement therapy. In Insect Molecular Biology, 2014, vol. 23, no. 6, p. 779–787. (2.976 - IF2013).

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[22] TAN A.W.L. - FRANCISCHETTI I.M.B. - SLOVÁK M. - KINI R.M. - RIBEIRO J.M.C. Sexual differences in the sialomes of the zebra tick, *Rhipicephalus pulchellus*. In ***Journal of Proteomics***, 2015, vol. 117, no., p. 120 – 144. (3.888 - IF2014).

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[26] BELL-SAKYI L. - PALOMAR A.M. - KAZIMÍROVÁ M. Isolation and propagation of a *Spiroplasma* sp. from Slovakian *Ixodes ricinus* ticks in *Ixodes* spp. cell lines. In ***Ticks and Tick-Borne Diseases***, 2015, vol. 6, iss. 5, p. 601–606. (2.718 - IF2014).

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[28] BENOIT J.B. - ATTARDO G.M. - BAUMANN A.A. - MICHALKOVÁ V. - AKSOY S. Adenotrophic Viviparity in Tsetse Flies: Potential for Population Control and as an Insect Model for Lactation. In ***Annual review of entomology***: [serial], 2015, vol. 60, no., p. 351–371. DOI: 10.1146/annurev-ento-010814-020834. (13.731 - IF2014).

[29] GREENWALT D.E. - VIDLIČKA Ľ. *Latiblattella avita* sp. nov. (Blattaria: Ectobiidae) from the Eocene Kishenehn Formation, Montana, USA. In ***Palaeontologia Electronica***, 2015, vol. 18, iss. 1, article no.: 16A, 9 pp. (2.081 - IF2014).

[30] HOI H. - KRIŠTOFÍK J. - DAROLOVÁ A. All you can eat: is food supply unlimited in a colonially breeding bird? In ***Ecology and Evolution***, 2015, vol. 5, iss. 2, p. 450-458. (2.320 - IF2014).

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2.1.3 List of monographs/books published abroad

[1] NEIL, Alexander - ALLEPUZ, Alberto - ALTEN, Bulent - BØDKER, Rene - BONNET, Sarah - CARPENTER, Simon - CÊTRE-SOSSAH, Catherine - CHIROUZE, Emilie - DEPAQUIT, Jérôme - DRESSEL, Kerstin - DUCHEYNE, Els - DVOŘÁK, Vít - KASAP, Ozge Erisoz - GALL, Yvonne - FALL, Assane Gueye - FARKAS, Robert - FIGUEROLA, Jordi - GARROS, Claire - GROSCHUP, Martin H. - HALADA, P. - HENDRICKX, Guy - HENTTONEN, Heikki - HLAVÁČKOVÁ, Kristyna - HORNOK, Sándor - HUBÁLEK, Zdeněk - ILTIS, Nicole - KAZIMÍROVÁ, Mária - KLEY, Nils. *The impact of a decade of research (2004-2015) on vector-borne diseases.*. EDEN and EDENext, 2015. 132 p.

2.1.4. List of monographs/books published in Slovakia

[1] APFELOVÁ, Mária - BUČKO, Jozef - CEĽUCH, Martin - DANKO, Štefan - FENĎA, Peter - HANZELOVÁ, Vladimíra - HELL, P. - CHOVANCOVÁ, Barbara - KADLEČÍK, Ján - KADLEČÍKOVÁ, Zuzana - KAŇUCH, Peter - KARASKA, Dušan - KAŠTIER, Peter - KOCIAN, Ľudovít - KOCIANOVÁ-ADAMCOVÁ, M. - KRIŠTÍN, Anton - KRIŠTOFÍK, Ján - KÜRTHY, Alexander - LEHOTSKÁ, Blanka - LEHOTSKÝ, Roman - MIKLÓS, Peter - MATIS, Štefan - MOŠANSKÝ, Ladislav - PČOLA, Štefan - PJENČÁK, Peter - SLÁDEK, Jozef - STANKO,

Michal - STOLLMAN, Andrej - ŠEVČÍK, Martin - ŠPAKULOVÁ, Marta - UHRIN, Marcel - URBAN, Peter - VALACHOVIČ, Dušan - ŽIAK, Dávid. *Cicavce Slovenska : rozšírenie, bionómia a ochrana* = Mammals of Slovakia, distribution, bionomy and protection. Krištofík Ján, Danko Štefan (Eds.). 1. vyd. Bratislava : Veda, 2012. 712 s. ISBN 978-80-224-1264-3.

[2] FALISOVÁ, Anna - TAKÁČ, Peter - LENGYELOVÁ, Tünde. *Výskum a vývoj nových bioterapeutických metód : chronológia, etnografické aspekty, pramene* [Research and development of new bio therapeutic methods: chronology, ethnographic aspects source]. Bratislava : Historický ústav SAV, 2013. 130 s. Publikácia k projektu OPVV 26240220030 Výskum a vývoj nových bioterapeutických metód a ich využitie pri liečbe niektorých závažných ochorení. ISBN 978-80-971483-2-4.

[3] HOLECOVÁ, M. - FRISOVÁ CHRISTOPHORYOVÁ, Jana - MRVA, Martin - ROHÁČOVÁ, Magdaléna - STAŠIOV, Slavomír - ŠTRICHELOVÁ, Jana - ŠUSTEK, Zbyšek - TIRJAKOVÁ, Eva - TUF, Ivan H. - VĎAČNÝ, P. - ZLINSKÁ, J. *Biodiversity of soil micro- and macrofauna in oak-hornbeam forest ecosystem on the territory of Bratislava*. Bratislava : Comenius University in Bratislava, 2012. 143 pp. ISBN 978-80-223-3319-1.

[4] MAJZLAN, Oto. *Chrobáky (Coleoptera) Tatier* = Beatles (Coleoptera) of Tatras. Bratislava : Ústav zoológie SAV : Scientica, 2015. 224 s. ISBN 978-80-971483-0-0.

[5] ORSZÁGH, Ivan - ČEJKA, Tomáš - ORSZÁGHOVÁ, Zlatica. *Slovenské mená mäkkýšov (Mollusca)* = Slovak Names of the Mollusca. Bratislava : Univerzita Komenského v Bratislave, 2012. 208 str. Preložené pod názvom: 978-80-223-3170–8.

[6] STANKO, Michal. *Ryšavka tmavopása (Apodemus agrarius, Rodentia) na Slovensku.* [Striped field mouse (Apodemus agrarius, Rodentia) in Slovakia]. Košice : Parazitologický ústav SAV : Equilibria, 2014. 181 s. APVV-0267-10, Vega č. 1/0390/12. ISBN 978-80-89707-06-5.

[7] VIDLIČKA, Ľubomír. *Sieťokrídlovce (Neuroptera) Tatier* = Neuropterous insects (Neuroptera) of the Tatra Mountains. Bratislava : Ústav zoológie SAV : Scientica, 2015. 109 pp. ISBN 978-80-970326-5-4.

2.1.5. List of other scientific outputs specifically important for the institute, max. 10 items

Monographic studies in journals published abroad

[1] MAŠÁN, Peter - HALLIDAY, Bruce. Review of the mite family Pachylaelapidae (Acari: Mesostigmata). In *ZOOTAXA*, 2014, vol.3776, no. 1, p. 1–66. (2014 - Current Contents). ISSN 1175-5334.

Chapters in scientific monographs published abroad

[2] KAZIMÍROVÁ, Mária. Pharmacologically Active Compounds from Ticks and Other Arthropods and Their Potential Use in Anticancer Therapy. In *Natural Compounds as Inducers of Cell Death. Volume 1*. - Heidelberg New York London : Springer Dordrecht, 2012, part 2, Chapter 7, pp. 163-182. ISBN 978-94-007-4574-2.

[3] MAJTÁN, Juraj - BOHOVÁ, Jana - HORNIAČKOVÁ, Miroslava - MAJTÁN, Viktor. Anti-biofilm activity of natural honey against wound bacteria. Majtán Juraj (ed). In *HONEY: Current Research and Clinical Applications : Food and Beverage Consumption and Helth*. 1st edition. - New York : Nova Science Publishers, 2012, chapter V., p. 83-106. ISBN 978-1619426566.

[4] ŠIMO, L. - SONENSHINE, Daniel E. - PARK, Y. - ŽITŇAN, Dušan. The Nervous and Sensory Systems: Structure, Function, Proteomics and Genomics (Book chapter 13). In *Biology of Ticks*. Volume 1. - Oxford, GB : Oxford University Press, Inc, 2013, pp. 309-367. ISBN 978-0-19-974405-3.

[5] VALACHOVÁ, Ivana - BOHOVÁ, Jana - KOZÁNEK, Milan - TAKÁČ, Peter - MAJTÁN, Juraj. Lucilia sericata medicinal maggots: a new source of antimicrobial compounds. In *Microbial pathogens and strategies for combating them: science, technology and education*. Vol. 3. - Formatex Research Center, 2013, p. 1745-1753. ISBN ISBN: 978-84-942134-1-0.

[6] ŽITŇAN, Dušan - ADAMS, M.E. Neuroendocrine regulation of ecdysis. In *Insect Endocrinology*. - Elsevier, 2012, chapter 7, p. 253-309. ISBN 978-0-12-384749-2.

2.1.6. List of patents, patent applications, and other intellectual property rights registered abroad, incl. revenues

Application No.: 62/230,923
Filled on: 18/07/2015
Author names: Krishnamoorthy J.I., Koh Ch.Y., Kini R.M., Kazimírová Mária, Roller Ladislav
Patent name: Novel thrombin inhibitors
Co-owner: Institute of Zoology SAS

2.1.7. List of patents, patent applications, and other intellectual property rights registered in Slovakia, incl. revenues

Number of RP: 5031/2012
Author names: Florián Štěpán, Kozánek Milan, Takáč Peter, Čambal Marek
Patent name: Adhezívum na báze kopolyméru poly(vinylalkohol-vinylacetátu)
Owner: Institute of Zoology SAS

2.1.8. Table of research outputs (as in annual reports).

Papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) have to be listed separately.

Scientific publications	2012			2013			2014			2015			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
Scientific monographs and monographic studies in journals and proceedings published abroad *(AAA, ABA)*	0,0	0,000	0,000	0,0	0,000	0,000	1,0	0,023	2,011	1,0	0,027	2,024	**2,0**	**0,5**	**0,012**	**1,006**
Scientific monographs and monographic studies in journals and proceedings published in Slovakia *(AAB, ABB)*	3,0	0,064	6,130	1,0	0,022	1,970	1,0	0,023	2,011	2,0	0,053	4,048	**7,0**	**1,8**	**0,041**	**3,521**
Chapters in scientific monographs published abroad *(ABC)*	3,0	0,064	6,130	2,0	0,044	3,941	0,0	0,000	0,000	0,0	0,000	0,000	**5,0**	**1,3**	**0,029**	**2,515**
Chapters in scientific monographs published in Slovakia *(ABD)*	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	**0,0**	**0,0**	**0,000**	**0,000**
Scientific papers published in journals registered in Current Contents Connect *(ADCA, ADCB, ADDA, ADDB)*	42,0	0,901	85,815	51,0	1,130	100,494	63,0	1,455	126,709	26,0	0,695	52,628	**182,0**	**45,5**	**1,056**	**91,542**
Scientific papers published in journals registered in Web of Science Core Collection and SCOPUS *(ADMA, ADMB, ADNA, ADNB)*	9,0	0,193	18,389	12,0	0,266	23,646	10,0	0,231	20,113	10,0	0,267	20,242	**41,0**	**10,3**	**0,238**	**20,622**
Scientific papers published in other foreign journals (not listed above) *(ADEA, ADEB)*	10,0	0,215	20,432	13,0	0,288	25,616	5,0	0,115	10,056	3,0	0,080	6,072	**31,0**	**7,8**	**0,180**	**15,592**
Scientific papers published in other domestic journals (not listed above) *(ADFA, ADFB)*	14,0	0,300	28,605	15,0	0,332	29,557	16,0	0,370	32,180	12,0	0,321	24,290	**57,0**	**14,3**	**0,331**	**28,670**
Scientific papers published in foreign peer-reviewed proceedings *(AEC, AECA)*	7,0	0,150	14,302	3,0	0,066	5,911	0,0	0,000	0,000	0,0	0,000	0,000	**10,0**	**2,5**	**0,058**	**5,030**
Scientific papers published in domestic peer-reviewed proceedings *(AED, AEDA)*	12,0	0,258	24,518	6,0	0,133	11,823	3,0	0,069	6,034	8,0	0,214	16,193	**29,0**	**7,3**	**0,168**	**14,586**
Published papers (full text) from foreign and international scientific conferences *(AFA, AFC, AFBA, AFDA)*	2,0	0,043	4,086	0,0	0,000	0,000	0,0	0,000	0,000	1,0	0,027	2,024	**3,0**	**0,8**	**0,017**	**1,509**
Published papers (full text) from domestic scientific conferences *(AFB, AFD, AFBB, AFDB)*	17,0	0,365	34,734	7,0	0,155	13,793	3,0	0,069	6,034	5,0	0,134	10,121	**32,0**	**8,0**	**0,186**	**16,095**

- **Supplementary information and/or comments on the scientific outputs of the institute.**

Most significant results of the Institute's research activity are published in the journals included in ISI databases (WOS, CC, etc). The number of these publications per researcher (without PhD students) and year was at least 1.5 during the assessment period. We successfully published in journals with high impact factor, in average over the median IF in zoology and equal to the median IFs in physiology, biochemistry and molecular biology (InCites Reports 2014). Besides excellent papers published within international collaboration (Glossina Genome Initiative 2014 in *Science*; Jiang et al. 2013 in *PNAS*; Benoit et al. 2015 in *Ann Rew Entomol*, Baráková et al. 2014 in *Emerging Infect Diseases*), the number of "home-made" papers published in high quality journals (IF 2 - 5) has increased during the assessment period (e.g. Mašán et al. 2013; Valachová et al 2013; Roller et al. 2015; Svitálková et al 2015).

One of the major scientific outputs are monographs. The Institute is a member of consortium of European research institutions (6FP and 7FP EU projects) studying vector-borne diseases for more than a decade. The results of this long-term co-operation were summarized in the monograph (Neil et al. 2015). We also published several extensive reviews in monographs published abroad during the assessment period (Žitňan & Adams 2012; Šimo et al. 2013; Kazimírová 2012; Majtán et al. 2012; Valachová et al. 2013). Several monographs in Slovak language inform about distribution and abundance of terrestrial and aquatic animals and are very important at the national scale. These publications (monitoring reports, checklists, identification keys, etc) of national relevance serve as reference manual for other researcher branches (botanists, ecologists, foresters, etc) and as supportive material for implementation of the directives related to the protection of habitats and species within Slovakia.

2.2. Responses to the research outputs (citations, etc.)

2.2.1. Table with citations per annum.

Citations of papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) have to be listed separately.

Citations, reviews	2011		2012		2013		2014		total		
	number	No. / FTE	number	No. / FTE	number	No. / FTE	number	No. / FTE	number	averaged number per year	av. No. / FTE
Citations in Web of Science Core Collection (1.1, 2.1)	717,0	15,390	708,0	15,690	661,0	15,266	873,0	23,336	**2959,0**	**739,8**	**17,161**
Citations in SCOPUS (1.2, 2.2) if not listed above	119,0	2,554	90,0	1,994	145,0	3,349	147,0	3,929	**501,0**	**125,3**	**2,906**
Citations in other citation indexes and databases (not listed above) (3.2,4.2,9,10)	43,0	0,923	40,0	0,886	58,0	1,339	25,0	0,668	**166,0**	**41,5**	**0,963**
Other citations (not listed above) (3, 4, 3.1, 4.1)	314,0	6,740	170,0	3,767	194,0	4,480	104,0	2,780	**782,0**	**195,5**	**4,535**
Reviews (5,6)	0,0	0,000	1,0	0,022	0,0	0,000	0,0	0,000	**1,0**	**0,3**	**0,006**

2.2.2. List of 10 most-cited publications, with number of citations, in the assessment period (2011 – 2014).

[1] XIA, Qingyou - WANG, Jun - ZHOU, Zeyang - LI, Ruiqiang - FAN, Wei - CHENG, Daojun - CHENG, Tingcai - QIN, Junjie - DUAN, Jun - XU, Hanfu - LI, Qibin - LI, Ning - WANG, Mingwei - DAI, Fangyin - LIU, Chun - LIN, Ying - ZHAO, Ping - ZHANG, Huijie - LIU, Shiping - ZHA, Xingfu - LI, Chunfeng - ZHAO, Aichun - PAN, Minhui - PAN, Guoqing - SHEN, Yihong - GAO, Zhihong - WANG, Zilong - WANG, Genhong - WU, Zhengli - HOU, Yong - CHAI, Chunli - YU, Quanyou - HE, Ningjia - ZHANG, Z. - LI, Songgang - YANG, Huanming - LU, Cheng - WANG, Jian - XIANG, Zhonghuai - MITA, Kazuei - KASAHARA, Masahiro - NAKATANI, Yoichiro - YAMAMOTO, Kimiko - ABE, Hiroaki - AHSAN, Brudrul - DAIMON, Takaaki - DOI, Koichiro - FUJII, Tsuguru - FUJIWARA, Haruhiko - FUJIYAMA, Asao - FUTANASHI, R. - HASHIMOTO, Shin-ichi - ISHIBASHI, Jun - IWAMI, Masafumi - KADONO-OKUDAF, Keiko - KANAMORI, Hiroyuki - KATAOKA, Hiroshi - KATSUMA, Susumu - KAWAOKA, Shinpei - KAWASAKI, Hideki - KOHARA, Yuji - KOZAKI, T. - KUROSHU, Reginaldo M. - KUWAZAKI, Seigo - MATSUSHIMA, Kouji - MINAMI, Hiroshi - NAGAYASU, Yukinobu - NAKAGAWA, Tatsuro - NARUKAWA, Junko - NOHATA, Junko - OHISHI, Kazuko - ONO, Yukiteru - OSANAI-FUTAHASHIJ, Mizuko - OZAKI, Katsuhisa - QU, Wei - ROLLER, Ladislav - SASAKI, Shin - SASAKI, Takuji - SEINO, Atsushi - SHINOMURA, M. - TADASU, Shin-i - SHINODA, Tetsuro - SHIOTSUKI, Takahiro - SUETSUGU, Yoshitaka - SUGANO, Sumio - SUWA, Makiko - SUZUKI, Yutaka - TAKIYA, Shigeharu - TAMURA, Toshiki - TANAKA, Hiromitsu - TANAKA, Yoshiaki - TOUHARA, Kazushige - YAMADA, Tomoyuki - YAMAKAWA, Minoru - YAMANAKA, Naoki - YOSHIKAWA, Hiroshi - ZHONG, Yang-Sheng - SHIMADA, Toru - MORISHITA, Shinichi. The genome of a lepidopteran model insect, the silkworm Bombyx mori. In *Insect Biochemistry and Molecular Biology*, 2008, vol. 38, p. 1036-1145. ISSN 0965-1748.
Number of citation (2011-2014): 121

[2] ROLLER, Ladislav - YAMANAKA, Naoki - WATANABE, Ken - DAUBNEROVÁ, Ivana - ŽITŇAN, Dušan - KATAOKA, Hiroshi - TANAKA, Yoshiaki. The unique evolution of neuropeptide genes in the silkworm Bombyx mori. In *Insect Biochemistry and Molecular Biology*, 2008, vol. 38, no. 12, p. 1147-1157. ISSN 0965-1748.
Number of citation (2011-2014): 70

[3] YAMANAKA, Naoki - YAMAMOTO, Sachie - ŽITŇAN, Dušan - WATANABE, Ken - KAWADA, Tsuyoshi - SATAKE, Honoo - KANEKO, Yu - HIRUMA, Kiyoshi - TANAKA, Yoshiaki - SHINODA, Tetsuro - KATAOKA, Hiroshi. Neuropeptide Receptor Transcriptome Reveals Unidentified Neuroendocrine Pathways. In *PLoS ONE*, 2008, vol. 3, no.8, e3048.
Number of citation (2011-2014): 60

[4] HANINCOVÁ, Klára - TARAGEĽOVÁ, Veronika - KOČI, Juraj - SCHÄFFER, S.M. - HAILS, R. - ULLMANN, A.J. - PIESMAN, J. - LABUDA, Milan - KURTENBACH, K. Association of Borrelia garinii and B- valaisiana with songbirds in Slovakia. In *Applied and Environmental Microbiology*, 2003, vol. 69, no. 5, p. 2825-2830 DOI: 10.1128/AEM.69.5.2825-2830.2003. (3.691 - IF2002). ISSN 0099-2240.
Number of citation (2011-2014): 50

[5] NUTTALL, Patricia A. - TRIMNELL, A.R. - KAZIMÍROVÁ, Mária - LABUDA, Milan. Exposed and concealed antigens as vaccine targets for controlling ticks and tick-borne diseases. In *Parasite immunology*, 2006, vol. 28, no. 4, p. 155-163. (1.445 - IF2005). (2006 - Current Contents). ISSN 0141-9838.
Number of citation (2011-2014): 46

[6] *Rozšírenie vtákov na Slovensku* = Birds distribution in Slovakia. Editors: DANKO, Štefan – DAROLOVÁ, Alžbeta - KRIŠTÍN, Anton. Bratislava : Veda, 2002. 688 s. ISBN 80-224-0714-3.
Number of citation (2011-2014): 42

[7] DUBSKÁ, Lenka - LITERÁK, I. - KOCIANOVÁ, Elena - TARAGEĽOVÁ, Veronika - SYCHRA, O. Differential role of passerine birds in distribution of Borrelia Spirochetes based on data from ticks collected from birds during the postbreeding migration period in Central Europe. In *Applied and Environmental Microbiology*, 2009, vol. 75, no. 3, p. 596-602. (3.801 - IF2008). (2009 - Current Contents). ISSN 0099-2240.
Number of citation (2011-2014): 41

[8] MEDLOCK, Jolyon - HANSFORD, Kayleigh M - BORMANE, A. - DERDÁKOVÁ, Markéta - ESTRADA-PEÑA, Agustín - GEORGE, Jean-Claude - GOLOVLJOVA, I. - JAENSON, Thomas G.T. - JENSEN, Jens-Kjeld - JENSEN, Per M. - KAZIMÍROVÁ, Mária - OTEO, José A. - PAPA, A. - PFISTER, Kurt - PLANTARD, Olivier - RANDOLPH, S.E. - RIZZOLI, Annapaola - SANTOS-SILVA, Maria Margarida - SPRONG, H. - VIAL, Laurence - HENDRICKX, Guy - ZELLER, H. - VAN BORTEL, Wim. Driving forces for changes in geographical distribution of Ixodes ricinus ticks in Europe. In *Parasites & vectors*, 2013, vol. 6, iss. 1, 11 pp. (3.246 - IF2012). ISSN 1756-3305.
Number of citation (2011-2014): 41

[9] HANINCOVÁ, Klára - SCHÄFFER, S.M. - ETTI, S. - SEWELL, H.S. - TARAGEĽOVÁ, Veronika - ŽIAK, Dalimír - LABUDA, Milan - KURTENBACH, K. Association of Borrelia afzelii with rodents in Europe. In *Parasitology*, 2003, vol. 126, p. 11-20 Part 1 DOI: 10.1017/S0031182002. (1.828 - IF2002). (2003 - Current Contents). ISSN 0031-1820.
Number of citation (2011-2014): 39

[10] KIM, Y. J. - ŽITŇAN, Dušan - GALIZIA, C.G. - CHO, K.H. - ADAMS, M.E. A command chemical triggers an innate behavior by sequential activation of multiple peptidergic ensembles. In *Current Biology*, 2006, vol. 16, no. 14, p. 1395-1407. ISSN 0960-9822.
Number of citation (2011-2014): 38

2.2.3. List of most-cited authors from the Institute (at most 10 % of the research employees with university degree engaged in research projects) and their number of citations in the assessment period (2011– 2014).

Author	Number of citation (2011-2014)
PROKOP, Pavol	551
ŽITŇAN, Dušan	422
ROLLER, Ladislav	378
KAZIMÍROVÁ, Mária	270

- **Supplementary information and/or comments on responses to the scientific output of the institute.**

Quality of our results is reflected in high number of citations in the assessment period. Number of citations in WOS and SCOPUS citation indexes has gradually increased. Six scientists were cited more than 100 times per year at the end of the assessment period what is the highest number in the history of IZ SAS.

2.3. Research status of the institute in international and national contexts

- **International/European position of the institute**

2.3.1. List of the most important research activities demonstrating the international relevance of the research performed by the institute, incl. major projects (details of projects should be supplied under Indicator 2.4). Max. 10 items.

1) **Ticks and Tick-borne diseases research programme**

We investigated the biology, ecology and epidemiology of tick-borne infections and the role of rodents in their circulation. *Ixodes ricinus* is epidemiologically most important European tick species. We determined presence and abundance of urban and suburban populations of *Ixodes ricinus* in Slovakia and existence of urban, suburban, rural and natural foci of tick-borne infections. The results suggest a risk of exposure of town dwellers and domestic and companion animals to infected ticks. The identity of species and strains of tick-borne microorganisms pathogenic to humans (Candidatus *Neoehrlichia mikurensis*, *Rickettsia helvetica*. *R. monacensis*, *Borrelia miyamotoi*, *Borrelia afzelii*, *B. garinii*, *B. burgdorferi* s.s., *B.*

spielmanii, *Babesia microti*, *B. venatorum*) was confirmed in questing *I. ricinus* ticks. Piroplasmida species new for the territory of Slovakia were identified in *Haemaphysalis concinna* ticks. Our findings suggest that I. ricinus and rodents play important roles in the epidemiology of zoonotic genotypes of Candidatus *N. mikurensis* and *Babesia microti* in Slovakia. In contrast, investigations on the genetic variability and ecological associations of *Anaplasma phagocytophilum* strains circulating in different habitat types of Slovakia confirmed findings from other European countries and suggest that various strains of the bacterium circulate in distinct enzootic cycles and rodents are not reservoirs of the human-pathogenic strain. The analysis of the high diversity of the tick microbiome, including pathogenic microorganisms (pathobiome), contributes to the understanding of the vector competence of ticks and tick – host – pathogen relationships, which is a prerequisite for development of new control measures against ticks and tick-borne infections.

Project: 7RP-EU 261504 - Biology and control of vector-borne infections in Europe

Partners: e.g. Research and Innovation Centre, Fondazione Edmund Mach, Italy; Department of Zoology, University of Oxford, Oxford, UK

2) **Tsetse flies research programme**

This includes research on tsetse flies and use of sterile insect technique (SIT) in order to eradicate sleeping sickness and nagana in Africa. Tsetse research and mass rearing facility provides breeding material for a large tsetse fly production facilities in Ethiopia, Kenya, Burkina Faso and Senegal. At the same time the research on the scientific tasks has been conducted to improve breeding properties of tsetse colonies, optimize flight ability of sterile males to efficiently compete with wild males of tsetse *Glossina pallidipes*. We were successfully secured several international research grants: Enhancing vector refractoriness to trypanosome infection (IAEA 17713); Improving SIT for tsetse flies through research on their symbionts and pathogens (IAEA 14812); Validation and refinement of new techniques for large scale rearing and for long-distance transport of fly material in support of tsetse mass rearing centres in West Afrika (IAEA 16773) and few other IAEA grants.

Partners: International Atomic Energy Agency; Department of Epidemiology of Microbial Diseases, Yale School of Public Health, Yale University, New Haven, Connecticut, USA

3) **Neuroendocrine regulation of development and behavior in arthropods programme**

This research programme has been predominantly focused on two related areas:

Neuropeptides involved in regulation of ecdysis and reproduction in insects. During long-term international collaboration, we identified a gene encoding novel neuropeptides related to vertebrate tachykinins and their receptors in three insect species. We described expression and functions of these peptides. Using RNAi we found that they play important role in regulation of reproduction and fertility and therefore we named them natalisins (JIANG H, IKHAGVA A, DAUBNEROVA I, CHAE H, SIMO L, JUNG S-H, YOON Y-K, SEONG J-Y, ZITNAN D, PARK Y, KIM Y-J 2013). Natalisin, a new tachykinin-like signaling system, regulates sexual activity and fecundity in insects. Proc. Nat. Acad. Sci. USA 13 Sep 10;110(37):E3526-34 doi/10.1073/pnas.1310676110).

Neuropeptide regulation of development and behavior in hard ticks (Ixodidae). We described expression and functions of neuropeptides in the hard ticks with focus on peptidergic neurons innervating the salivary glands and gut. These organs are important reservoirs of tickborne patogens and studies revealed a link between neuropeptides and transmission of various pahogens that are main focus in epidemiology and medicine. We identified large central neurons that innervate salivary glands and produce several neuropeptides that control activity of these organs during tick feeding. Our data are summarized in the monograph where we describe identification, expression and possible function of all known neuropeptides along with nervous, endocrine and sensory organs of ticks (SONENSHINE D, SIMO L, PARK Y, ZITNAN D. 2013). The nervous and sensory systems: structure, function, proteomics and genomics. Biology of ticks (D.E. Sonenshine, R.M. Roe, eds.).

Project: NIH-GM067310-11 - Molecular physiology of the epitracheal endocrine system

Partners: Gwangju Institute of Science and Technology, Buk-gu Gwangju, South Korea; Department of Entomology, Kansas State University, Kansas, USA.

4) **Biotherapy research programme**

Together with our collaborative clinical partners we succesfully established biotherapeutical methods such as larval therapy, apitherapy and ichtyotherapy in Slovakia. We also isolated several bioactive compounds from larval secretion/excretion and honey that can be used as potential therapeutic agents. The biotechnology of the larval therapy has been transfered within the framework of development aid to the Republic of Kenya.

Projects: SAMRS/2013/KEN/01/02 (Slovak Aid) Sustainable utilization of biodiversity of Kenya by bioprospecting and transfer of model biotechnology; Yamada Bee Farm Grant, 0173, Effect of royal jelly on skin regeneration: the role of matrixmetalloproteinase-9, 1.10.2013 / 30.9.2014

Partners: Kenya Agricultural Research Institute, Nairobi (KARI)

2.3.2. List of international conferences (co)organised by the institute.

None

2.3.3. List of edited proceedings from international scientific conferences.

None

2.3.4. List of journals edited/published by the institute:

2.3.4.1. WOS (IF of journals in each year of the assessment period)

[1] **Biologia** (If 2012 – 0.506; IF 2013 – 0.696; IF 2014 – 0.827; IF 2015 – 0.719)
5-year IF – 0.740

2.3.4.2. SCOPUS

2.3.4.3. other databases

[2] **Malacologica Bohemoslovaca** – indexed by Zoological Record (Biosis)
[3] **Entomofauna Carpathica -** indexed by Zoological Record (Biosis)

2.3.4.4. not included in databases

[4] **Limnologický spravodajca** – not included in database

- **National position of the institute**

2.3.5. List of selected projects of national importance

EU Structural Funds

[1] Creation of biotherapeutic facility and development of technology for research and production of biofarmaceutics, ITMS-26240220020, coordinator IZ SAS
[2] Development of methods for detection of tick-borne pathogens and vaccine strategies directed toward tick control, ITMS-26240220044, coordinator IZ SAS
[3] Development and application of the innovative diagnostic approach for the molecular identification of animals, ITMS-26240220049, coordinator IZ SAS

Slovak Research and Development Agency

[4] Utilization of transgenic approaches for functional analysis of neuropeptides and their receptors regulating behavior and development in insects, APVV-0827-11, coordinator IZ SAS
[5] Biodiversity of river corridors in tropical forests: present state, human impacts and restoration perspectives, APVV-0213-10, coordinator IZ SAS
[6] Clinical testing of slovak honeydew honey, APVV-0115-11, coordinator IZ SAS

[7] Structure of foci and emerging diseases with emphasis on role of rodents in urban type of natural foci of diseases, APVV-0267-10, investigator IZ SAS
[8] Danube sturgeons management and protection, APVV-0820-13, coordinator IZ SAS
[9] The role of neuropeptides and receptors in regulation of pathogen transfer from ticks to their hosts, APVV-14-0556, coordinator IZ SAS
[10] Pesticide-free control of the house fly and stable fly populations on livestock farms in Slovakia, APVV-14-0652, investigator IZ SAS

Slovak Aid Project

[11] Sustainable utilization of biodiversity of Kenya by bioprospecting and transfer of model biotechnology, SAMRS/2013/KEN/01/02, 107 459 Eur, Principal investigator: Milan Kozánek

2.3.6. Projects of the Slovak Research and Development Agency (APVV)

[1] Biodiversity of river corridors in tropical forests: present state, human impacts and restoration perspectives. (5/2011 – 10/2014)
Principal investigator: Fedor Čiampor
[2] Structure of foci and emerging diseases with emphasis on role of rodents in urban type of natural foci of diseases. (5/2011 – 10/2014)
Responsible investigator for the IZ SAS: Markéta Derdáková
[3] Clinical testing of slovak honeydew honey. (7/2012 – 12/2015)
Principal investigator: Juraj Majtán
[4] Utilization of transgenic approaches for functional analysis of neuropeptides and their receptors regulating behavior and development in insects. (7/2012 – 12/2015)
Principal investigator: Ladislav Roller
[5] Biological significance and pharmacological features of proteins in tick saliva. (10/2013 – 9/2017)
Responsible investigator for the IZ SAS: Mária Kazimírová
[6] Danube sturgeons management and protection. (10/2013 – 9/2017)
Principal investigator: Ladislav Pekárik
[7] Small mammals as a potential source of zoonotic bacteria and resistance to antibiotics. (7/2015 – 6/2019)
Responsible investigator for the IZ SAS: Markéta Derdáková
[8] Pesticide-free control of the house fly and stable fly populations on livestock farms in Slovakia (7/2015 – 6/2018)
Responsible investigator for the IZ SAS: Milan Kozánek
[9] The role of neuropeptides and receptors in regulation of pathogen transfer from ticks to their hosts (7/2015 – 6/2018)
Principal investigator: Dušan Žitňan

2.3.7. Projects of the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA)

[1] Forming of taxocoenoses of selected groups of evertebrates in mountain ecosystems influenced by natural catastrophes, climatical changes and anthropogenic intervences. (01/2010 – 12/2013)
Principal investigator: Zbyšek Šustek
[2] Population ecology of the alpine marmot *M. marmota latirostris*. (01/2010 – 12/2013)
Principal investigator: Radovan Václav
[3] Differences in reproduction and behavioral parameters in reed warbler (*Acrocephalus scirpaceus*) nesting in two different microhabitats in cat tail (*Typha* sp.) and reed (*Phragmites australis*)). (01/2011 – 12/2014).
Principal investigator: Alžbeta Darolová
[4] Dermanyssoid mites (Acari, Mesostigmata) associated with birds and their nests (Aves) in Slovakia, with consideration on taxonomy, ecology and chorology of individual species. (01/2011 – 12/2013)
Principal investigator: Peter Mašán

[5] The role of honey in the eradication process of bacterial pathogens of chronic wounds. (01/2011 – 12/2013)
Principal investigator: Juraj Majtán
[6] Genetic variability of *Anaplasma phagocytophilum* and its impact in the epizootiology of anaplasmosis of wild animals and livestock. (01/2011 – 12/2014)
Principal investigator: Markéta Derdáková
[7] Identification of novel anticoagulants in salivary glands of ticks (Acari: Ixodidae). (01/2012 – 12/2014)
Principal investigator: Mirko Slovák
[8] Cockroaches (Blattaria) from the family Nocticolidae – revision, occurence, distribution and ecological requirements. (01/2013 – 12/2016)
Principal investigator: Ľubomír Vidlička
[9] The role of H-organ and catecholamines in behavior and development of insects. (01/2013 – 12/2015)
Principal investigator: Dušan Žitňan
[10] Identification and expression of neuropeptides in the silkworm (*Bombyx mori*). (01/2013 – 12/2016)
Principal investigator: Ladislav Roller

2.3.8. Projects of SAS Centres of Excellence

None

2.3.9. National projects supported by EU Structural Funds

[1] Creation of biotherapeutic facility and development of technology for research and production of biofarmaceutics (11/2009 – 10/2012)
Principal investigator: Milan Kozánek
[2] Development of methods for detection of tick-borne pathogens and vaccine strategies directed toward tick control (11/2010 – 10/2013)
Principal investigator: Dušan Žitňan
[3] Development and application of the innovative diagnostic approach for the molecular identification of animals (11/2010 – 12/2013)
Principal investigator: Zuzana Čiamporová-Zaťovičová
[4] Centre of excelence for Glycomics (03/2010 – 04/2014)
Responsible investigator in the IZ SAS: Peter Takáč
[5] Development of ecological methods for control of populations of selected forest pests in vulnerable alpine regions of Slovakia (12/2010 – 12/2014)
Responsible investigator in the IZ SAS: Milan Kozánek
[6] Research and development of new bioterapeutic methods and its application in some illnesses treatment (06/2010 – 06/2015)
Responsible investigator in the IZ SAS: Peter Takáč
[7] Comenius University in Bratislava, Science Park (03/2013 – 12/2015)
Responsible investigator in the IZ SAS: Milan Kozánek
[8] Creation of R&D infrastructure for studies on genetic biodiversity of organisms and participation in International Barcoding of Life Initiative (10/2015 – 12/2015)
Responsible investigator in the IZ SAS: Milan Kozánek

2.3.10. List of journals (published only in the Slovak language) edited/published by the institute:

2.3.10.1. WOS (IF of journals in each year of the assessment period)

None

2.3.10.2. SCOPUS

None

2.3.10.3. Other databases

None

2.3.10.4. Not included in databases

None

- **Position of individual researchers in an international context**

2.3.11. List of invited/keynote presentations at international conferences, as documented by programme or invitation letter

[1] ŽITŇAN, Dušan - DAUBNEROVÁ, Ivana - ZIBRINOVÁ, Alexandra - ROLLER, Ladislav - KIM, Do-Hyoung - ADAMS, Michael Edward. Expression and function of neuropeptides and their receptors in Bombix mori. In Scientific Program for 24th ICE 2012 - New Era in Entomology : abstract CD. - Daegu Korea, **2012**, abstract no. S305W02 / Insect Immunology, Physiology and Neurobiology / session S305.

[2] ŽITŇAN, Dušan - DAUBNEROVÁ, Ivana - ZIBRINOVÁ, Alexandra - ROLLER, Ladislav - VALACHOVÁ, Ivana - BUDIŠ, J. - BREJOVÁ, B - ADAMS, M.E. Identification of novel neuropeptide-receptor pathways in Bombix mori. In Invertebrate Neuropeptide Conference (INC) **2013**. - Krabi, Thailand, 2013, p.12.

[3] MAJTÁN, Juraj - MAYER, Alexandra - SLEZÁK, Viliam - TAKÁČ, Peter - OLEJNIK, Juraj. Treatment Of The Lower Leg Ulcers With Honeydew Honey. In 3rd International Conference on the Medicinal Use of Honey : Program & abstract book. University Hasanuddin, Makassar, Indonesia. - Makassar, Indonesia : University Hasanuddin, Makassar, Indonesia, **2013**, p. 15 /Syp. 5 – 02/.

[4] MAJTÁN, Juraj. Med medicínskej kvality: náročná cesta medu od včelára k lekárovi. In Mezinárodní konference o medu : Sborník přednášek a abstrakt a Výstavní katalog. Šotolová Marie (ed). - Brno, CZ : Pracovní společnost nástavkových včelařú CZ, z.s., **2015**, str. 37. ISBN 978-80-260-8648-2.

[5] ŽITŇAN, Dušan - DAUBNEROVÁ, Ivana - ROLLER, Ladislav - ADAMS, M.E. Complex mechanisms of ETH expression and release in insects. (oral presentation). In Invertebrate Neuropeptide Conference **2015**, February 15.-19.2015, Bagan, Myanmar, "without pagination".

2.3.12. List of researchers who served as members of the organising and/or programme committees

None

- **Position of individual researchers in a national context**

2.3.13. List of invited/keynote presentations at national conferences, as documented by programme or invitation letter

[1] TAKÁČ, Peter - ČAMBÁL, M. - SLEZÁK, Viliam - MAJTÁN, Juraj. Maggot debridement therapy – the biotherapeutic method for healing of leg ulcers and other chronic wounds : lecture. In Program 21. Slovak angiological congress spojeného so 6. kurzom Central European Vascular Forum.

2.3.14. List of researchers who served as members of organising and programme committees of national conferences

XVI. conference of Slovak Limnological Society and Czech Limnological Society, Jasná, Nízke Tatry, 130 participants, 25.-29.06.2012 :

Organising committee

[1] RNDr. ElenaŠtefková, PhD.
[2] RNDr. Zuzana Čiamporová-Zaťovičová, PhD.
[3] RNDr. Marta Illýová, PhD.

Congress: 18. Feriancove dni "Zoológia 2012", Zvolen, 115 participants, 22.-24.11.2012 :

Organising committee

[4] Mgr. Ladislav Pekárik, PhD.

Conference III. Labudove dni, Bratislava, 24.-25.April 2013

Programme committee

[5] RNDr. Milan Kozánek, CSc.
[6] Doc. RNDr. Michal Stanko, DrSc

Organising committee

[7] RNDr. Mária Kazimírová, CSc.
[8] MVDr. Markéta Derdáková, PhD.
[9] Mgr. Veronika Tarageľová, PhD.
[10] Mgr. Diana Selyemová, PhD.

Congress 19. Feriancove dni "Zoológia 2014", Prešov, 140 účastníkov, 20.11.-22.11.2014

Organising committee

[11] Mgr. Ladislav Pekárik, PhD.

Programme committee

[12] doc. RNDr. Michal Stanko, DrSc

Conference IV. Labudove dni, Bratislava, 4.-6.November 2015

Programme committee

[13] Ing. Ladislav Roller, PhD.
[14] Doc. RNDr. Michal Stanko, DrSc

Organising committee

[15] MVDr. Markéta Derdáková, PhD.
[16] RNDr. Mária Kazimírová, CSc.
[17] Mgr. Veronika Rusňáková Tarageľová, PhD.
[18] Mgr. Diana Selyemová, PhD.

- **Supplementary information and/or comments documenting the international and national status of the Institute**

During 24 years of the existence, the Institute has become a leading zoological institution in Slovakia. Reorganization of the Institute and creating more compact research teams increased the scientific potential for funding of large projects from EU structural funds and other international and Slovak financial sources. The last evaluation of the Institute confirmed that established policy followed a progressive trend and research work brought deserving results. Recent and future scientific activities can be characterized from several aspects: basic experimental, ecological and applied research. As mentioned above, we have active collaborations with numerous local academic institutions from SAS and universities, as well as universities and research centers in EU, USA, Japan and Korea.

Editorial boards of scientific journals

[1] Čejka, T. – Folia faunistica Slovaca (member)
– Malacologica Bohemoslovaca (editor)
[2] Čiampor, F. – ISRN Entomology (editor)
– Zootaxa (editor)
[3] Čiamporová-Zaťovičová, Z. – Limnologický spravodajca (editor)
[4] Darolová, A. – Tichodroma (member)
[5] Derdáková, D. – Ticks and Tick Borne Diseases (section editor)
[6] Kalúz, S. – Entomofauna Carpathica (member)
– Folia Faunistica Slovaca (funkcia: člen)
[7] Kazimírová, M. – Advances in Zoology and Botany (member)
– Biologia (editor)
– Persian Journal of Acarology (member)
[8] Majtán, J. – Asian Pacific Journal of Tropical Biomedicine (member)
– Evidence-Based Complementary and Alternative Medicine (member)
– International Journal of Genuine Traditional Medicine (TANG) (Associate Editor)
[9] Prokop, P. – Biologia (member)
– Educational Sciences: Theory & Practise (member)
– Entomofauna Carpathica (editor)
– Eurasia Journal of Mathematics, Science and Technology Education (member)
– International Electronic Journal of Elementary Education (member)
– International Electronic Journal of Environmental Education (member)
– International Journal of Biology Education (member)
– International Journal of Environmental and Science Education (vice cheef editor)
– Journal of Baltic Science Education (member)
– Journal of Coastal Life Medicine (member)
– SOP Transactions on Psychology (member)
[10] Roller, L. – Entomofauna Carpathica (member)
[11] Slovák, M. – Entomofauna Carpathica (member)
[12] Šustek, Z. – Biologia (member)
– Elytron (member)
– Oltenia, Studii şi Comunicări, Ştiinţele Naturii (member)
[13] Václav, R. - Biologia (member)
– Tichodroma (member)
– Zoological Research (member)
[14] Vidlička, Ľ. – Acta Rerum Naturalium Musei Nationalis Slovaci (member)
– Annotationes zoologicae et botanicae Musei Slovaci (member)
– Entomofauna Carpathica (member)
[15] Žitňan, D. – General and Comparative Endocrinology (member)

2.4. Tables of project structure, research grants and other funding resources

- **International projects and funding**

2.4.1. Major projects within the European Research Area and other important project – Framework Programmes of the EU, ERA-NET, European Science Foundation, NATO, COST, INTAS, etc. (here and in items below please specify: type of project, title, grant number, duration, total funding and funding for the institute, responsible person in the institute and his/her status in the project, e.g. coordinator "C", work package leader "W", investigator "I"),

	Project title	Typ / Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute / Responsible person
2012	Biology and control of vector-borne infections in Europe - EDENext	7FP EU/261504	01/2011-12/2014	38 600	I / Mária Kazimírová
	The Morava River Restoration: Plan of measures prepared in agreement with EC Water and Nature Protection Directives	INTERREG/N_00094	10/2010-05/2013	18 171,83	I / Ferdinand Šporka
2013	Diversity and transmission of tick-borne pathogens	Interacademic agreement (MAD)/	01/2013-12/2014		I / Maria Kazimírová
2014	Molecular epidemiology of lyme borreliose spirochetes in Europe	Interacademic agreement (MAD)/	01/2014-12/2015		I / Markéta Derdáková
2015					

2.4.2. Other international projects, incl. total funding and funding for the institute

[1] **Effect of royal jelly on skin regeneration: the role of matrixmetalloproteinase-9**
Type of project: Yamada Bee Farm Grant
Grant Number: 0173
Duration: 12 months (10/2013 – 09/2014)
Funding for the Institute (Eur): 12 609 Eur
Responsible person in the Institute / status: Juraj Majtán / C

[2] **Molecular physiology of the epitracheal endocrine system**
Type of project: NIH GM
Grant Number: 67310-11
Duration: 48 months (01/2010-12/2013)
Funding for the Institute (Eur): 65 000 Eur
Responsible person in the Institute / status: Dušan Žitňan / I

[3] **Enhancing vector refractoriness to trypanosome infection**
Type of project: IAEA
Grant Number: 17713
Duration: 24 months (11/2013 – 11/2015)
Funding for the Institute (Eur): 39 600 Eur
Responsible person in the Institute / status: Peter Takáč / I

[4] **Improving SIT for tsetse flies through research on their symbionts and pathogens**
Type of project: IAEA
Grant Number: 14812
Duration: 12 months (01/2012 – 12/2012)
Funding for the Institute (Eur): 10 000 Eur
Responsible person in the Institute / status: Peter Takáč / I

[5] **Maintenance of a colony of up to 50 000 *G.p. gambiensis* female flies**
Type of project: IAEA
Grant Number: 201103024-GS
Duration: 16 months (08/2011 – 12/2012)
Funding for the Institute (Eur): 27 950 Eur (2012)
Responsible person in the Institute / status: Peter Takáč / C

[6] **Maintenance of a "Seed Colony" of up to 50 000 female flies of *Glossina pallidipes* ("Tororo" strain) and supply of excess *G.pallidipes* pupae to STEP in Ethiopia**
Type of project: IAEA
Grant Number: 201104538-GS
Duration: 12 months (01/2012 – 12/2012)
Funding for the Institute (Eur): 84 500 Eur ()
Responsible person in the Institute / status: Peter Takáč / C

[7] **Mass rearing and research of tsetse flies for tsetse eradication in Ethiopia**
Type of project: IAEA
Grant Number: ETH5012-90076
Duration: 24 months (01/2012 – 12/2013)
Funding for the Institute (Eur): 27 950 Eur
Responsible person in the Institute / status: Peter Takáč / C

[8] **Validation and refinement of new techniques for large scale rearing and for long-distance transport of fly material in support of tsetse mass rearing centres in West Africa**
Type of project: IAEA
Grant Number: 16773
Duration: 36 months (05/2011 – 05/2014)
Funding for the Institute (Eur): 42 000 Eur (2012-2014)
Responsible person in the Institute / status: Milan Kozánek / C

[9] **Molecular epidemiology of Lyme Borreliose spirochetes in Europe**
Type of project: DAAD (German Academic Exchange Servis)
Grant Number:
Duration: 24 months (01/2014 – 12/2015)
Funding for the Institute (Eur):
Responsible person in the Institute / status: Markéta Derdáková / C

2.4.3. Other important, international projects and collaborations without direct funding (max. 10 projects)

Important International collaborations

[1] Department of Zoology, University of Oxford, Oxford, OX1 3PS, United Kingdom Topic: Biologically active compounds in ticks.
[2] National University of Singapore, Singapore. Topic: Anticoagulants from hematophagous arthropods.
[3] Department of Integrative Biology and Evolution, University of Veterinary Medicine, Wien, Austria. Topic: Studies concerning ethology – repoductive strategies, acoustic – song quality, parasitology, mammaliology – investigation of mound-building mice
[4] Department of Integrated Biosciences, The University of Tokyo, Chiba, Japan Division of Biological Science, Nagoya University, Nagoya, Japan; National Institute of Agrobiological Science, Ibaraki, Japan. Topic: Identification, expression and function of neuropeptides in *Bombyx*.
[5] Gwangju Institute of Science and Technology, Buk-gu Gwangju, South Korea. Topic: Molecular mechanisms controling development and behavior in Drosophila.
[6] Department of Entomology, Kansas State University, Kansas, USA. Topic: Neuroendocrine system of ticks.
[7] Department of Epidemiology & Public Health. Yale University, New Haeven, USA. Topic: microbiome, proteomics and physiology of tsetse fly.

[8] Research and Innovation Centre, Fondazione Edmund Mach, Italy. Topic: Genetic variability of *Anaplasma phagocytophilum*.
[9] Baxter Innovations GmbH, Orth an der Donau, Austria. Topic: Experimental infection of ticks with different borrelia strains.
[10] Laboratoire de Biométrie et Biologie Évolutive, CNRS & University of Lyon, France. Topic: Molecular ecology of the Alpine marmot

- **National projects and their funding**

2.4.4. Projects supported by the Slovak Research and Development Agency (APVV)

Role of the Institute e.g. coordinator "C", investigator "I".

	Project title	Typ / Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute / Responsible person
2012	Biodiversity of river corridors in tropical forests: present state, human impacts and restoration perspectives	APVV-0213-10	05/2011-10/2014	226 999	C / Fedor Čiampor
	Structure of foci and emerging diseases with emphasis on role of rodents in urban type of natural foci of diseases	APVV-0267-10	05/2011-10/2014	116 600	I / Markéta Derdáková
	Clinical testing of slovak honeydew honey	APVV-0115-11	07/2012-12/2015	77 192	C / Juraj Majtán
	Utilization of transgenic approaches for functional analysis of neuropeptides and their receptors regulating behavior and development in insects	APVV-0827-11	07/2012-12/2015	137 508	C / Ladislav Roller
	Harmonisation of methods for the monitoring of qualitative and quantitative composition of fish stock of large rivers	SK-SRB-0057-11	01/2012-12/2013	4 500	C / Ladislav Pekárik
	Spoločenstvá lienkovitých v podmienkach zmien klímy a introdukcia nového druhu *Harmonia axyridis*	SK-CZ-0200-11	01/2012-12/2013	3 992	C / Diana Selyemová
	Novel approaches in insect transformation	SK-GR-0034-11	01/2012-12/2014	5 300	C / Dušan Žitňan
2013	Biological significance and pharmacological features of proteins in tick saliva	APVV-0737-12	10/2013-09/2017	18 018	I / Mária Kazimírová
	Danube sturgeons management and protection	APVV-0820-13	10/2013-09/2017	82 772	C / Ladislav Pekárik
	Investigation of tsetse fly symbionts and their infect on mass reared colonies	SK-GR-0063-11	01/2013-12/2014	5 300	C / Peter Takáč
2014					
2015	Small mammals as a potential source of zoonotic bacteria and resistance to antibiotics	APVV-14-0274	7/2015-6/2019	5 943	I / Markéta Derdáková
	Pesticide-free control of the house fly and stable fly populations on livestock farms in Slovakia	APVV-14-0652	7/2015-6/2019	12 755	I / Mailan Kozánek
	The role of neuropeptides and receptors in regulation of pathogen transfer from ticks to their hosts	APVV-14-0556	7/2015-6/2019	24 540	C / Dušan Žitňan

2.4.5. Projects supported by the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA) for each year, and their funding

VEGA	2012	2013	2014	2015
Number	20	22	22	18
Funding in the year (EUR)	78 717	103 559	80 715	83 244

[1]

- **Summary of funding from external resources**

2.4.6. List of projects supported by EU Structural Funds

[1] Creation of biotherapeutic facility and development of technology for research and production of biofarmaceutics (11/2009 – 10/2012)
Principal investigator: Milan Kozánek

[2] Development of diagnostic tools for detection of tick-borne pathogens and preparation of anti-tick vaccines (11/2010 – 10/2013)
Principal investigator: Dušan Žitňan

[3] Development and application of the innovative diagnostic approach for the molecular identification of animals (11/2010 – 12/2013)
Principal investigator: Zuzana Čiamporová-Zaťovičová

[4] Centre of excelence for Glycomics (03/2010 – 04/2014)
Responsible investigator in the IZ SAS: Peter Takáč

[5] Development of ecological methods for control of populations of selected forest pests in vulnerable alpine regions of Slovakia (12/2010 – 12/2014)
Responsible investigator in the IZ SAS: Milan Kozánek

[6] Research and development of new bioterapeutic methods and its application in some illnesses treatment (06/2010 – 06/2015)
Responsible investigator in the IZ SAS: Peter Takáč

[7] Comenius University in Bratislava, Science Park (03/2013 – 12/2015)
Responsible investigator in the IZ SAS: Milan Kozánek

[8] Creation of R&D infrastructure for studies on genetic biodiversity of organisms and participation in International Barcoding of Life Initiative. (10/2015 – 12/2015)
Responsible investigator in the IZ SAS: Milan Kozánek

[1] Excluding projects for the popularisation of science

2.4.7. Summary of external resources of the EU Structural Funds (ERDF/ESF)

Role of the Institute in the project, e.g. coordinator "C", work package leader "W", investigator "I".

Year	Project title	Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute
2012	Creation of biotherapeutic facility and development of technology for research and production of biofarmaceutics	ITMS-26240220020	11/2009-10/2012	93 798,70	C
	Development of methods for detection of tick-borne pathogens and vaccine strategies directed toward tick control	ITMS-26240220044	11/2010-10/2013	574 392,35	C
	Development and application of the innovative diagnostic approach for the molecular identification of animals	ITMS-26240220049	11/2010-12/2013	479 449,48	C
	Centre of excelence for Glycomics	ITMS-26240120031	03/2010-04/2014	108 325	I
	Development of ecological methods for control of populations of selected forest pests in vulnerable alpine regions of Slovakia	ITMS-262400220087	12/2010-12/2014	430 865,80	I
	Research and development of new bioterapeutic methods and its application in some illnesses treatment	ITMS-262400220030	06/2010-06/2015	500 767	I
2013	Comenius University in Bratislava, Science Park	ITMS-26240220086	03/2013-12/2015	97 900	I
2014					
2015	Creation of R&D infrastructure for research on genetic biodiversity of organisms and participation in International Barcoding of Life Initiative	ITMS 26230120004	10/2015-12/2015	666 000	I

External resources	2012	2013	2014	2015	total	average
External resources (milions of EUR)	1,210	1,262	0,661	1,078	**4,210**	**1,052**
External resources transfered to coooperating research institute (milions of EUR)	0,000	0,223	0,023	0,013	**0,260**	**0,065**

- **Supplementary information and/or comments on research projects and funding sources**

National and international projects are essential sources of funding for research and further development of laboratory infrastructure. Majority of research projects are funded from the national science agencies VEGA and APVV. Each IZ SAS scientist and PhD student participates at least in one project funded from these national sources. High priority has projects from international sources and our research teams have been participating in several framework projects since FP5. During the FP7 period, the Institute participated in the project EDENext. The competitiveness of research teams at the IZ SAS is demonstrated also by the project funded by the national Institutes of Health (USA) or projects from IAEA. We were very successful in obtaining projects from EU Structural Funds. These projects were used to substantially upgrade the infrastructure of the Institute.

2.5. PhD studies and educational activities

2.5.1. List of accredited programmes of doctoral studies, period of validity

[1] 4.2.3 molekulárna biológia [molecular biology] - period of validity: 07.07.2009 – till now

[2] 4.2.5 zoológia [zoology] - period of validity: 11.01.2010 – till now

The IZ SAS has become an attractive place for doctoral study and currently covers two accredited programmes. Within the assesment period doctoral training positions were fully occupied.

2.5.2. Summary table on doctoral studies (number of internal/external PhD students; number of foreign PhD students, number of students who successfully completed their theses, number of PhD students who quit the programme*)*

PhD study	31.12.2012			31.12.2013			31.12.2014			31.12.2015		
Number of potential PhD supervisors	26			24			24			19		
PhD students	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted
Internal	12,0	0,0	2,0	13,0	2,0	1,0	13,0	5,0	0,0	11,0	2,0	1,0
External	2,0	0,0	1,0	2,0	0,0	0,0	2,0	0,0	0,0	2,0	0,0	0,0
Other supervised by the research employees of the institute	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

2.5.3. Summary table on educational activities

Teaching	2012	2013	2014	2015
Lectures (hours/year)[2]	27	116	28	9
Practicum courses (hours/year)[2]	71	52	32	88
Supervised bachelor theses (in total)	7	12	9	5
Supervised diploma theses (in total)	11	32	16	8
Supervised PhD theses (in total)	9	19	15	8
Members in PhD committees (in total)	4	4	3	6
Members in DrSc. committees (in total)	2	0	0	0
Members in university/faculty councils (in total)	1	1	0	0
Members in habilitation/inauguration committees (in total)	1	1	0	2

2

2.5.4. List of published university textbooks

[1] ČAMBÁL, M. - KOZÁNEK, Milan - TAKÁČ, Peter - MAJTÁN, Juraj. *Larvoterapia a jej využitie v klinickej praxi. : Vysokoškolské učebné texty*. Bratislava : Ústav zoológie Slovenskej akadémie vied : Lekárska fakulta Univerzity Komenského v Bratislave, 2012. 91 pp. ISBN

[2] KOZÁNEK, Milan - ČAMBÁL, M. - TAKÁČ, Peter - MAJTÁN, Juraj. *Hirudoterapia a jej využitie v klinickej praxi : Vysokoškolské učebné texty*. Bratislava : Ústav zoológie Slovenskej akadémie vied : Lekárska fakulta Univerzity Komenského v Bratislave, 2012. 63 pp.

[3] MAJTÁN, Juraj - KOZÁNEK, Milan - TAKÁČ, Peter - ČAMBÁL, M. *Apiterapia a jej využitie v klinickej praxi : Vysokoškolské učebné texty*. Bratislava : Ústav zoológie Slovenskej akadémie vied : Lekárska fakulta Univerzity Komenského v Bratislave, 2012. 34 pp.

[4] TAKÁČ, Peter - ZAUJEC, Lubomír - ČAMBÁL, M. - KOZÁNEK, Milan - MAJTÁN, Juraj. *Ichtyoterapia a jej využitie v klinickej praxi. : Vysokoškolské učebné texty*. Bratislava : Ústav zoológie Slovenskej akadémie vied : Lekárska fakulta Univerzity Komenského v Bratislave, 2012. 44 pp.

2.5.5. Number of published academic course books

None

2.5.6. List of joint research laboratories/facilities with universities

[1] Laboratory for developing of biotherapeutic methods (Faculty of Medicine, Slovak Medical University)

- **Supplementary information and/or comments on doctoral studies and educational activities**

(a) doctoral study

The IZ SAS acts as an attractive institution for PhD students in Zoology and Molecular Biology. During the assessment period the doctoral training positions were fully occupied. On average, two students entered and two students defended PhD thesis annually.

(b) pedagogical activities

Majority of researchers from the IZ SAS supervise bachelor, diploma and rigorous theses, mainly in cooperation with the Faculty of Science of the Comenius University in Bratislava. The subjects of the thesis were various research areas in "Zoology", "Ecology", “Physiology of Animals”, “Genetics” and “Molecular Biology”. Some of supervisors also gave lectures at the Faculty of Naural Sciences, Comenius University and Faculty of Medicine, Slovak Medical University. Several researchers of the Institute were members of Commissions for doctoral study, State commissions for bachelor and diploma examinations, Rigorous commissions and in the Habilitation and Inauguration Commissions.

Short-term visits and positions of our PhD students abroad:

Mgr. Zuzana Svitálková

Lehrstuhl für Vergleichende Tropenmedizin und Parasitologie

Veterinärwissenschaftliches Department

Ludvig-Maximilians-Universität, München, Germany

06.04. – 04.05.2013

08.12. – 20.12.2013

02.02. – 14.02.2014

[2] Do not include time spent with bachelor, diploma or PhD students during their supervising

Mgr. Zuzana Svitálková
RIVM National Institute for Public Health and the Environment
Bilthoven, The Netherlands
05.10. – 23.10.2015

Mgr. Michal Chvostáč
German National Reference centre for Borrelia (NRZ)
Bavarian Health and Food Safety authority (LGL)
Oberschleissheim, Germany
30.09. – 29.10.2014
12.10. – 24.10.2015

Mgr. Tatiana Vaculová
German National Reference centre for Borrelia (NRZ)
Bavarian Health and Food Safety authority (LGL)
Oberschleissheim, Germany
30.09. – 29.10.2014
12.10. – 24.10.2015

Mgr. Alexandra Zibrinová
Gwangju Institute of Science and Technology (GIST)
Gwangju, South Korea
05.02. – 08.06.2015

Mgr. Eva Krascsenitsová
Institute of Forest Entomology
Forest Pathology and Forest Protection
Wien, Austria
01.02. – 30.06.2012

Mgr. Kristína Laššová
Natural History Museum
London, Great Britain
27.04. – 24.05.2014

Mgr. Marek Semelbauer
Plant Pest Diagnostics Center (PPDC)
Sacramento, California, USA
08.07. – 23.07.2014

Mgr. Katarína Goffová
Ruhr-University
Bochum, Germany
02.02. – 21.02.2014

2.6. Social impact

2.6.1. List of the most important results of applied research projects. Max. 10 items

[1] ČERNÁK, Martin - MAJTÁNOVÁ, Nora - ČERNÁK, Andrej - MAJTÁN, Juraj. Honey Prophylaxis Reduces the Risk of Endophthalmitis During Perioperative Period of Eye Surgery. In Phytotherapy Research, 2012, vol. 26, p. 613–616 DOI: 10.1002/ptr.3606. (2.086 - IF2011).

[2] VLČEKOVÁ, Paulína - KRUTÁKOVÁ, Barbora - TAKÁČ, Peter - KOZÁNEK, Milan - SALUŠ, Juraj - MAJTÁN, Juraj. Alternative treatment of gluteofemoral fistulas using honey: a case report. In International Wound Journal, 2012, vol. 9, no. 1, p. 100-103. ISSN 1742-4801X. DOI: 10.1111/j.1742-481X.2011.00844.x. (1.458 - IF2011).

[3] MELNIČÁKOVÁ, Jana - DERDÁKOVÁ, Markéta - BARÁK, Imrich. A system to simultaneously detect tick-borne pathogens based on the variability of the 16S ribosomal genes. In Parasites & vectors, 2013, vol. 6, no. 1, article no. 269, 12pp. (3.246 - IF2012).

[4] MAYER, Alexandra - SLEZÁK, Viliam - TAKÁČ, Peter - OLEJNIK, J. - MAJTÁN, Juraj. Treatment of non-healing leg ulcers with honeydew honey. In Journal of Tissue Viability, 2014, vol. 23, iss. 3, p. 94-97.

[5] ČIČKOVÁ, Helena - KOZÁNEK, Milan - TAKÁČ, Peter. Growth and survival of blowfly Lucilia sericata larvae under simulated wound conditions: implications for maggot debridement therapy. In Medical and Veterinary Entomology, 2015, vol. 29, iss. 4, p. 416-424. (2.860 - IF2014).

[6] ČIČKOVÁ, Helena - NEWTON, Larry G. - LACY, Curt R. - KOZÁNEK, Milan. The use of fly larvae for organic waste treatment: review. In Waste Management, 2015, vol. 35, p. 68–80. (3.220 - IF2014).

[7] Morava river restoration

Within the MoRe project (European Regional Development Fund) the data for the Morava river restoration in Slovak-Austrian border stretch and of adjacent oxbows in the river kilometres 54-69. 16 km were prepared. This project was solved in accordance with the agreement with EC Water and Nature Protection Directives". The main objectives were to restore the original character of the meandering lowland river in order to achieve a dynamic equilibrium according to the ecosystem approach and to improve the diversity of natural habitats in the floodplains (Dr. Šporka).

[8] FLORIÁN, Štefan - KOZÁNEK, Milan - TAKÁČ, Peter - ČAMBAL, Marek 2012. Adhezívum na báze kopolyméru poly(vinylalkohol-vinylacetátu). Application Patent No. 5031/2012

2.6.2. List of the most important studies commissioned for the decision-making authorities, the government and NGOs, international and foreign institutes

2012:

[1] Expertise activity to the occurence of nature protected species of beetles in trees planned for felling at three urban sites in Bratislava. Study required by the Regional Office Bratislava Ružinov (Šustek Z.)

2013:

[2] Expertise activity: Preparation of Natura 2000 sustainable management plans for eight threatened bird species listed under Annex I of the EU's Birds Directive in the Protected Bird Area Poiplie. Expertise required by the State Nature Conservation Agency, Banská Bystrica. (Václav R.)

[3] Estimation of abundance and population trends for all threatened species listed under Annex I of the EU's Birds Directive in the Protected Bird Area Poiplie in 2010-2013. Expertise required by the State Nature Conservation Agency, Banská Bystrica. (Václav R.)

[4] Evaluation of national programs of preservation of two threatened bird species (the Eurasian bittern and the ferruginous duck). Expertise required by the State Nature Conservation Agency, Banská Bystrica and BirdLife Slovakia. (Václav R.)

[5] Expertise activity for the State Nature Conservation Agency, Banská Bystrica, Slovakia. Review of the proposal for amendment of govermnet act 440/2008 collection regarding the avian influenza epidemiology. (Václav R.)

2014:

[6] Biological monitoring of Gabčíkovo water dam using the Mollusca as the bioindicative animal group. Expertise activity for the Ministry of Agriculture and Rural Development. (2011-2015) (Čejka T.)

[7] Evaluation of populations of the threatened bird species and preparation of Natura 2000 sustainable management plans in the Protected Bird Area Veľkoblahovské rybníky and Kráľová. Expertise required by the State Nature Conservation Agency, Banská Bystrica. (Darolová E.)

[8] Evaluation of populations of five species of birds in the protected bird areas of Slovak Republic. Expertise required by the State Nature Conservation Agency, Banská Bystrica. (Krištofík J., Václav R.)

2015:

[9] Expertise to the project LIFENAT/AT/05 – restoration of the Lower Morava floodplains. Commisioned by the Ministry of Environment of the Slovak Republic. (Šporka F.)

[10] Reviewing 17 programs for managment of protected bird areas Natura 2000 in Slovakia. Expertise commisioned by the State Nature Conservation Agency, Banská Bystrica. (Václav R.)

[12] Expertise to the problematic method of monitoring of birds, commisioned by the District Nature Conservancy Office in Nové Zámky, Slovakia. (Václav R.)

[13] Monitoring of the Gabčíkovo water dam impact on environment and study of cladocerans and copepods fauna. Comissioned by the Waterworks Construction Company (state company), duration: 2013-2015. (Illyová M.)

2.6.3. List of contracts and research projects with industrial and other commercial partners, incl. revenues

[1] **Joint workplace with industry:** Scientica, s.r.o.
Partners: Institute of Zoology, KARI TRC Kenya
Focus: Direct transfer of scientific knowledge gained in basic research and their application in specific fields of social practice.
Evaluation: Current projects with application outputs: Research and development of new biotherapeutic methods and their use in the treatment of certain serious diseases. Development of ecological methods for controlling populations of selected species of forest pests in vulnerable mountain areas of Slovakia. Development and biodegradation testing technology of farm animals manure. Its activities are not restricted only to the territory of Slovakia. Within the framework of development aid to the Republic of Kenya is dedicated to the transfer of scientific knowledge, potentially also to other countries, especially to East Africa.

[2] **Contract:** Monitoring of the Gabčíkovo water dam impact on environment and study of cladocerans and copepods fauna
Responsible person: Marta Illyová
Duration: 2013-2015
Funding for organization: 3345 Eur
Sponsor: Waterworks Construction Company, state company

[3] **Contract:** Monitoring of water fauna – cladocerans and copepods at study sites specified for bilateral data exchange between Slovak and Magyar Republics – field research at sites MP6, MP9, MP10, MP14, MP18, MP23
Responsible person(s): Marta Illyová
Duration: 2013-2015
Funding for organization: 8900 Eur
Sponsor: Waterworks Construction Company, state company

2.6.4. List of licences sold abroad and in Slovakia, incl. revenues

None

2.6.5. List of most important social discourses under the leadership or with significant participation of the institute (max. 10 items)

None

2.6.6. Summary of relevant activities, max. 300 words

The Institute provides outputs applicable in nature conservancy, human health and pest control. The relevant activities include:

Human health:

– diagnostic techniques for detection of tick-borne pathogens and approaches for preparation of vaccines against ticks
– biotherapeutical methods, especially maggot debridement therapy for the treatment of non-healing wounds and its introduction into clinical practice

Nature conservancy:

– monitoring of fauna, identification of bioindicative species - managment and restoration of natural habitats

Pest control:

– sterile insect techniques (SIT) of tsetse flies to eradicate sleeping sickness and nagana in Africa
– the bark beetle biological control by their natural pathogens, parasitoids or predators

In addition to the studies and contracts listed above, several researers of the Institute were members of advisory boards: Advisory board for CITES (Čejka T), State Nature Conservation Agency Commitee for monitoring of birds (Darolová E), Advisory Board for safety of food and nutrition in the Ministry of Agriculture and Rural Development of the Slovak Republic (Majtán J.), Commitee for monitoring and reporting under Article 17 of Habitats Directive in the Ministry of Environment of the Slovak Republic (Pekárik L).

2.7. Popularisation of Science (outreach activities)

2.7.1. List of the most important popularisation activities, max. 20 items

2012

[1] Derdáková M., Tarageľová V., Roller L, Slovák M. – participation in movie „Živí proti živým“ in documentary series Spektrum vedy, STV 2, 30.10.2012
[2] Kozánek M. – popularisation lecture „Novel biotherapeutic methods in therapy of serious infective diseases.“, in Vedecká kaviareň – CVTI Bratislava, 27.9.2012
[3] Václav R. – popularisation article: „Parasites utilized climatic changes“, in daily SME, 26.10.2012

2013

[4] Derdáková M., Tarageľová V., Selyemová D., - booklet on ticks as vectors of diseases in urban areas, for schools and medicine doctors, title: „Živí proti živým“, 2013
[5] Takáč P. Participation in exhibition Agrokomplex 2013. Exhibition award „Zlatý kosák“ for „Utilization of biotherapeutic methods in human medicine“, 40. medzinárodná poľnohospodárska a potravinárska výstava Agrokomplex 2013, Nitra, 22.8.2013
[6] Takáč P. Participation in exhibition Slovmedica 2013. Exhibition award for „Novel biotherapeutic methods“, INCHEBA EXPO, Bratislava, 28.9.2013
[7] Takáč P., Kozánek M. – participation in movies „Hirudotherapy“ and „Ichtyotherapy“ (20 min documents), TV8, 14.9.2013, 12.10.2013

2014

[8] Majtán J. - popularisation lecture in Regional conference „Apiculture close to nature“, Kráľová pri Senci, 9.8.2014. Title: Slovenský medovicový med v klinickej praxi.

[9] Vidlička L. – participation in TV discourse „Midnight discussions – invasive species and biodiversity“, TA3, 26.9.2014

[10] Pekárik L. – participation in popularisation exhibition “Európska Noc výskumníkov 2014” in Bratislava, 26.9.2014

[11] Pekárik L. – participation in World Fish Migration Day, Bratislava, 24.5.2014

[12] Čejka T. – popularization articles (55 items) in weekly magazine Týždeň, 2013-2014

[13] Takáč P. – participation in TV discourse about Project Slovak Aid and larval therapy in Kenya in TV Joj, 20.4.2014

2015

[14] Derdáková M. – participation in broadcast discourse „Nočná pyramída discussions – ticks and tick-borne pathogens“, Slovak Radio RTVS, 19.6.2015

[15] Majtán J. – participation in TV discourse „Midnight discussions – Bees can cure“, TA3, 3.7.2015

[16] Semelbauer M. – popularisation lectures for secondary scholars (20x), organisation of the Club of Biology in PriF UK, Bratislava, 2014-2015

[17] Takáč P. Participations in exhibition Slovmedica 2015. Exhibition award „Diplom Zlatá Incheba 2015“ for "Biosack with sterile maggots of the blowfy (*Lucilia sericata*)." And Exhibition award „Zlatá Incheba 2015“ for "Hydrogel from biopolymers with extracts of salivary glands and guts of maggots of the blowfly (ES hydrogél) for larval therapy". Slovmedica 2015, Incheba a.s., Bratislava, 2.10.2015

2.7.2. Table of outreach activities according to institute annual reports

Outreach activities	2012	2013	2014	2015	total
Articles in press media/internet popularising results of science, in particular those achieved by the Institute	7	14	3	4	28
Appearances in telecommunication media popularising results of science, in particular those achieved by the Institute	16	6	9	6	37
Public popularisation lectures	4	1	16	3	24

- **Supplementary information and/or comments on popularisation activities, max. 300 words**

The Institute conducts a wide spectrum of activities for popularization of science. These activities explain general public practical utilization and application of our work. They involve TV and radio performances, participation in expositions, presentations in schools and other academic institutions, presentations on the internet and also publications in various periodicals and daily press. The popularization activities concern nature protection and human impacts on environment, interesting animal species and their behaviour, the occurrence of animals in an urban environment and their contacts with human population. Among particularly important activities are those that concern the risks of animal vector borne diseases, medical importance of specific animal species, the use of animals and their products for human health, and a practical use of technology for biodegradation of organic excrements by some animal species. We were very successful in

popularization of biotherapeutical methods, namely apitherapy, maggot larval therapy, hirudotherapy and ichtyioterapy. These activities were awarded in international exhibitions Agrocomplex and Slovmedica - Incheba Expo.

2.8. Background and management. Human resources and implementation of recommendations from previous assessment

2.8.1. Summary table of personnel

Personnel	2012	2013	2014	2015
All personnel	62,0	58,0	55,0	45,0
Research employees from Tab. Research staff	42,0	39,0	42,0	40,0
FTE from Tab. Research staff	34,590	33,125	30,300	26,410
Average age of research employees with university degree	47,7	48,0	48,9	50,7

2.8.1.1. Professional qualification structure (as of 31.12. 2015) FEMALE

FEMALE	AGE								
Number of	< 30	31 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	> 65
DrSc. / prof.	0	0	0	0	0	0	0	0	0
II.a / Assoc. prof.	0	0	1	2	0	0	2	0	0
Other researchers PhD./CSc.	0	2	0	1	0	0	0	0	0
doc. / Assoc. prof.	0	0	0	0	0	0	0	0	0

2.8.1.2. Professional qualification structure (as of 31.12. 2015) MALE

MALE	AGE								
Number of	< 30	31 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	> 65
DrSc. / prof.	0	0	0	0	0	0	1	1	0
II.a / Assoc. prof.	0	0	1	2	1	2	0	3	2
Other researchers PhD./CSc.	0	2	0	0	0	0	0	0	0
doc. / Assoc. prof.	0	0	0	1	0	0	1	0	0

2.8.2. Postdoctoral and mobility scheme

2.8.2.1. Postdoctoral positions supported by national and international resources

None

2.8.2.2. Postdoctoral positions supported by external funding

[1] Majtan, Juraj

[2] Valachová, Ivana

[3] Procházka, Emanuel

[4] Daubnerová, Ivana

2.8.2.3. SAS stipends and SASPRO stipends

None

2.8.2.4. Internal funding - the Slovak Academy of Sciences Supporting Fund of Stefan Schwarz

[1] Ivana Dauberová (2014 – 2018)

2.8.3. Important research infrastructure *(max. 2 pages)*

The Institute of Zoology (IZ SAV) built several laboratories and rearing facilities to conduct research on model laboratory organisms and to analyze samples collected in the field. Molecular biology and genetics laboratory is equipped for DNA analysis and gene cloning techniques and contains several gradient PCR cyclers, Real Time PCR cyclers, centrifuges, incubators including CO2 incubator, freezers for -80°C and -20°C, UV transiluminators, luminometer and equipment for gel electrophoresis. GMO risk class 1 Laboratory for transgenic manipulation of insects, insect cells and E.coli has been established since 2010. Epidemiology laboratory has equipment for handling tissue and bacterial cultures (laminar boxes, incubators) and digital PCR system (BioRad) for highly sensitive PCR which was obtained from the EU Structural funds in 2015. Microscopy and Imaging Facility is equiped for fluorescent immunohistochemistry and in situ hybridization of wholemounts and tissue sections. It contains the fluorescent microscope with differential interference contrast (Nikon Eclipse) and digital camera, confocal system Leica TCS SPE suitable for 3D projections and calcium imaging, Leica fluorescent stereomicrosopes for screening of transgenic animals, manipulation with labelled samples and macrophotography. Electrophysiology amplifiers, manipulators and electrodes for measuring neural and myogenic activities are also available. Biochemical and Proteomic laboratory is equipped with modern technical instruments for separation of protein samples (HPLC, FLPC, UPLC, gel electrophoresis, etc). In 2015, new gas chromatograph (Thermo Fisher) and QDa mass detector (Waters) for chromatographic analysis were obtained from the EU Structural funds and placed in the Applied lab. Our rearing facilities include rooms and chambers with controled temperature and light for rearing of several insect and tick species.

Our institute is a member of the BITCET consortium created for sharing sophisticated research equipment (e.g. Mass spectrometers, Illumina NGS, DNA sequencers and confocal microscopes) located in institutes of SAS and the Faculty of Natural Sciences, Comenius Univ. (PriFUK) in Bratislava. The modern infrastructure acquired from the EU and US grants, EU Structural funds and local grant agencies (APVV) provide opportunities for fruitfull collaboration with other research teams in Slovakia and academic institutions in the world.

2.8.4. Description of how the results and suggestions of the previous assessment were taken into account

1) It is advisable to concentrate the publication activity mainly to high quality WOS journals.

   Our long-term priority is to maintain high productivity with good quality papers published in WOS journals. During the last 5 years scientists of our intitute produced remarkably high number of WOS papers (average 1.5 paper per person per year; without PhD students). Some of these papers were published in prestigious journals with IF 7-30 (Science, PNAS, Annual Reviews of Entomology, Plos Biology, Current Biology, Emerging Infect Diseases). We want to continue in this trend and have a potential to generate more high quality papers describing results produced in our labs.

2) It is highly advisable to increase the number of DrSc. There is an obvious need to develop a better system ensuring a high level of PhD students, ability to communicate with other researchers (e.g. conferences, seminars), preparing independent project proposals, etc.

   RNDr. F. Šporka successfully defended his DrSc. title so we can train PhD students in Zoology and Molecular Biology. More scientists in our institute can reach criteria for DrSc and are planning to submit their Disertation thesis within 1-2 years. Communication between PhD students and other researches has considerably improved. We have been organizinig annual conferences for PhD students where they present and discuss their data. In regular lab meetings we present and analyse progress of each scientist. Each PhD. student and young scientist is encouraged to attend conferences/workshops and can apply for independent project proposals and travel grants.

3) In the future research topics and visions should be discussed and developed by permanent discussions within the Institute.

   As mentioned above we organize regular meetings where members from different labs discuss possible topics for future collaboration within the Institute and with other research groups from other intitutes, universieties, medical clinics and companies in Slovakia and abroad. Our grants and publications clearly show that we are very open and active in this regard.

- **Supplementary information and/or comments on management, research infrastructure, and trends in personnel development**

The Institute is divided into four departments with clearly defined areas of interest, projects and sufficient equipment. The director and scientific board of the Institute are responsible to follow and establish modern trends in biological sciences. We pay close attention to promising research programs and to financial resources necessary for successful research. Our priority is to hire creative and motivated PhD students and postdocs. This requires to increase number of PhD supervisors and guarantors of the study programs. So far, we can train PhD students in Zoology and Molecular Biology which seems sufficient. The principal trend in personnel development is to build creative teams of PhD students and young scientists around experienced and progressive principal investigators from Slovakia and other countries.

3. Research strategy and future development of the institute for the next five years (2016-2020) (Recommended 3 pages, max. 5 pages)

3.1. Present state of the art in both the national and the international contexts

We have a long-term collaboration with numerous institutions and universities in Slovakia and other countries in Europe, USA, Korea, Japan and Africa. These collaborations involved various projects including basic experimental research focused on identification and function of bioactive substances, parasitology and epidemiology of ticks and tick-borne pathogens, ecology and taxonomy of various invertebrate and vertebrate animals, and applied projects in medicine, forestry and agriculture. One of the most important goals for our future work is to stimulate and expand these collaborations which usually result in successful projects and generation of novel and interesting data published in high quality journals and books. Cooperative efforts of skilled and motivated scientists are essential for exchange of the knowledge and improvement of theoretical and technical skills. They also provide opportunities to obtain financial support from various grant agencies and international sources. So far, we have been very successful in obtaining grants from domestic as well as international agencies (e.g. APVV, NIH, 7.FP, Life, Structural funds). This financial support enabled us to buy necessary equipment (see infrastructure), chemicals, kits and provided salaries for several young scientists and technicians. To improve quality of our work and expertize it is essential to constantly learn modern techniques and innovative approaches in all fields of biological sciences examined at the IZ SAS. For these purposes we built several specialized laboratories with specific equipment. Support from several grant agencies and Structural funds from EU was crucial for building these laboratories at our institute. We have labs for Molecular biology and genetic studies, Microscopy and imaging lab, Biochemical and Proteomic laboratory lab, Epidemiology lab and a lab for Applied research.

3.2. Research strategy of the institute in the national and the international contexts, objectives and methods

Our long-term strategy is to constantly improve and develop our expertise in viable and promising research areas in zoology and related biological disciplines. In the recent decade we spent a lot of financial resources and effort to build several laboratories. Now it is important to effectively utilize these labs and equipment for production of interesting data in experimental and applied research, as well as in various analyses of the field samples. To maintain and further develop technical and scientific potential of these labs, we need to create consortia with other institutes at SAS and abroad to obtain necessary funding. Results from the applied research have a great potential for further development in cooperation with biotechnology companies, hospitals or medical institutes. Equally good opportunities provide ecological projects in hydrobiology, epidemiology, soil biology, forestry and agriculture during apparent climatic changes associated with invasion of numerous pests in our waters, fields and forests. Even more alarming is migration of pathogen vectors (ticks, mosquitoes) along with increased number of new dangerous pathogen species into higher altitudes and different environmental niche. Ecologically and medically oriented projects tackling expansion of invasive pests or newly emerging diseases are funded by several agencies in EU and we will make arrangements to participate in these projects. Expected funds will be used to support important research areas and promising teams, as well as for reconstruction of some lab space and buying new useful equipment.

One of the most important challenges is to attract talented and motivated students and researches that would create productive environment and generate important data that would be interesting for other scientists and general public. Successful institution should be able to mentor and educate creative people interested in science and therefore, we need to pay special attention to our local universities and academic institutions abroad, from where we could recruit students, postdocs and senior scientists. In a very competitive environment and much better salaries at academic institutions in EU this task is rather difficult, but there are several research teams in Slovakia which are quite productive and successful. Scientists at the IZ SAS provide attractive

themes for bachelor, diploma and PhD studies, and to hire the best available students. We also have interesting projects which enabled us to hire several talented postdocs from Slovakia and foreign countries. To expand our research teams and learn new techniques we used grants that provided funding for exchange study programs and postdoctoral research positions abroad. This proved to be very stimulating especially for young and creative scientists. As a rule at our institute, our young scientists should visit labs abroad and attend international scientific conferences during their PhD studies. After successful defense of PhD thesis they are strongly encouraged to take postdoctoral positions at good universities or research institutes in EU, USA, Japan or Korea. Another important goal is to attract these trained and motivated postdocs and scientists back home after their position abroad has expired and provide them with appropriate lab space, equipment, services and salaries. We are making a lot of effort to create good lab conditions comparable to those in other EU countries. Moreover, scientists working at our institute have close professional relationships with numerous research institutions, so there is a good perspective for future work and opportunities to establish new collaborations and produce interesting results. Our priority is to maintain high productivity and increase quality of papers, as well as use modern techniques with the best available equipment.

Project proposals submited to 7RP or H2020	**2012**	**2013**	**2014**	**2015**
Institute as coordinator	0	0	0	0
Institute as participant	1	1	1	1

4. Other information relevant for the assessment

The Slovak Rating and Ranking Agency ARRA evaluated the institutions and their teams in Slovak Academy of Science with the aim to identify an excellent scientific teams. Among the group of agricultural and veterinaty institutions in II. Department of SAS this status was only given to the team of Dr. Žitňan from the Institute of Zoology. IZ SAS will support other promising and productive teams.

RNDr. Dušan Žitňan, DrSc.
Director of the Institute of Zoology SAS