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

Period: January 1, 2016 - December 31, 2021

1. Basic information on the institute

1.1. Legal name and address

Institute of Parasitology, Slovak Academy of Sciences (IP SAS), Hlinkova 3, 04001 Košice, Slovakia

1.2. URL of the institute web site

https://pau.saske.sk/

1.3. Executive body of the institute and its composition

Directoriat	Name	Year of birth	Years in the position, from - to
Director	HROMADOVÁ Ivica	1969	6; 2016-2022
Deputy director	ANTOLOVÁ Daniela	1977	6; 2016-2022
	MITERPÁKOVÁ Martina	1974	6; 2016-2022
Scientific secretary	N/A		

1.4. Head of the Scientific Board

VÁRADY, Marián (February 2016 – February 2022)

1.4.1 Composition of the International Advisory Board

- **Prof. MOSKWA, Bożena**
  Director of the Institute and Head of the Department, Witold Stefański Institute, Polish Academy of Sciences, Warszaw, Poland
- **Prof. PETKEVIČIUS, Saulius**
  Leading researcher at the Department for Infectious Diseases, Veterinary Academy, Lithuanian University of Health Sciences, Kaunas, Lithuania
- **Prof. DEPLAZES, Peter**
  Director of the Institute of Parasitology, Vetsuisse Faculty, University of Zürich, Zürich, Switzerland
- **Prof. GRUBHOFFER, Libor**
  Director of the Biology Centre of the Czech Academy of Sciences, České Budějovice, Czech Republic
- **KUZMIN Yuriy, DSc.**
  Leading researcher at the Department of Parasitology, I. I. Schmalhausen Institute of Zoology, Kyiv, Ukraine

1.5. Basic information on the research personnel

1.5.1. Fulltime equivalent work capacity of all employees (FTE all), FTE of employees with university degrees engaged in research projects (FTE researchers)

2016		2017		2018		2019		2020		2021		2016-2021	
FTE all	FTE researchers	FTE all	FTE researchers	FTE all	FTE researchers	FTE all	FTE researchers	FTE all	FTE researchers	FTE all	FTE researchers	average FTE all per year	average FTE researchers per year
40.32	29.33	36.83	24.06	39.85	27.03	42.36	28.28	44.69	31.27	44.48	32.06	**41.42**	**28.67**

1.6. Basic information on the funding of the institute

1.6.1. Institutional salary budget, other salary budget[1], non-salary budget[2]

Salary budget	2016	2017	2018	2019	2020	2021	average
Institutional salary budget *[millions of EUR]*	0.645	0.695	0.761	0.915	1.013	1.028	**0.843**
Other salary budget *[millions of EUR]*	0.105	0.082	0.096	0.102	0.090	0.081	**0.093**
Total salary budget *[millions of EUR]*	0.750	0.777	0.857	1.017	1.103	1.109	**0.936**
Non-salary budget *[millions of EUR]*	0.519	0.625	0.856	0.535	0.444	0.413	**0.565**

1.7. Mission Statement of the Institute as presented in the Foundation Charter indicating the years when it was adopted and revised

The Institute of Parasitology of the Slovak Academy of Sciences (IP SAS) develops research activities in the fields of the biological, medical, pharmaceutical, agricultural, and forestry sciences. It focuses on the study of parasites and parasite-induced diseases of humans, animals, and plants and of the interrelationships between parasites and their hosts, reservoirs, vectors, and environments. IP SAS conducts research of the life cycles and manifestations of parasitic organisms and studies the therapeutic and prophylactic manipulation of parasite-borne diseases. The Institute implements activities towards the rapid introduction of new knowledge into social practice. IP SAS develops collaborations with similarly oriented institutes of the Slovak Academy of Sciences (SAS), universities, and other research organisations in Slovakia and abroad. IP SAS provides scientific education as an external educational institution and participates in other levels and forms of under- and postgraduate study. The Institute organises educational and popularisation activities associated with the implementation of results into practice. IP SAS ensures the publication of scientific results in periodicals and the non-periodical press.

1.8. Summary of R&D activity pursued by the institute during the evaluation period in both national and international contexts. Describe the scientific importance and societal impact of each important result/discovery. Explain on general level – the information should be understandable for a non-specialist (recommended 5 pages, max. 10 pages for larger institutes with more than 50 average FTE researchers per year as per Table 1.5.1.)

IP SAS conducts complex studies of parasites and parasitic diseases of humans, animals, and plants. The scientific results of IP SAS mostly have the characteristics of basic research (65%) but also of strategic applied research (35%). The mission of IP SAS is to accomplish research objectives at the national and international levels. Basic research is mainly conducted under the close cooperation with foreign parasitological institutions in Europe, North America, and Asia. Applied research is mainly conducted with

[1] Salary budget originating outside the regular budgetary resources of the organization, e.g. from the project funding.
[2] Includes Goods and Services and PhD fellowships

various private and state organisations. Laboratories are the scientific and organisational units of the institute.

The ***Laboratory of Human Parasitology*** (**20% basic/80% applied research**) mainly conducts applied research linked with the diagnosis, epidemiology, and control of human parasitic diseases and zoonotic parasitoses (parasitic infections transmitted from animals to humans). The main models are the medically important tapeworms *Echinococcus multilocularis* and *Echinococcus granulosus*, whose larval stages cause alveolar or cystic echinococcosis with possible lethal effects. Other models are the tapeworms *Taenia saginata* (beef tapeworm), *Taenia solium* (pork tapeworm), *Hymenolepis nana*, *Hymenolepis diminuta*, and *Hymenolepis microstoma* and the roundworms *Toxocara canis* and *Toxocara cati*, whose larval stages cause larval toxocarosis in humans. The research is focused on the improvement of serological and molecular methods for the highly sensitive and specific diagnosis of parasitic agents. Epidemiological studies of the prevalence and parasitic burden of human parasitoses have also been conducted in endemic and non-endemic regions of Slovakia. The laboratory cooperates closely with physicians, hospitals, and diagnostic laboratories, which are direct beneficiaries of the results. The basic research of the laboratory is directed towards the assessment of the evolutionary events and dispersal patterns of parasitic agents.
The epidemiological study of hymenolepidid tapeworms identified a surprisingly high prevalence (21%) of *H. nana* in rodents (mice, rats, and hamsters) from pet shops and breeding clubs. The results have indicated neglected risks of the transmission of hymenolepiasis from pets to humans (especially children) and the need for effective control and preventive measures. The first record on the zoonotic tapeworm *H. microstoma* in the common shrew (*Sorex araneus*) was documented in Slovakia and central Europe in general. The important role of an atypical canine host, the grey wolf (*Canis lupus*), in the dissemination of echinococcosis was detected in an epidemiological study of *E. multilocularis* (35.7% positivity). The results are of interest for public health and perspectives of wildlife conservation. Epidemiological studies of the seroprevalence of toxocarosis and toxoplasmosis confirmed a substantially higher risk of infection in the Roma population from segregated settlements in comparison to the majority of the population of Slovakia. As much as 22.1% of the inhabitants of the Roma settlements were positive for *Toxocara* spp. and 45.0% were positive for *Toxoplasma gondii*. In contrast, the majority of the population was 1.0% seropositive to *Toxocara* spp. and 24.1% to *T. gondii*.

The ***Laboratory of Veterinary Parasitology*** (**50% basic/50% applied research**) is engaged in diagnostics and epidemiological research of parasitic diseases of domestic animals and wildlife, with special emphasis on newly emerging parasitic species and infections caused by them. The model parasites are parasitic worms (helminths) of domestic and wild carnivores, e.g. the pulmonary roundworms *Dirofilaria* and *Angiostrongylus*, the gastrointestinal tapeworm *Echinococcus multilocularis*, the roundworm *Toxocara*, and the tissue roundworms *Trichinella* and *Thelazia.* The laboratory is also studying endoparasites of the Tatra chamois (*Rupicapra rupicapra tatrica*) and the Tatra marmot (*Marmota marmota latirostris*), important endemic species of the Tatra National Park. Another model is the roundworm *Capillaria hepatica*, a highly pathogenic parasite of rats and other rodents. Long-term research has monitored the entire area of Slovakia, with particular focus on urban and rural types of landscapes and Tatra National Park.
Comprehensive results were obtained for the detection, monitoring, and research of dirofilariosis, angiostrongylosis, and thelaziosis, newly emerging parasitic diseases of carnivores in Slovakia. Risk environmental factors were detected and highly endemic areas were identified after epidemiological studies of these parasitic diseases. The results have high societal impact, because the research was conducted with the close cooperation of the State Veterinary and Food Administration, executive departments of the Slovak Republic, the European Food Safety Authority, veterinarians, farmers, and the State Forests organisation of the Tatra National Park. The scientific importance of the study of newly emerging parasites is underlined by the international collaboration on the epidemiology and ecology of the causative agents of dirofilariosis, angiostrongylosis, and thelaziosis. The migratory routes of the medically important tapeworm *Echinococcus multilocularis* from eastern Europe were also determined with broad international cooperation.

The ***Laboratory of Ichthyoparasitology*** (**70% basic/30% applied research**) is focused on the integrative taxonomy, systematics, and phylogeny of multicellular parasites of freshwater and marine fishes, including

the etiological agents of fish-borne diseases from various zoogeographic regions of the world. The research is mainly conducted at the international level and has the characteristics of basic research. It is focused on basal groups of tapeworms, e.g. *Gyrocotyle* parasitising marine cartilaginous fishes related to sharks, and monozoic tapeworms of the order Caryophyllidea, parasites of freshwater siluriform and cypriniform fishes. Other parasitic models are the etiological agents of fish-borne diseases, such as those caused by *Metagonimus* flukes, *Dibothriocephalus* tapeworms, and *Anisakis* roundworms. Ecotoxicological studies are conducted in heavily polluted aquatic environments, in which thorny-headed worms and tapeworms are studied as potential bioindicators of pollution. This type of research has the characteristics of applied research. The societal impact is ensured by the study of parasites infecting commercially important fish hosts representing a threat to aquaculture.
A taxonomic revision of fish tapeworms led to a description of two genera and seven species new to science. The species diversity, host association, and biogeography of the evolutionarily ancient *Gyrocotyle* were revised based on morphology and molecular phylogenetics. The invasive tapeworm *Khawia japonensis*, originally described in Japan, was detected in farmed carp in central Europe. Larvae of the Japanese broad tapeworm, *Dibothriocephalus nihonkaiensis*, were found in pink salmon in Alaska, USA, for the first time. Original karyological characteristics and their evolutionary importance were studied in four species (Cestoda and Monogenea) parasitising fish. Triploidy linked with the parthenogenic mode of reproduction was identified in the medically important human parasite *Dibothriocephalus latus.* A combination of advanced imaging techniques (confocal microscopy and scanning/transmission electron microscopy) provided complex 3D images of the specialised body surface of *D. latus* and the distribution of the frontal glands necessary for tissue penetration and the attachment of the infective stages to the host. The bioaccumulation of hazardous organic compounds in fish and their parasites were studied in a heavily polluted ecosystem. Concentrations of polychlorinated biphenyls above the limits set by European regulations were detected in fish muscles, confirming a high risk for biota and humans.

The ***Laboratory of Plant Nematology*** (**70% basic/30% applied research**) is focused on the study of communities of soil nematodes in natural ecosystems (grasslands and forests) and agroecosystems in Slovakia. Attention is paid to the taxonomy and systematics of free-living nematodes and plant parasitic nematodes of various ecosystems and their use as bioindicators of changes in the soil environment due to climatic, natural, or anthropogenic changes. New phytopathologically and economically important species of plant parasitic nematodes in Slovakia were monitored in the context of global climate change. The scientific outputs of the laboratory primarily have the characteristics of basic research, with a focus on ecological studies. The results of the laboratory can also be directly implemented in the practises of agriculture and forestry, especially in the field of plant protection and the assessment of soil ecosystems. The societal impact is displayed by the consultations with state and private organisations dealing with plant diseases and plant protection at national and international levels, particularly in quarantining parasitic nematodes.
Studies of the interactions between plant communities, nematode communities, and soil properties in various types of ecosystems indicated that nematodes were useful indicators of the status of soil ecosystems and changes in ecosystems after disturbance (short-term study), but also in a phase of the regeneration of ecosystems after disturbance (long-term study). Research on the impacts of the most widespread invasive plant species on soil nematode communities, the activity of microorganisms, and soil properties indicated that the impact of invasive plant species on nematode communities could be positive, neutral, or negative. The impact of the interaction between stands of natural forest and stands influenced by human activity on nematode communities were also studied. Species-rich deciduous forests supported by extensive root systems had a higher diversity of nematode taxa and a higher abundance of herbivores than did species-poor coniferous forests. Nematode abundance and biomass were lower in old managed and unmanaged forests associated with more-extensive root systems and the sequestration of carbon in soil. These findings suggest strong bottom-up effects of belowground tree inputs and indicate that some components of the nematode community may be differentially affected by the quantity and quality of resources.

The ***Laboratory of Environmental Parasitology*** (**50% basic/50% applied research**) is focused on the problems of the onset, course, and risks of dissemination of parasites under various environmental

conditions. Parasitic diseases are studied in different social groups of the human population living under various sanitary standards. Attention is also paid to efficient methods for reducing the epidemiologically important contamination of urban and rural ecosystems by the causative agents of parasitic infections. The model parasites are different species of intestinal helminths and intestinal protists, namely *Giardia duodenalis* and *Cryptosporidium* spp. The study of the parasitic contamination of the environment is conducted in localities with various types of systems for recycling waste. The results are widely used by state institutions and by veterinary, hygiene, healthcare, and agricultural services.
The genetically unique cat-specific assemblage F of the intestinal protist *Giardia duodenalis* was detected in Slovakia in people living in communities with low hygienic standards. This finding was the first in Europe and documented a broad host spectrum of *G. duodenalis* assemblages. The zoonotic intestinal protists *Cryptosporidium* spp. and *Giardia* spp., the fluke *Stichorchis subtriquetrus,* and the roundworm *Travassosius rufus* were found in the European beaver (*Castor fiber*) reintroduced to Slovakia. The endoparasites of domestic dogs and cats were analysed with an emphasis on zoonotic species as potential transmitters of parasitic diseases to humans. The accumulation of environmental contaminants (antibiotic-resistant bacteria and eggs of helminths) was described in insufficiently processed sewage sludge, which contributed to a better understanding of their impact on the environment.

The ***Laboratory of Immunology*** (**100% basic research**) is focused on monitoring the cellular and humoral immune response of hosts to parasitic infection with the primary goal to determine host-parasite relationships. The research is directed towards a better understanding of innate and adaptive immune responses of the hosts and the immunogenicity of selected zoonotic parasites. It is focused on new prophylactic and therapeutic potentials of immunomodulating substances of various origin (bacterial, fungal, and artificial) leading to enhanced drug efficacy, beneficial immunomodulation, suppressed inflammation, and pathological changes. The most studied parasitic models are medically important zoonotic helminths, such as larval stages of the tapeworm *Echinococcus multilocularis* and the roundworms *Trichinella spiralis* and *Ascaris suum*. The research is conducted at the experimental level using BALB/c inbred mice and the Mongolian gerbil (*Meriones unguiculatus*) and represents basic research. The laboratory is developing immunomodulatory approaches for modulating the immune system at the cellular and molecular levels. The results from the laboratory help to explain the mode of action of immunomodulators and their perspectives in the prophylaxis and therapy of parasitic diseases and have international importance.
The laboratory has tested the immunogenic properties and antiparasitic effects of probiotic bacterial strains, which offer possibilities of more effective antiparasitic therapies and the reduction of anthelmintic resistance. The use of probiotics in the therapy of parasitic infection was verified to gain a better understanding of the molecular mechanisms associated with the beneficial effects of probiotic bacteria. The research identified antiparasitic and immunogenic properties of probiotic strains in experimental trichinellosis in mice. The most effective probiotic strains were strains of *Enterococcus faecium*, *Lactobacillus fermentum*, and *Enterococcus durans*, each with its own strain-specific modulation. *E. faecium* stimulated the oxidative metabolism of peritoneal macrophages, induced a Th1 response in the intestinal phase of trichinellosis, and increased IgA production. *L. fermentum* induced Th1 dominance, necessary for protecting the host against newly hatched larvae, and also regulated pathological changes induced by inflammation. *E. durans* affected nonspecific immunity, and stimulated the metabolic activity of macrophages, phagocytosis and oxidative burst of blood leukocytes, and intestinal CD8+ T lymphocytes. The results suggest the positive modulation of the host immune response in *T. spiralis* infections and the prospective use of probiotic strains in the prevention and therapy of trichinellosis.

The ***Laboratory of Population Genetics*** (**100% basic research**) is focused on the genetic structure of populations of medically and veterinarily important tapeworms (Cestoda) and flukes (Trematoda) across enzootic regions in Europe and other continents. The core model parasites are the giant liver fluke *Fascioloides magna*, a liver parasite of domestic and wild ruminants, and *Dibothriocephalus latus* and *Dibothriocephalus dendriticus*, tapeworms of the order Diphyllobothriidea parasitising piscivorous mammals, including humans. Molecular and genetic analyses of various mitochondrial genes and ribosomal subunits are used for determining the phylogenetic lineages, origin, and migratory routes of the parasites. The *de novo* design of polymorphic multilocus microsatellite markers is routinely performed in the

laboratory. Originally designed microsatellites are applied in studies of the dispersal history and scenarios of colonisation of introduced populations. The relationship between the current distribution and historical migration of the hosts and dispersal routes of the parasites is also studied.
Large-scale analyses of the population genetics of native North American and introduced European populations of *F. magna* identified multiple origins of European populations of the parasite, confirming its several independent introductions to Europe along with cervid hosts. Molecular studies identified the Czech origin of *F. magna* from newly detected natural foci of fascioloidosis in Poland and Germany. The spread of fascioloidosis from a historically old and isolated Czech focus to neighbouring countries was confirmed. A long-term survey of the dynamics of occurrence of *F. magna* in a forest on the Danube floodplain, GIS modelling, and multicriteria analytical methods assessed the risk of the transmission of *F. magna* outside the well-established European focus of fascioloidosis in the Danube region. Polymorphic microsatellite markers were originally designed for *D. latus* and *D. dendriticus* using next-generation sequencing of microsatellite libraries and were applied in an assessment of the origins and migratory routes of both tapeworms. Ichthyoparasitological surveys in multiple localities in Slovakia, Poland, Switzerland, and Italy provided the most recent data and a map of the current distribution of *D. latus* in the Baltic, Danube, and Alpine regions.

The ***Laboratory of Experimental Pharmacology*** (**90% basic/10% applied research**) investigates the molecular mechanisms of the antiparasitic and immunomodulatory activities of biological products and anthelmintics. The research is conducted in accordance with a programme of drug discovery for controlling medically important cestode infections. Antiparasitic and cytoprotective potentials are studied in selected natural compounds such as secondary metabolites of plants (e.g. silymarin and astaxantin). The main research strategy is a rational approach to drug discovery focussing on molecules interfering with specific molecular targets in parasites. The experiments are performed on laboratory mice infected with larval stages of the model tapeworms *Mesocestoides vogae* and *Echinococcus multilocularis,* which have the ability of asexual tumour-like growth and can also accidentally infect humans. Pharmacological research uses a multidisciplinary approach using methods of molecular and cell biology, immunology, histology, and biochemistry. The outcomes of the research indicate the potential of a combined therapy for humans and other animals using commercial anthelmintics and transfer factors.
The immunological regulation and role of larval secretory and somatic molecules of the model tapeworm *M. vogae* were determined. The stage-specific expression of individual secretory and somatic antigens induced high levels of IgM antibodies in the peritoneal cavity involved in larval masking in contrast with a higher level of IgG antibodies in the serum. The dynamics of the occurrence and representation of individual phenotypes of myeloid cells in the peritoneal cavity and spleen of mice were described after oral infection and after application of secretory products to the mice. Lymphocytes were polarised to Th2 type cytokines and subsequently to strongly suppressive Treg lymphocytes with reduced secretion of IFN-γ cytokines and overproduction of IL-10 in the chronic phase. Molecules secreted by larvae could directly induce the accelerated production of immature myeloid cells and immunosuppression. The mechanisms of commonly used anthelmintics (albendazole and praziquantel) in the immunopathology of hosts with *M. vogae* infections were studied. The co-administration of the flavonoid silymarin and the biological “transfer factor immodin” as adjuvants strongly modulated the effects of the drugs. Combined therapy led to higher efficacy, downregulated fibrosis and oxidative stress, increased the production of antiparasitic IFNγ and IL-12 cytokines, normalised the concentration of IL-4, and suppressed the production of IL-10 and TGF-β cytokines. In vitro epigenetic experiments on larvae and various types of immune cells indicated that anthelmintics could directly affect the machinery of the mRNA transcription of genes regulating cytokine secretion and the polarisation of macrophages that contributed to Th2/T reg immunity.

The ***Laboratory of Therapy of Parasitic Infections*** (**30% basic/70% applied research**) is directed towards an interdisciplinary approach for the effective therapy of parasitic diseases in domestic and wild animals. It is focused on a better understanding of a variety of parasitic diseases along with various aspects of anthelmintic resistance. The main goal is to provide improved means of diagnosis and to develop effective management strategies that can be used to conserve the efficacy of currently used anthelmintics. The model parasites are species of gastrointestinal roundworms, tapeworms, and flukes parasitising wild and

domestic ruminants, mainly sheep and goats. The main experimental model is *Haemonchus contortus*, the red stomach roundworm of small and large ruminants.
Livestock farming faces problems associated with diseases caused by gastrointestinal nematodes, such as declining performance, the risk of anthelmintic resistance, and the risk of chemical residues in animal products. The effect of the enrichment of standard feed mixtures with medicinal plants and the trace elements zinc and selenium was evaluated in lambs infected with *H. contortus*. The plant mixtures consisted of combinations of the dried herbs *Althaea officinalis*, *Petasites hybridus*, *Inula helenium*, *Malva sylvestris*, *Chamomilla recutita*, *Plantago lanceolata*, *Rosmarinus officinalis*, *Solidago virgaurea*, *Fumaria officinalis*, *Hyssopus officinalis*, *Melissa officinalis*, *Foeniculum vulgare*, and *Artemisia absinthium*. The application of medicinal plants in feed mixtures substantially reduced the production of eggs by the parasites and the number of parasites in the gastrointestinal tracts of the hosts. The studies confirmed the beneficial effects of medicinal plants and trace elements on lamb health, which has an impact on the sustainable control of parasitic helminths. Despite the availability of several anthelmintic agents for the treatment of helminthiases, the increasing prevalence of anthelmintic resistance in gastrointestinal parasites has often led to complete therapeutic failure. Developing new strategies and recommendations for effective antiparasitic control is therefore needed. The laboratory participated in the development of a meta-analysis that identified the main indicators of the prevalence of anthelmintic resistance in parasites of ruminants throughout Europe.

The ***Laboratory of Molecular Ecology of Vectors*** (**60% basic/40% applied research**) focuses on the study of host-vector-pathogen interactions at the molecular level. The laboratory studies the characterisation of macro- and microclimatic factors influencing the occurrence and survival of vectors in natural environments. Strong emphasis is placed on studying the eco-epidemiology, epizootiology, pathogenesis, genetic variability, phylogeny, and phylogeography of vector-borne pathogens with zoonotic potential. The laboratory is studying vectors (ectoparasites) such as ticks (Ixodida and Ixodidae), fleas (Siphonaptera), mites (Mesostigmata), and lice (Phthiraptera) and vector-borne bacterial (*Borrelia*, *Anaplasma*, *Ehrlichia*, *Mycoplasma*, *Rickettsia*, and *Bartonella*), parasitic (*Babesia*), and viral (tick-borne encephalitis virus) diseases. Humans are the most frequently studied hosts, but domestic and wild mammals, birds, and reptiles are also studied. The societal importance lies in the detection of neglected pathogens, vectors, and hosts involved in the transmission and spread of newly emerging diseases. The risks of transmission of infections between humans and domestic animals are also evaluated. The laboratory provides the molecular diagnosis of infections for public-health institutions, hospitals, veterinarians, and the general public.
The differential diagnosis and molecular identification of *Babesia gibsoni* in dogs and its differentiation from *Babesia canis,* more common causative agent of canine babesiosis, was of great veterinary importance due to the different therapies required for infections with the two species of *Babesia*. The first data on *Babesia vulpes* and *Mycoplasma* spp. in red foxes indicated their important role in the maintenance and spread of pathogens in the sylvatic cycle within and outside the foci. A zoonotic strain of *Babesia microti*, a causative agent of human babesiosis, was confirmed in rodents and *Ixodes ricinus* ticks. *Ixodes trianguliceps* ticks were free of infection, so the existence of a special vector-pathogen relationship was suggested. The molecular evidence and genetic diversity of the spotted fever group *Rickettsia* spp. in small mammals from eastern Slovakia identified specific associations between *Rickettsia* spp. and their reservoir hosts. The first case of a human *Rickettsia*-like infection, and an unexpectedly high occurrence of bacteria responsible for human granulocytic anaplasmosis, were recorded in patients positive for the human immunodeficiency virus (HIV). *Candidatus* Cryptoplasma sp. was identified as the only species of the family Anaplasmataceae acquired by green lizards, indicating negative selection against other pathogens transmitted by tick vectors. New species and genotypes of *Cryptosporidium apodemi* sp. n., *Cryptosporidium ditrichi* sp. n., and *Cryptosporidium muscrat* I. and II. were identified in rodents from various European localities.

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 (in percentage)

Basic research 65% / Applied research 35%
International 70% / Regional 30%

2.1.2 List of selected publications documenting the most important results of basic research. The total number of publications should not exceed the number of average FTE researchers per year. The principal research outputs (max. 10% of the total number of selected publications, including Digital Object Identifier – DOI if available) should be underlined. Authors from the evaluated organizations should be underlined.

*Notes: the average FTE researchers per year was 34; **, corresponding author; authors from IP SAS are underlined; JCR, Journal Citation Reports (WoS); SJR, Scientific Journal Rankings (Scopus).*

• ***Parasites of human***

[**1**] PAPAJOVÁ, Ingrid - BYSTRIANSKA, Júlia - GIBODA, Michal - BECKER, Sören L. - UTZINGER, Jürg - MARTI, Hanspeter**. Intestinal parasites in segregated minority communities of Slovakia: results from a cross-sectional survey in children. In *Acta Tropica*, 2021, vol. 214, art. no. 105783. (2020: **3.112** - IF, **Q1** - JCR, 0.969 - SJR, **Q1** - SJR). ISSN 0001-706X. https://doi.org/10.1016/j.actatropica.2020.105783

[**2**] ŠIMEKOVÁ, Katarína - SOJÁK, Ľubomír - VÍCHOVÁ, Bronislava - BALOGOVÁ, Lenka - JAROŠOVÁ, Júlia - ANTOLOVÁ, Daniela**. Parasitic and vector-borne infections in HIV-positive patients in Slovakia - evidence of an unexpectedly high occurrence of *Anaplasma phagocytophilum*. In *Pathogens*, 2021, vol. 10, no. 12, art. no. 1557. (2020: **3.492** - IF, **Q2** - JCR, 0.984 - SJR, **Q2** - SJR). ISSN 2076-0817. https://doi.org/10.3390/pathogens10121557

[**3**] PIPIKOVÁ, Jana - PAPAJOVÁ, Ingrid** - MAJLÁTHOVÁ, Viktória - ŠOLTYS, Jindřich - BYSTRIANSKA, Júlia - SCHUSTEROVÁ, Ingrid - VARGOVÁ, Veronika. First report on *Giardia duodenalis* assemblage F in Slovakian children living in poor environmental conditions. In *Journal of Microbiology, Immunology and Infection*, 2020, vol. 53, no. 1, p. 148-156. (2019: **3.493** - IF, **Q2** - JCR, 0.947 - SJR, **Q1** - SJR). ISSN 1684-1182. https://doi.org/10.1016/j.jmii.2018.04.007

[**4**] KRÁLOVÁ-HROMADOVÁ, Ivica** - RADAČOVSKÁ, Alžbeta - ČISOVSKÁ BAZSALOVICSOVÁ, Eva - KUCHTA, Roman. Ups and downs of infections with the broad fish tapeworm *Dibothriocephalus latus* in Europe from 1900 to 2020: Part I. In *Advances in Parasitology*, 2021, vol. 114, p. 75-166. (2020: **3.870** - IF, **Q1** - JCR, 3.351 - SJR, **Q1** - SJR). ISSN 0065-308X. https://doi.org/10.1016/bs.apar.2021.08.008

[**5**] OROSOVÁ, Martina** - MARKOVÁ, Anna - PROVAZNÍKOVÁ, Irena - OROS, Mikuláš - RADAČOVSKÁ, Alžbeta - ČADKOVÁ, Zuzana - MAREC, František. Molecular cytogenetic analysis of a triploid population of the human broad tapeworm, *Dibothriocephalus latus* (Diphyllobothriidea). In *Parasitology*, 2021, vol. 148, no. 7, p. 787-797. (2020: **3.234** - IF, **Q2** - JCR, 0.951 - SJR, **Q1** - SJR). ISSN 0031-1820. https://doi.org/10.1017/S0031182021000408

[**6**] BARČÁK, Daniel** - YONEVA, Aneta - SEHADOVÁ, H. - OROS, Mikuláš - GUSTINELLI, A. - KUCHTA, Roman. Complex insight on microanatomy of larval "human broad tapeworm" *Dibothriocephalus latus* (Cestoda: Diphyllobothriidea). In *Parasites & vectors*, 2019, vol. 12, no. 1, art. no. 408. (2018: **3.031** - IF, **Q1** - JCR, 1.565 - SJR, **Q1** - SJR). ISSN 1756-3305. https://doi.org/10.1186/s13071-019-3664-8

• ***Veterinary parasitology***

[**7**] MITERPÁKOVÁ, Martina - KOMJÁTI-NAGYOVÁ, Martina - HURNÍKOVÁ, Zuzana - VÍCHOVÁ, Bronislava**. Retrospective molecular study on canine hepatozoonosis in Slovakia – Does infection risk for dogs really exist? In *Ticks and Tick-Borne Diseases*, 2017, vol. 8, no. 4, p. 567-573. (2016: **3.230** - IF, **Q1** - JCR, 1.308 - SJR, **Q1** - SJR). ISSN 1877-959X. https://doi.org/10.1016/j.ttbdis.2017.03.005

[**8**] MITERPÁKOVÁ, Martina - VALENTOVÁ, Daniela - ČABANOVÁ, Viktória** - BEREŠÍKOVÁ, Ľudmila. Heartworm on the rise - new insights into *Dirofilaria immitis* epidemiology. In *Parasitology Research*, 2018, vol. 117, no. 7, p. 2347-2350. (2017: **2.558** - IF, **Q2** - JCR, 0.991 - SJR, **Q1** - SJR). ISSN 0932-0113. https://doi.org/10.1007/s00436-018-5912-9

[**9**] ČABANOVÁ, Viktória** - MITERPÁKOVÁ, Martina - DRUGA, Michal - HURNÍKOVÁ, Zuzana - VALENTOVÁ, Daniela. GIS-based environmental analysis of fox and canine lungworm distribution: an epidemiological study of *Angiostrongylus vasorum* and *Crenosoma vulpis* in red foxes from Slovakia. In *Parasitology Research*, 2018, vol. 117, no. 2, p. 521-530. (2017: **2.558** - IF, **Q2** - JCR, 0.991 - SJR, **Q1** - SJR). ISSN 0932-0113. https://doi.org/10.1007/s00436-017-5728-z

[**10**] ČABANOVÁ, Viktória - KOCÁK, Peter - VÍCHOVÁ, Bronislava - MITERPÁKOVÁ, Martina**. First autochthonous cases of canine thelaziosis in Slovakia: a new affected area in Central Europe. In *Parasites & vectors*, 2017, vol. 10, art. no.179. (2016: **3.035** - IF, **Q1** - JCR, 1.534 - SJR, **Q1** - SJR). ISSN 1756-3305. https://doi.org/10.1186/s13071-017-2128-2

• ***Vectors (ticks and mosquitoes) & vector-borne diseases***

[**11**] KOČÍKOVÁ, Božena - MAJLÁTH, Igor - VÍCHOVÁ, Bronislava - MALINIČOVÁ, Lenka - PRISTAŠ, Peter - CONNORS, Vincent A. - MAJLÁTHOVÁ, Viktória**. *Candidatus* Cryptoplasma associated with green lizards and *Ixodes ricinus* ticks, Slovakia, 2004-2011. In *Emerging Infectious Diseases*, 2018, vol. 24, no. 12, p. 2348-2351. (2017: **7.422** - IF, **Q1** - JCR, 3.278 - SJR, **Q1** - SJR). ISSN 1080-6040. https://doi.org/10.3201/eid2412.161958

[**12**] VÍCHOVÁ, Bronislava** - HORSKÁ, Mária - BLAŇAROVÁ, Lucia - ŠVIHRAN, Milan - ANDERSSON, M. - PEŤKO, Branislav. First molecular identification of *Babesia gibsoni* in dogs from Slovakia, Central Europe. In *Ticks and Tick-Borne Diseases*, 2016, vol. 7, no. 1, p. 54-59. (2015: **2.690** - IF, **Q2** - JCR, 1.248 - SJR, **Q1** - SJR). ISSN 1877-959X. https://doi.org/10.1016/j.ttbdis.2015.08.004

[**13**] BLAŇAROVÁ, Lucia** - STANKO, Michal - MIKLISOVÁ, Dana - VÍCHOVÁ, Bronislava - MOŠANSKÝ, Ladislav - KRALJIK, Jasna - BONA, Martin - DERDÁKOVÁ, Markéta. Presence of *Candidatus* Neoehrlichia mikurensis and *Babesia microti* in rodents and two tick species (*Ixodes ricinus* and *Ixodes trianguliceps*) in Slovakia. In *Ticks and Tick-Borne Diseases*, 2016, vol. 7, no. 2, p. 319-326. (2015: **2.690** - IF, **Q2** - JCR, 1.248 - SJR, **Q1** - SJR). ISSN 1877-959X. https://doi.org/http://dx.doi.org/10.1016/j.ttbdis.2015.11.008

[**14**] HEGLASOVÁ, Ivana** - VÍCHOVÁ, Bronislava - KRALJIK, Jasna - MOŠANSKÝ, Ladislav - MIKLISOVÁ, Dana - STANKO, Michal. Molecular evidence and diversity of the spotted-fever group *Rickettsia* spp. in small mammals from natural, suburban and urban areas of Eastern Slovakia. In *Ticks and Tick-Borne Diseases*, 2018, vol. 9, iss. 6, p. 1400-1406. (2017: **2.612** - IF, **Q2** - JCR, 1.421 - SJR, **Q1** - SJR). ISSN 1877-959X. https://doi.org/10.1016/j.ttbdis.2018.06.011

[**15**] ZUBRIKOVÁ, Dana** - WITTMANN, Maria - HÖNIG, Václav - ŠVEC, Pavel - VÍCHOVÁ, Bronislava - ESSBAUER, S. - DOBLER, G. - GRUBHOFFER, Libor - PFISTER, Kurt. Prevalence of tick-borne encephalitis virus and *Borrelia burgdorferi* sensu lato in *Ixodes ricinus* ticks in Lower Bavaria and Upper Palatinate, Germany. In *Ticks and Tick-Borne Diseases*, 2020, vol. 11, no. 3, art. no. 101375. (2019: **2.749** - IF, **Q2** - JCR, 1.182 - SJR, **Q1** - SJR). ISSN 1877-959X. https://doi.org/10.1016/j.ttbdis.2020.101375

[**16**] HEGLASOVÁ, Ivana** - RUDENKO, Natalia - GOLOVCHENKO, M. - ZUBRIKOVÁ, Dana - MIKLISOVÁ, Dana - STANKO, Michal. Ticks, fleas and rodent-hosts analyzed for the presence of *Borrelia miyamotoi* in Slovakia: the first record of *Borrelia miyamotoi* in a *Haemaphysalis inermis* tick. In *Ticks and Tick-Borne Diseases*, 2020, vol. 11, no. 5, art. no. 101456. (2019: **2.749** - IF, **Q2** - JCR, 1.182 - SJR, **Q1** - SJR). ISSN 1877-959X. https://doi.org/10.1016/j.ttbdis.2020.101456

[**17**] ČABANOVÁ, Viktória - MITERPÁKOVÁ, Martina** - VALENTOVÁ, Daniela - BLAŽEJOVÁ, Hana - RUDOLF, Ivo - STLOUKAL, Eduard - HURNÍKOVÁ, Zuzana - DZIDOVÁ, Marianna. Urbanization impact on mosquito community and the transmission potential of filarial infection in central Europe. In *Parasites & vectors*, 2018, vol. 11, art. no. 261. (2017: **3.163** - IF, **Q1** - JCR, 1.702 - SJR, **Q1** - SJR). ISSN 1756-3305. https://doi.org/10.1186/s13071-018-2845-1

[**18**] **ČABANOVÁ, Viktória**** - TICHÁ, Elena - BRADBURY, Richard Stewart - **ZUBRIKOVÁ, Dana** - VALENTOVÁ, Daniela - CHOVANCOVÁ, Gabriela - GREŠÁKOVÁ, Ľubomíra - **VÍCHOVÁ, Bronislava** - ŠIKUTOVÁ, Silvie - CSANK, Tomáš - **HURNÍKOVÁ, Zuzana** - **MITERPÁKOVÁ, Martina** - RUDOLF, Ivo. Mosquito surveillance of West Nile and Usutu viruses in four territorial units of Slovakia and description of a confirmed autochthonous human case of West Nile fever, 2018 to 2019. In *Eurosurveillance*, 2021, vol. 26, no. 19, art. no. 2000063. (2020: **6.307** - IF, **Q1** - JCR, 2.766 - SJR, **Q1** - SJR). ISSN 1560-7917. https://doi.org/10.2807/1560-7917.ES.2021.26.19.2000063

[**19**] ČABANOVÁ, Viktória - ŠIKUTOVÁ, Silvie - STRAKOVÁ, Petra - ŠEBESTA, Oldřich - VÍCHOVÁ, Bronislava - ZUBRIKOVÁ, Dana - MITERPÁKOVÁ, Martina - MENDEL, J. - HURNÍKOVÁ, Zuzana - HUBÁLEK, Zdeněk - RUDOLF, Ivo**. Co-Circulation of West Nile and Usutu Flaviviruses in Mosquitoes in Slovakia, 2018. In *Viruses-Basel*, 2019, vol. 11, art. no. 639. (2018: **3.811** - IF, **Q2** - JCR, 1.812 - SJR, **Q1** - SJR). ISSN 1999-4915. https://doi.org/10.3390/v11070639

• ***Morphology & genetics***

[**20**] MATOUŠKOVÁ, Martina - BÍLÝ, Tomáš - BRUŇANSKÁ, Magdaléna** - OROS, Mikuláš - KOSTIČ, Borislav - NEBESÁŘOVÁ, Jana. New data on spermiogenesis and trepaxonematan axoneme in basal tapeworms (Cestoda, Caryophyllidea, Lytocestidae) parasitizing cyprinid fishes. In *Scientific Reports*, 2019, vol. 9, art. no. 12881. (2018: **4.011** - IF, **Q1** - JCR, 1.414 - SJR, **Q1** - SJR). ISSN 2045-2322. https://doi.org/10.1038/s41598-019-49312-9

[**21**] BARČÁK, Daniel - FAN, Chia-Kwung - SONKO, P. - KUCHTA, Roman - SCHOLZ, Tomáš - OROSOVÁ, Martina - CHEN, Hsuan-Wien - OROS, Mikuláš**. Hidden diversity of the most basal tapeworms (Cestoda, Gyrocotylidea), the enigmatic parasites of holocephalans (Chimaeriformes). In *Scientific Reports*, 2021, vol. 11, art. no. 5492. (2020: **4.380** - IF, **Q1** - JCR, 1.240 - SJR, **Q1** - SJR). ISSN 2045-2322. https://doi.org/10.1038/s41598-021-84613-y

[**22**] UHROVIČ, Dalibor - OROS, Mikuláš - KUDLAI, Olena - CHOUDHURY, Anindo - SCHOLZ, Tomáš**. Molecular evidence of three closely related species of *Biacetabulum* Hunter, 1927 (Cestoda: Caryophyllidea): a case of recent speciation in different fish hosts (Catostomidae)? In *Parasitology*, 2021, vol. 148, no. 9, p. 1040 - 1056. (2020: **3.234** - IF, **Q2** - JCR, 0.951 - SJR, **Q1** - SJR). ISSN 0031-1820. https://doi.org/10.1017/S0031182021000743

[**23**] JUHÁSOVÁ, Ľudmila - KRÁĽOVÁ-HROMADOVÁ, Ivica** - BAZSALOVICSOVÁ, Eva - MINÁRIK, Gabriel - ŠTEFKA, Jan - MIKULÍČEK, Peter - PÁLKOVÁ, Lenka - PYBUS, Margo. Population structure and dispersal routes of an invasive parasite, *Fascioloides magna*, in North America and Europe. In *Parasites & vectors*, 2016, vol. 9, art. no. 547. (2015: **3.234** - IF, **Q1** - JCR, 1.720 - SJR, **Q1** - SJR). ISSN 1756-3305. https://doi.org/10.1186/s13071-016-1811-z

[**24**] ŠPAKULOVÁ, Marta** - BOMBAROVÁ, Marta - MIKLISOVÁ, Dana - NECHYBOVÁ, Stanislava - LANGROVÁ, Iva. How to become a successful invasive tapeworm: a case study of abandoned sexuality and

exceptional chromosome diversification in the triploid carp parasite *Atractolytocestus huronensis* Anthony, 1958 (Caryophyllidea: Lytocestidae). In *Parasites & vectors*, 2019, vol. 12, art. no. 161. (2018: **3.031** - IF, **Q1** - JCR, 1.565 - SJR, **Q1** - SJR). ISSN 1756-3305. https://doi.org/10.1186/s13071-019-3420-0

• ***Pharmacology & treatment***

[**25**] **VENDEĽOVÁ, Emília** - CAMARGO DE LIMA, Jeferson - RODRIQUEZ LORENZATTO, Karina - MARIANTE MONTEIRO, Karina - MUELLER, Thomas - VEEPASCHIT, Jyotishman - GRIMM, Clemens - BREHM, Klaus - **HRČKOVÁ, Gabriela** - LUTZ, Manfred B. - FERREIRA, Henrique B. - KOMGUEP, Nono**. Proteomic analysis of excretory-secretory products of *Mesocestoides corti* metacestodes reveals potential suppressors of dendritic cell functions. In *Plos Neglected Tropical Diseases,* 2016, vol. 10, no. 10, art. no. e0005061. (2015: **3.948** - IF, **Q1** - JCR, 2.444 - SJR, **Q1** - SJR). ISSN 1935-2735. https://doi.org/10.1371/journal.pntd.0005061

[**26**] MAČÁK KUBAŠKOVÁ, Terézia - MUDROŇOVÁ, Dagmar - VARGOVÁ, Miroslava - REITEROVÁ, Katarína - HRČKOVÁ, Gabriela**. Cellular and humoral peritoneal immunity to *Mesocestoides vogae* metacestode infection in mice. In *Parasites & vectors*, 2021, vol. 14, art. no. 54. (2020: **3.876** - IF, **Q1** - JCR, 1.404 - SJR, **Q1** - SJR). ISSN 1756-3305. https://doi.org/10.1186/s13071-020-04541-0

[**27**] MAČÁK KUBAŠKOVÁ, Terézia - MUDROŇOVÁ, Dagmar - VELEBNÝ, Samuel - HRČKOVÁ, Gabriela**. The utilisation of human dialyzable leukocyte extract (IMMODIN) as adjuvant in albendazole therapy on mouse model of larval cestode infection: Immunomodulatory and hepatoprotective effects. In *International Immunopharmacology*, 2018, vol. 65, p. 148-158. (2017: **3.118** - IF, **Q2** - JCR, 1.051 - SJR, **Q2** -SJR). ISSN 1567-5769. https://doi.org/10.1016/j.intimp.2018.09.045

[**28**] BABJÁK, Michal - KÖNIGOVÁ, Alžbeta - URDA DOLINSKÁ, Michaela - KUPČINSKAS, Tomas - VADLEJCH, Jaroslav - VON SAMSON-HIMMELSTJERNA, Georg - PETKEVIČIUS, Saulius - VÁRADY, Marián**. Does the in vitro egg hatch test predict the failure of benzimidazole treatment in *Haemonchus contortus*? In *Parasite - Journal de la Societe Francaise de Parasitologie*, 2021, vol. 28, art. no. 62. (2020: **3.000** - IF, **Q2** - JCR, 0.951 - SJR, **Q1** - SJR). ISSN 1252-607X. https://doi.org/10.1051/parasite/2021059

• ***Ecotoxicology & ecology***

[**29**] **BRÁZOVÁ, Tímea** - **MIKLISOVÁ, Dana** - **BARČÁK, Daniel** - **UHROVIČ, Dalibor** - **ŠALAMÚN, Peter** - **OROSOVÁ, Martina** - **OROS, Mikuláš****. Hazardous pollutants in the environment: Fish host-parasite interactions and bioaccumulation of polychlorinated biphenyls. In *Environmental Pollution*, 2021, vol. 291, art. no. 118175. (2020: **8.071** - IF, **Q1** - JCR, 2.136 - SJR, **Q1** - SJR). ISSN 0269-7491. https://doi.org/10.1016/j.envpol.2021.118175

[**30**] ŠALAMÚN, Peter** - HANZELOVÁ, Vladimíra - MIKLISOVÁ, Dana. Variability in responses of soil nematodes to trace element contamination. In *Chemosphere*, 2018, vol. 210, p. 169-174. (2017: **4.427** - IF, **Q1** - JCR, 1.435 - SJR, **Q1** - SJR). ISSN 0045-6535. https://doi.org/10.1016/j.chemosphere.2018.07.009

[**31**] ŠALAMÚN, Peter** - HANZELOVÁ, Vladimíra - MIKLISOVÁ, Dana - ŠESTINOVÁ, Oľga - FINDORÁKOVÁ, Lenka - KOVÁČIK, Peter. The effects of vegetation cover on soil nematode communities in various biotopes disturbed by industrial emissions. In *Science of the Total Environment*, 2017, vol. 592, p. 106-114. (2016: **4.900** - IF, **Q1** - JCR, 1.652 - SJR, **Q1** - SJR). ISSN 0048-9697. https://doi.org/10.1016/j.scitotenv.2017.02.238

[**32**] ČEREVKOVÁ, Andrea** - MIKLISOVÁ, Dana - SZOBOSZLAY, Márton - TEBBE, Christoph C. - CAGÁŇ, Ľ. The responses of soil nematode communities to Bt maize cultivation at four field sites across Europe. In *Soil Biology & Biochemistry*, 2018, vol. 119, p. 194-202. (2017: **4.926** - IF, **Q1** - JCR, 2.604 - SJR, **Q1** - SJR). ISSN 0038-0717. https://doi.org/10.1016/j.soilbio.2018.01.023

[**33**] ČEREVKOVÁ, Andrea** - IVASCHENKO, Kristina - MIKLISOVÁ, Dana - ANANYEVA, Nadezhda - RENČO, Marek. Influence of invasion by Sosnowsky's hogweed on nematode communities and microbial activity in

forest and grassland ecosystems. In *Global Ecology and Conservation*, 2020, vol. 21, article no. e00851. (2019: **2.526** - IF, **Q2** - JCR, 1.165 - SJR, **Q1** - SJR). ISSN 2351-9894. https://doi.org/10.1016/j.gecco.2019.e00851

[**34**] RENČO, Marek** - ČEREVKOVÁ, Andrea - HOMOLOVÁ, Zuzana. Nematode communities indicate the negative impact of *Reynoutria japonica* invasion on soil fauna in ruderal habitats of Tatra national park in Slovakia. In *Global Ecology and Conservation*, 2021, vol. 26, art. no. e01470. (2020: **3.380** - IF, **Q1** - JCR, 1.133 - SJR, **Q1** - SJR). ISSN 2351-9894. https://doi.org/10.1016/j.gecco.2021.e01470

2.1.3 List of monographs/books published abroad

[**1**] KRÁLOVÁ-HROMADOVÁ, Ivica - JUHÁSOVÁ, Ľudmila - BAZSALOVICSOVÁ, Eva. The giant liver fluke, *Fascioloides magna*: past, present and future research. 1st edition, Springer, Switzerland, 2016, 109 pages, ISBN 978-3-319-29506-0. https://doi.org/10.1007/978-3-319-29508-4

2.1.4. List of monographs/books published in Slovakia

[**1**] KOVÁČIK, Peter - KMEŤOVÁ, Mária - ŠALAMÚN, Peter. Determinácia fytomasy rastlín a parametrov pôdy aplikáciou vermikompostov a vermivýluhov. [Determination of plant phytomass and soil parameters by application of vermicomposts and vermiextracts]. 1st edition, Slovenská poľnohospodárska univerzita, Nitra, 2018, 121 pages, ISBN 978-80-552-1924-0

[**2**] STANKO, Michal - SLOVÁK, Mirko. História výskumov ekológie kliešťov na území Česka a Slovenska do roku 2000. [The history of the research of tick ecology in the Czech Republic and Slovakia till 2000]. 1st edition, VEDA Vydavateľstvo SAV, Bratislava, 2019, 544 pages, ISBN 978-80-224-1752-5

[**3**] BALLA, Miloš - ČAPEK, Miroslav - DANKO, Štefan - FULÍN, Miroslav - CHRAŠČ, Peter - KLOUBEC, Bohuslav - LITERÁK, I. - MOŠANSKÝ, Ladislav - PAČENOVSKÝ, Samuel - PEŠKE, Lubomír - REPEL, Matej - ŠIMKOVÁ, Andrea - VYHNAL, Stanislav. Vtáctvo slovenskej časti Medzibodrožia. [Birds of the Medzibodrožie Region, Eastern Slovakia]. Š. Danko, M. Balla, M. Repel (eds.). 1st edition, Slovenská ornitologická spoločnosť, BirdLife Slovensko, Bratislava, 2017, 505 pp. ISBN 978-80-89526-17-8

2.1.5. List of other scientific outputs specifically important for the institute, max. 10 items for institute with less than 50 average FTE researchers per year, 20 for institutes with 50 – 100 average FTE researchers per year and so on

[**1**] SZEKERES, Sándor - MAJLÁTHOVÁ, Viktória - MAJLÁTH, Igor - FÖLDVÁRI, Gabor. Neglected hosts: the role of lacertid lizards and medium-sized mammals in the eco-epidemiology of Lyme borreliosis. In *Ecology and prevention of Lyme borreliosis: Ecology and Control of vector-borne diseases.* Wageningen Academic Publishers, the Netherlands, 2016, pp. 103-126, ISBN 978-90-8686-838-4, https://doi.org/10.3920/978-90-8686-838-4_8

[**2**] DEPLAZES, Peter - RINALDI, Laura - ALVAREZ ROJAS, Cristian A. - TORGERSON, Paul R. - HARANDI, Majid Fasihi - ROMIG, Thomas - ANTOLOVÁ, Daniela - SCHURER, Jana M. - LAHMAR, Samia - GRINGOLI, Guiseppe - MAGAMBO, Japhet K. - THOMPSON, Andrew - JENKINS, Emily J. Global distribution of alveolar and cystic echinococcosis. In *Echinococcus and Echinococcosis*. 1st edition, Elsevier L.t.d. Academic Press, the Netherlands, 2017, pp. 315-493, ISBN 978-0-12-811471-1, https://doi.org/10.1016/bs.apar.2016.11.001

[**3**] SCHOLZ, Tomáš - OROS, Mikuláš. Caryophyllidea van Beneden in Carus, 1863. In *Planetary biodiversity Inventory (2008-2017). Tapeworms from vertebrate bowels of the earth: Special publication No. 25*. 1st

edition, University of Kansas, Natural History Museum, Kansas, USA, 2017, pp. 47-64, ISBN 978-0-89338-002-1

[**4**] D'AMELIO, Stefano - ŠNÁBEL, Viliam - CAVALLERO, Serena. Ascaris. In *Handbook of Foodborne Diseases*. 1st edition, CRC Press, Taylor and Francis Group, USA, 2018, pp. 845-852, ISBN 978-1-138-03630-7

[**5**] PAPAJOVÁ, Ingrid - ŠOLTYS, Jindřich. Nematode Infections Spread in Slovakia, an European Temperate Region. In *Helminthiasis*. 1st edition, IntechOpen, London, UK, 2020, pp. 1-16, ISBN 978-1-78985-336-0, https://doi.org/10.5772/intechopen.86389

[**6**] ČEREVKOVÁ, Andrea - RENČO, Marek. Impact of Forest Management Practices after Windstorm and Wildfire in Spruce Forest on Soil Nematode Communities. In *Forest Ecosystems: Management, Impact Assessment and Conservation*. 1st edition, Nova Science Publishing, New York, USA, 2016, pp. 45-65, ISBN 978-1-63485-794-9

[**7**] CIMBOLÁKOVÁ, Iveta - UHER, Ivan - VESZELITS-LAKTIČOVÁ, K. - VARGOVÁ, Mária - KIMÁKOVÁ, T. - PAPAJOVÁ, Ingrid. Heavy Metals and the Environment. In *Environmental Factors Affecting Human Health*. IntechOpen, London, UK, 2020, ISBN 978-1-78985-528-9, https://doi.org/10.5772/intechopen.86876

[**8**] GANCARČÍKOVÁ, Soňa - POPPER, M. - HRČKOVÁ, Gabriela - MAĎAR, M. - MUDROŇOVÁ, Dagmar - SOPKOVÁ, Drahomíra - NEMCOVÁ, Radomíra. Antibiotic-Treated SPF mice as a gnotobiotic model. In *Antibiotic use in animals*. 1st edition, IntechOpen, London, UK, 2018, pp. 45-83, ISBN 978-953-51-3750-4, https://doi.org/10.5772/intechopen.71623

[**9**] HRUŠKOVÁ, Tatiana - SASÁKOVÁ, N. - GREGOVÁ, Gabriela - PAPAJOVÁ, Ingrid - BUJDOŠOVÁ, Zuzana. Disinfection of Water Used for Human and Animal Consumption. In *Disinfection*. 1st edition, IntechOpen, London, UK, 2018, pp. 9-31, ISBN 978-1-78984-475-7, https://doi.org/10.5772/intechopen.76430

[**10**] VARGOVÁ, Mária - VESZELITS-LAKTIČOVÁ, K. - HROMADA, Rudolf - CIMBOLÁKOVÁ, Iveta - UHER, Ivan - PAPAJOVÁ, Ingrid - KORIM, Peter. Sanitation and the Environment. In *Environmental Factors Affecting Human Health*. 1st edition, IntechOpen, London, UK, 2020, ISBN 978-1-78985-528-9, https://doi.org/10.5772/intechopen.93106

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

N/A

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

N/A

2.1.8. Narrative on the most important research outputs of the institute – especially focused on their importance for society (3-5 pages)

• ***Parasites of human***

Giardia duodenalis is the unicellular parasite causing gastrointestinal disorders in humans, wild and companion animals. It is one of the most widespread parasites in humans, who can be infected by consuming contaminated water and food or by direct transmission from host to host. This parasitic disease occurs more frequently in areas with poor hygienic standards. *G. duodenalis* can be divided into eight genetic assemblages (A – G) based on the specific structures of genes encoding triosaphosphate isomerase and glutamate dehydrogenase. The assemblages are strictly host-specific and can be found only in humans (A and B) or exclusively in other animals (C – G). The sequence analysis of *G. duodenalis* obtained from children living under low hygienic standards in marginal communities in eastern Slovakia detected the presence of multiple *G. duodenalis* genotypes. In addition to assemblages A and B specific to humans, several isolates were classified as the cat-specific assemblage F for the first time in Europe. The results indicated the zoonotic potential of assemblage F and a broader spectrum of causative agents of giardiasis in humans. Information about the transmission of *G. duodenalis* in children from socioeconomically disadvantaged communities will facilitate and improve preventive measures for eradicating giardiasis in the paediatric population.

Soil-transmitted helminths (STHs) are amongst the most prevalent parasites worldwide and cause the most commonly neglected diseases. STHs refer to a group of parasitic nematodes, most notably the human roundworm *Ascaris lumbricoides*, the human whipworm *Trichuris trichiura*, and the human hookworms *Ancylostoma duodenale* and *Necator americanus*. STHs were predominantly found amongst the Roma communities in eastern Slovakia living in unsanitary conditions with limited access to clean water and health facilities. Prevalences of 27.4% for *A. lumbricoides* and 2.3% for *T. trichiura* were detected amongst the Roma children (7 months to 18 years of age). Soil-transmitted helminthiases still represent a health threat, especially for Roma children, so eradication and public-health programmes addressing hygienic standards need to be implemented by local governmental authorities.

The immunodeficiency caused by reduced levels of CD4 T lymphocytes, destroyed due to constant multiplication of human immunodeficiency virus (HIV), increases the risk of infectious diseases in people infected with HIV. Tick-borne pathogens may cause chronic, debilitating opportunistic infections and even death in immunologically compromised individuals. A molecular study conducted on 89 HIV-positive patients identified the vector-transmitted bacterium *Anaplasma phagocytophilum* in 11 (12.4%) patients, suggesting a higher susceptibility of HIV-infected people to vector-borne pathogens. The correlation with the number of CD4 T lymphocytes was not recorded, so further studies are necessary to clarify the correlation between immunodeficiency in HIV-positive people and vector-borne infections.

Diphyllobothriosis is a fish-borne zoonosis affecting several million people around the globe. Humans acquire infections by consuming raw, smoked, or improperly cooked fish containing infective larval stages of tapeworms of the order Diphyllobothriidea. Six of the 70 diphyllobothriid species have been confirmed as parasites of humans. The broad fish tapeworm *Dibothriocephalus latus* is the most common causative agent of diphyllobothriosis in Europe. A map of the current distribution of *D. latus* in enzootic regions across Europe was produced after ichthyoparasitological examinations of fish intermediate hosts and the inspection of samples obtained from humans. The dynamics of the occurrence of *D. latus* was also assessed in Fennoscandia, the Baltic region, the Danube River region, and the Alpine lakes region. The Alpine lakes region includes the subalpine lakes of Switzerland and northern Italy and is the most important current endemic region of diphyllobothriosis in Europe due to the local popularity of eating dishes containing raw perch. In contrast, long-term preventive measures in northern Europe and the Danube region substantially decreased this zoonosis. The detailed microanatomy and functional morphology of the nervous, glandular, excretory, and secretory systems of *D. latus* from the Alpine region were studied using confocal laser scanning electron microscopy and transmission electron microscopy. The inner structures of the anterior part of *D. latus* responsible for the attachment of the tapeworm in the host were described and their functions were identified. An in-depth karyological analysis of *D. latus* identified the triploidy of the tapeworm linked with asexual parthenogenic reproduction. Parthenogenesis was confirmed by the detection of aberrant meiosis and the absence of fully developed spermatozoa.

• Veterinary parasitology

Parasites of dogs are of great veterinary importance because they are causative agents of serious, sometimes even fatal, canine parasitic diseases. Dogs may be effective sentinel animals for assessing the exposure of infection for the human population, because 60 – 80% of infections in nature are zoonotic (potentially transmitted from animals to humans). Original and comprehensive results were obtained in the study of four newly emerged canine parasitic infections – angiostrongylosis, dirofilariosis, thelasiasis, and babesiosis. *Angiostrongylus vasorum*, the causative agent of canine angiostrongylosis, inhabits the pulmonary arteries of dogs and other carnivores. The first two autochthonous cases of canine angiostrongylosis in Slovakia were reported in 2013. Since then, several surveys have been conducted at IP SAS and the potential influence of selected environmental variables on the occurrence of *A. vasorum* was quantified using logistic regression. The distribution of *A. vasorum* was a typical spatial clustering and occurred in endemic foci mainly in eastern Slovakia. Interestingly, a cluster of foci of *A. vasorum* infections was found in both the wettest and driest areas of Slovakia. A multivariable model for *A. vasorum* identified the tendency of the parasite to prefer areas with higher amounts of arable land and fewer forests.

The zoonotic dirofilarial worms *Dirofilaria immitis* and *Dirofilaria repens* are the most interesting amongst veterinarians in Europe. *D. immitis* adults live in the pulmonary arteries and occasionally the right chambers of the heart of the definitive hosts. *D. repens* is localised in subcutaneous and ocular tissues. A comprehensive study of dirofilariosis in Slovakia indicated that *D. repens* has been a dominant species for a long time (since the first record in 2005). A more dangerous *D. immitis*, however, has been increasing in prevalence since 2016, when the first fatal cases amongst dogs were reported in Slovakia. Both dirofilarial species were also confirmed as causative agents of human infections in Slovakia.

Canine thelaziosis, an ocular parasitic disease caused by *Thelazia callipaeda* and transmitted by the fruit-fly *Phortica variegata* is an emerging zoonotic infection. The first autochthonous infections of dogs and foxes in Slovakia were recorded in 2016. Extensive screening for canine thelaziosis has identified increasing trends in the occurrence of the infection both temporally and spatially. The number of positive cases was alarming in the two largest municipalities – Bratislava and Košice. From a medical point of view, the majority of infected dogs presented mild ocular symptoms manifested by conjunctivitis, but 8.5% of the patients suffered from more serious mucopurulent discharges, and corneal ulcerations. Cooperation with physicians, clinics, and diagnostic institutes were also established due to the zoonotic nature of dirofilariosis and thelasiasis.

Canine babesiosis is a serious and potentially life-threatening parasitic infection of dogs, with the parasitic protist *Babesia canis* as the most common agent responsible for this parasitosis in Europe. In addition to *B. canis*, *Babesia gibsoni* was identified as another causative agent of babesiosis in Slovakia in 2016. Babesiosis caused by *B. gibsoni* is responsible for a more serious, chronic form of the disease characterised by haemolytic anaemia and febrile conditions. Babesiosis caused by *B. gibsoni* is not affected by the traditional antibabesial therapy commonly used against *B. canis*. Differential diagnostic methods discriminating between *B. canis* and *B. gibsoni* and a specific therapeutic treatment of *B. gibsoni* were standardised at IP SAS in close cooperation with veterinarians. The combined therapy led to the complete elimination of parasitaemia. Long-term monitoring of treated dogs did not find relapses of babesiosis or side effects of the therapy. The practical implication of this study has been important since the close cooperation was established between IP SAS, veterinarians, and state administrative organisations.

• Vectors (ticks and mosquitoes) & vector-borne diseases

The introduction of vectors and vector-borne diseases from southern Europe into northern localities, including Slovakia, is one of the direct consequences of climate change. Ongoing screening and proper diagnosis of newly emerging vectors and vector-borne diseases needs to be performed for acquiring accurate information of the circulation of parasitic, bacterial, and viral infections.

The first molecular screening of mosquitoes (vectors of *Dirofilaria* nematodes and several other serious parasitic and viral diseases) was conducted in Slovakia in studies of dirofilariosis. The roundworm *Dirofilaria repens* was detected in the mosquito species *Anopheles messeae*, *Anopheles maculipennis*, and the *Culex pipiens* complex. Congeneric *Dirofilaria immitis* was confirmed in *Coquillettidia richiardii* and *Culex pipiens* biotype *pipiens*. Both species of *Dirofilaria* were also found in *Ochlerotatus sticticus*. The molecular identification of the *Culex pipiens* complex in Slovakia was performed for the first time, and two biotypes were found: the medically important anthropophilic and mammophilic form “molestus”, which is

a vector of the West Nile virus, and the ornithophilic form “pipiens”, which plays only a minor role as a vector of the virus.

Four *Anopheles* species (*Anopheles daciae*, *An. messeae*, *An. hyrcanus*, and *An. plumbeus*) were found during the first comprehensive study of the distribution of mosquitos in Slovakia. *An. daciae* represented a new mosquito species in Slovakia, *An. messeae* and *An. hyrcanus* are important vectors for malaria, and *An. plumbeus* acts as a bridge vector (mosquito species feeding on both birds and mammals) of both tropical malaria and West Nile virus.

Molecular and genetic studies of vectors and vector-borne pathogens were conducted in many groups of wild hosts, including reptiles, rodents, insectivores, birds, and small mammals. Unicellular blood parasites of the genus *Schellackia* (Apicomplexa) and *Cryptoplasma* bacteria were found in lizards across central (Slovakia) and southern (Romania) Europe for the first time. Wild rodents are important reservoir hosts of many tick-borne pathogens. The bacterium *Candidatus* Neoehrlichia mikurensis and the protist parasite *Babesia microti* were identified in ticks and rodents of the genera *Apodemus* and *Myodes*, which play important roles in the circulation of viral, bacterial, and protozoal agents. Large numbers of rodents in urban and rural settlements represent potential risks for the transmission of pathogens from rodents to humans. The ongoing screening of the pathogens of rodents is thus important.

More than 10 species of small mammals from natural, suburban, and urban habitats of eastern Slovakia were examined using molecular methods for the presence of rickettsiae of the spotted fever group. Several *Rickettsia* species were detected in a wide spectrum of rodents, with the zoonotic *Ricketsia helvetica* as the predominant species, followed by *Rickettsia* sp. closely related to *Rickettsia felis*. The study provided the first molecular evidence of the zoonotic *Rickettsia slovaca* in rodents and confirmed the long-term persistence of *Rickettsia* spp. in small mammals in natural and suburban habitats of Slovakia.

Information on the occurrence, hosts, and vectors of *Borrelia miyamotoi* of the relapsing fever group has been scarce. Ecological studies of IP SAS indicated that rural habitats with various species of tick vectors and hosts represent suitable biotopes for the circulation of *B. miyamotoi*, which was found in questing and rodent-attached ticks and in rodents in various habitats (mainly rural) in eastern Slovakia.

• ***Morphology & genetics***

Multidisciplinary approach combining morphological methods (different microscopic techniques) and molecular approach (analyses of phylogenetically informative genes) proved to be the best strategy in the taxonomic studies of fish parasites. Gyrocotylideans are evolutionary ancient parasitic flatworms, and like their hosts, a relict group of holocephalan fishes (Chimaeriformes), they are considered to be “living fossils” of a vanished past. The species diversity, host associations and biogeography of these most basal tapeworms were poorly known. An examination of *Gyrocotyle* specimens isolated from holocephalans of Taiwan and Argentina provided evidence of a conspicuous contrast between the genetic and morphological data. The molecular data, inferred from mitochondrial and ribosomal genes, showed unexpected genetic interrelationships among isolates of the genus *Gyrocotyle*, because each of the four morphologically diverse genotypes from Taiwan clustered with isolates of distinct gyrocotylideans from the North Atlantic. It was detected that one gyrocotylidean species may parasitise more than one holocephalan host species.

Monozoic tapeworms (Caryophyllidea) are dominant components of parasite communities of suckers (Catostomidae) in North America, with genus *Biacetabulum* representing one of the more species-rich genera. Molecular and morphological evaluation of the tapeworms from different fish hosts revealed the existence of four species of *Biacetabulum*, namely *B. isaureae* n. sp., *B. overstreeti* n. sp., *B. longicollum* n. sp., and *B. hypentelii* n. sp., each occurring in the specific fish host.

Giant liver fluke *Fascioloides magna* is an important liver parasite of a wide range of free-living and domestic ruminants. This “inter-continental traveller” represents a remarkable species due to its large spatial distribution, invasive character, and potential to colonize new territories. The molecular analysis (microsatellites and mtDNA) of dispersal routes of the native populations of parasite in North America revealed west-east and south-north lineages that partially overlapped in the central part of the continent, where different host populations historically met. The exact origin of introduced European populations of *F. magna* and their potential translocation routes were determined. A serial dilution of genetic diversity along the dispersion route across central and eastern Europe was observed. The results were correlated with past human-directed translocations and natural migration of the final cervid hosts of *F. magna*.

Triploidy associated with the asexual parthenogenic mode of reproduction was detected in another invasive parasite – *Atractolytocestus huronensis*, monozoic non-segmented tapeworm of cyprinid fishes. The tapeworm originates from China and was introduced along with its hosts to North America, Europe, and Afrika. It was detected that parthenogens localized in the margin of the distribution zones (North America and Europe) have better colonasing capacities that sexually reproducing diploids localized in the centre of the distribution (China).

• Pharmacology & treatment

New findings were obtained on the immunological regulation of the host-parasite relationship and the role of larval secretory and somatic molecules of the model tapeworm *Mesocestoides vogae*. The stage-specific expression of individual secretory and somatic antigens induced high levels of IgM antibodies involved in larval masking in the peritoneal cavity in contrast to higher levels of IgG antibodies in the serum. The dynamics of the occurrence and representation of individual phenotypes of myeloid cells (macrophages, dendritic cells, and granulocytes) in the peritoneal cavity and spleen of mice after oral infection and after the application of secretory products were described. Lymphocytes 14 days after infection were polarised to the Th2 type cytokine and subsequently to strongly suppressive Treg lymphocytes with reduced IFN-γ cytokine secretion and IL-10 overproduction in the chronic phase in correlation with the growing number of dividing larvae and their secretions. These reactions were accompanied by the rapid elevation of immature myeloid cells, which have activated genes for markers responsible for immunosuppression and fibrosis. In vitro experiments confirmed that molecules secreted by larvae can directly induce the accelerated production of immature myeloid cells and immunosuppression.

The mechanisms of action of commonly used anthelmintics (albendazole and praziquantel) on the immunopathology of infected hosts was described. The co-administration of flavonoid silymarin and the biological “transfer factor immodin” as adjuvants significantly modulated the effects of the drugs, leading to higher efficacy, the downregulation of fibrosis and oxidative stress, increased the production of antiparasitic IFNγ and IL-12 cytokines, normalised the concentration of IL-4, and suppressed the production of IL-10 and TGF-β cytokines (T regulatory response). Individual drugs affected the molecular profiles of larvae-secreted antigens and corresponding antibodies, indicating direct interference with specific molecular targets in parasites. In vitro epigenetic experiments on larvae and various immune cells were the first to indicate that anthelmintics could directly affect the transcription of genes regulating cytokine secretion and the polarisation of macrophages that contribute to Th2/T reg immunity.

A high prevalence (79%) of parasite resistance to benzimidazole anthelmintics was determined on 30 goat farms in Slovakia during the long-term survey, which pointed to the crucial situation in the control of gastrointestinal parasites of goats. *In vitro* tests were used to predict the efficacy of the deworming drug and to estimate the percentage of resistance alleles in a parasite population. This information can serve as a reliable marker for early diagnostics of anthelmintic resistance allowing breeders and farmers to change their deworming strategy to prevent the spread of resistant worms in the herd. IP SAS participated in the development of a meta-analysis that identified the main indicators and the future trajectory of the current spread of anthelmintic parasite resistance in Europe. The results of this analysis improved the implementation of sustainable control procedures. New strategic plan was developed for the practical application of commercial tests and diagnostic kits based on the experience and knowledge of parasitologists throughout Europe.

• Ecotoxicology & ecology

The Zemplín region in eastern Slovakia is one of the areas most heavily contaminated with polychlorinated biphenyls (PCBs), not only in Slovakia, but also globally. The water reservoir Zemplínska Šírava is one of the most important sites of these dangerous lipophilic substances, which bind to sediments and are then released and incorporated into the bodies of aquatic organisms, mainly fish. The long-term consumption of contaminated fish poses a large risk to human health, so their continual monitoring is necessary. Several studies in the last decade have investigated the possible use of fish parasites for biomonitoring aquatic pollution due to their ability to accumulate large amounts of contaminants in their bodies. The intestinal parasite *Caryophyllaeus laticeps* (a monozoic, unsegmented tapeworm) and the cyprinid fish the common bream (*Abramis brama*) were studied as a parasite-host model of the accumulation of PCBs in the Zemplínska Šírava reservoir. High levels of PCBs in the intestine, hepatopancreas (liver), and muscle were

measured in the fish, indicating the persistent unsuitability of fish consumption in this locality. The ability of cestodes to accumulate substantially higher amounts of PCBs in comparison to fish organs was also confirmed for the first time. Cestodes are more sensitive than their fish hosts to pollutants in aquatic environments, so these parasites could be used as bioindicators, even at lower levels of pollution. From a medical point of view, the early detection of contaminants in the environment is extremely important for preventing the negative effects of PCBs on human health.

Healthy soils are essential for sustainable productivity, environmental quality, and the health of plants, animals, and humans. The assessment of soil health is essential for improving our knowledge about soil ecosystems and for a better understanding of the interactions amongst below- and aboveground components. Free-living soil and plant parasitic nematodes are effective bioindicators of soil disturbances and contamination. Soil nematode communities in grasslands and their accumulation of heavy metals were investigated in four industrial areas in eastern Slovakia. The differences in the behavioural reactions of nematodes to different quantities of selected heavy metals (As, Cd, Cr, Cu Ni, Pb, and Zn) in soil were studied. Individual nematode genera were differentiated into several clusters by their tolerance/intolerance to specific heavy metals. The nematode genera *Bitylenchus*, *Cephalobus*, *Dorylaimus*, *Eudorylaimus*, *Geocenamus, Pratylenchus*, *Protorhabditis*, *Rhabditis*, *Teratocephalous*, and *Trypila* were detected as suitable bioindicators of specific soil pollutants.

The spread of invasive plant species has limitless opportunities due to the global marketing and transportation of goods. Invasive plant species occupy new areas, create new types of habitats, and rapidly alter the original ecosystems. The effects of the invasive plants *Heracleum sosnowskyi* and *Reynoutria japonica* on selected soil microbial properties, plant communities, and the taxonomic and trophic composition of soil nematode communities were studied in two ecosystems (forest and grassland). Invasion by *H. sosnowskyi* into both habitats strongly affected the nematode communities but had a smaller effect on soil microbial activity. The changes in the nematode communities under the influence of *H. sosnowskyi* were mainly represented by stress-sensitive omnivores and herbivores. Invasion by *R. japonica* in urban areas of Tatra National Park negatively affected the native plant communities and the structure of soil nematode communities. The impact of *R. japonica* indicated a persistent disturbance of the ecosystem and soil food webs in comparison to uninvaded control plots. Nematode abundance and biomass were generally substantially lower in invaded than uninvaded plots. Dense stands of *R. japonica* may have simplified the structural complexity of the soil environment by reducing the richness of plant species, which may have contributed to lower species numbers and the abundance of all nematode trophic groups.

Public concerns about the negative effect of genetically modified plants (GMPs) on agroecosystems are widespread in Europe. Transgenic maize producing the insecticidal crystal protein (Cry1Ab) from *Bacillus thuringiensis* (*Bt*) is poisonous to lepidopterans, including the European Corn Borer (*Ostrinia nubilalis*). The commercial cultivation of *Bt* maize is thus not allowed in many European countries due to the potential variation of the environmental risk across biogeographical regions. Baseline data on nematode diversity in agro-ecosystems was provided in four European countries (Slovakia, Spain, Denmark, and Sweden) to improve our understanding of the potential long-term environmental effects of GMPs on nematode communities. Bacterial feeders such as root-fungal and fungal feeders were the dominant nematode genera in the maize fields. A large effect of the location of field sites on total nematode abundance, nematode abundance in trophic groups, the diversity of nematode genera, and ecological and functional nematode indices was detected. The impact of the location of a field site and interannual variation in the composition of the soil nematode community was larger than the impact of *Bt* maize cultivation.

2.1.9. Table of research outputs 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	2016			2017			2018			2019			2020			2021			total			
	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. / one million total salary budget	number	No. / FTE researches	No. /1 million total salary budget	number	averaged number per year	av. No. / FTE researches	av. No. / one million total salary budget
Scientific monographs and monographic studies in journals and proceedings published abroad *(AAA, ABA)*	1	0.034	1.333	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	**1**	**0.167**	**0.006**	**0.178**
Scientific monographs and monographic studies in journals and proceedings published in Slovakia *(AAB, ABB)*	0	0.000	0.000	0	0.000	0.000	1	0.037	1.167	1	0.035	0.983	0	0.000	0.000	0	0.000	0.000	**2**	**0.333**	**0.012**	**0.356**
Chapters in scientific monographs published abroad *(ABC)*	2	0.068	2.667	2	0.083	2.574	**3**	0.111	3.501	0	0.000	0.000	1	0.032	0.907	0	0.000	0.000	**8**	**1.333**	**0.047**	**1.425**
Chapters in scientific monographs published in Slovakia *(ABD)*	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	**0**	**0.000**	**0.000**	**0.000**
Scientific papers published in journals registered in Current Contents Connect *(ADCA, ADCB, ADDA, ADDB)*	33	1.125	44.000	38	1.579	48.906	55	2.035	64.177	32	1.132	31.465	54	1.727	48.957	52	1.622	46.889	**264**	**44.000**	**1.535**	**47.034**
Scientific papers published in journals registered in Web of Science Core Collection and SCOPUS not listed above *(ADMA, ADMB, ADNA, ADNB)*	5	0.170	6.667	7	0.291	9.009	17	0.629	19.837	8	0.283	7.866	19	0.608	17.226	18	0.561	16.231	**74**	**12.333**	**0.430**	**13.184**
Scientific papers published in other foreign journals (not listed above) *(ADEA, ADEB)*	0	0.000	0.000	1	0.042	1.287	0	0.000	0.000	3	0.106	2.950	0	0.000	0.000	0	0.000	0.000	**4**	**0.667**	**0.023**	**0.713**
Scientific papers published in other domestic journals (not listed above) *(ADFA, ADFB)*	11	0.375	14.667	16	0.665	20.592	6	0.222	7.001	12	0.424	11.799	9	0.288	8.160	8	0.250	7.214	**62**	**10.333**	**0.360**	**11.046**
Scientific papers published in foreign peer-reviewed proceedings *(AECA)*	1	0.034	1.333	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	0	0.000	0.000	**1**	**0.167**	**0.006**	**0.178**
Scientific papers published in domestic peer-reviewed proceedings *(AEDA)*	1	0.034	1.333	0	0.000	0.000	1	0.037	1.167	1	0.035	0.983	0	0.000	0.000	0	0.000	0.000	**3**	**0.500**	**0.017**	**0.534**
Published papers (full text) from foreign scientific conferences *(AFA, AFC)*	1	0.034	1.333	2	0.083	2.574	3	0.111	3.501	4	0.141	3.933	1	0.032	0.907	2	0.062	1.803	**13**	**2.167**	**0.076**	**2.316**
Published papers (full text) from domestic scientific conferences *(AFB, AFD)*	18	0.614	24.000	16	0.665	20.592	14	0.518	16.336	4	0.141	3.933	3	0.096	2.720	8	0	7	**63**	**11**	**0**	**11**

2.2. Measures of research outputs (citations, etc.)

2.2.1. Table with citations per annum (without self-citations)

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) are listed separately

Citations, reviews	2015		2016		2017		2018		2019		2020		total		
	number	No. / FTE researchers	number	No. / FTE researchers	number	No. / FTE researchers	number	No. / FTE researchers	number	No. / FTE researchers	number	No. / FTE researchers	number	averaged number per year	av. No. / FTE researchers
Citations in Web of Science Core Collection (1.1, 2.1)	549	18.72	616	25.60	726	26.86	646	22.84	824	26.35	1 011	31.53	**4 372**	**728.67**	**25.41**
Citations in SCOPUS (1.2, 2.2) if not listed above	89	3.03	70	2.91	85	3.14	55	1.94	112	3.58	129	4.02	**540**	**90.00**	**3.14**
Citations in other citation indexes and databases (not listed above) (3.2,4.2)	11	0.38	6	0.25	8	0.30	14	0.50	14	0.45	21	0.66	**74**	**12.33**	**0.43**
Other citations (not listed above) (3.1, 4.1)	62	2.11	65	2.70	60	2.22	64	2.26	40	1.28	35	1.09	**326**	**54.33**	**1.90**
Reviews (5,6)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	0.06	**2**	**0.33**	**0.01**

2.2.2. List of 10 most-cited publications published any time with the address of the institute, with number of citations in the assessment period (2015 – 2020)

[**1**] DEPLAZES, Peter** - RINALDI, Laura - ALVAREZ ROJAS, Cristian A. - TORGERSON, Paul R. - HARANDI, Majid Fasihi - ROMIG, Thomas - ANTOLOVÁ, Daniela - SCHURER, Jana M. - LAHMAR, Samia - GRINGOLI, Guiseppe - MAGAMBO, Japhet K. - THOMPSON, Andrew - JENKINS, Emily J. Global distribution of alveolar and cystic echinococcosis. In *Echinococcus and Echinococcosis*. 1st edition, Elsevier L.t.d. Academic Press, the Netherlands, 2017, pp. 315-493. ISBN 978-0-12-811471-1. https://doi.org/10.1016/bs.apar.2016.11.001
No. of citations: 241

[**2**] 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, art. no. 1, 11 pp. (2012: 3.246 - IF, Q1 - JCR, 1.224 - SJR, Q1 - SJR). ISSN 1756-3305. https://doi.org/10.1186/1756-3305-6-1
No. of citations: 212

[**3**] KENYON, Fiona** - GREER, A.W. - COLES, Gerald - CRINGOLI, Giuseppe - PAPADOPOULOS, Elias - CABARET, Jacques - BERRAG, Boumadiane - VÁRADY, Marián - VAN WYK, Jan - THOMAS, Eurion - VERCRUYSSE, Jozef - JACKSON, Frank. The role of targeted selective treatments in the development of refugia-based approaches to the control of gastrointestinal nematodes of small ruminants. In *Veterinary Parasitology*, 2009, vol. 164, no. 1, p. 3-11. (2008: 2.039 - IF, Q1 - JCR, 1.117 - SJR, Q1 - SJR). ISSN 0304-4017. https://doi.org/10.1016/j.vetpar.2009.04.015
No. of citations: 78

[**4**] LI, N. - XIAO, Lihua - ALDERISIO, Keri - ELWIN, Kristin - CEBELINSKI, Elizabeth - CHALMERS, R.A - SANTIN, Monica - FAYER, Ronald - KVAC, Martin - RYAN, Una - STANKO, Michal - GUO, Yaqiong - WANG, Lin - ZHANG, Longxian - CAI, Jinzhong - ROELLIG, Dawn - FENG, Yaoyu**. Subtyping *Cryptosporidium ubiquitum*, a Zoonotic Pathogen Emerging in Humans. In *Emerging Infectious Diseases*, 2014, vol. 20, no. 2, p. 217-224. (2013: 7.327 - IF, Q1 - JCR, 3.190 - SJR, Q1 - SJR). ISSN 1080-6040. https://doi.org/10.3201/eid2002.121797
No. of citations: 49

[**5**] TARAGEĽOVÁ, Veronika** - KOČI, Juraj - HANINCOVÁ, Klára - KURTENBACH, K. - DERDÁKOVÁ, Markéta - OGDEN, Nick H. - LITERÁK, I. - KOCIANOVÁ, Elena - LABUDA, Milan. Blackbirds and song thrushes constitute a key reservoir of *Borrelia garinii*, the causative agent of Borreliosis in Central Europe. In *Applied and Environmental Microbiology*, 2008, vol. 74, no. 4, p. 1289-1293. (2007: 4.004 - IF, Q1 - JCR, 2.036 - SJR, Q1 - SJR). ISSN 0099-2240. https://doi.org/10.1128/AEM.01060-07
No. of citations: 47

[**6**] CANARD, F.E.** - MOUQUET, N. - MOUILLOT, D. - STANKO, Michal - MIKLISOVÁ, Dana - GRAVEL, D. Empirical evaluation of neutral interactions in host-parasite networks. In *The American Naturalist*, 2014, vol. 183, no. 4, p. 468-479. (2013: 4.454 - IF, Q1 - JCR, 3.173 - SJR, Q1 - SJR). ISSN 0003-0147. https://doi.org/10.1086/675363
No. of citations: 45

[**7**] BUSI, Marina - ŠNÁBEL, Viliam - VARCASIA, Antonio - GARIPPA, Giovanni - PERRONE, Vitantonio - DE LIBERATO, Claudio - D'AMELIO, Stefano**. Genetic variation within and between G1 and G3 genotypes of *Echinococcus granulosus* in Italy revealed by multilocus DNA sequencing. In *Veterinary Parasitology*, 2007, vol. 150, no. 1-2, p. 75-83. (2006: 1.900 - IF, Q1 - JCR, 0.932 - SJR, Q1 - SJR). ISSN 0304-4017. https://doi.org/10.1016/j.vetpar.2007.09.003
No. of citations: 42

[**8**] ŠNÁBEL, Viliam** - ALTINTAS, Nazmiye - D'AMELIO, S. - NAKAO, M. - ROMIG, T. - YOLASIGMAZ, A. - GUNES, K. - TURK, M. - BUSI, M. - HUTTNER, M. - ŠEVCOVÁ, Danica - ITO, A. - ALTINTAS, N. - DUBINSKÝ, Pavol. Cystic echinococcosis in Turkey: genetic variability and first record of the pig strain (G7) in the country. In *Parasitology Research*, 2009, vol. 105, no. 1, p. 145-154. (2008: 1.473 - IF, Q3 - JCR, 0.701 - SJR, Q1 - SJR). ISSN 0932-0113. https://doi.org/10.1007/s00436-009-1376-2
No. of citations: 42

[**9**] DERDÁKOVÁ, Markéta** - VÁCLAV, Radovan - PANGRÁCOVÁ-BLAŇAROVÁ, Lucia - SELYEMOVÁ, Diana - KOČI, Juraj - WALDER, G. - ŠPITÁLSKA, Eva. *Candidatus* Neoehrlichia mikurensis and its co-circulation with *Anaplasma phagocytophilum* in *Ixodes ricinus* ticks across ecologically different habitats of Central Europe. In *Parasites & vectors*, 2014, vol. 7, art. no. 160. (2013: 3.251 - IF, Q1 - JCR, 1.541 - SJR, Q1 - SJR). ISSN 1756-3305. https://doi.org/10.1186/1756-3305-7-160
No. of citations: 41

[**10**] VON SAMSON-HIMMELSTJERNA, Georg** - COLES, Gerald - JACKSON, Frank - BAUER, Christian - BORGSTEEDE, Fred - CIRAK, Veli Y. - DEMELER, Janina - DONNAN, Alison - DORNY, Peirre - EPE, Christian - HARDER, Achim - HOGLUND, Johan - KAMINSKY, Ronal - KERBOEUF, Dominique - KUETLER, Ulla - PAPADOPOULOS, Elias - POSEDI, Janez - SMALL, John - VÁRADY, Marián - VERCRUYSSE, Jozef - WIRTHERLE, Nicole. Standardization of the egg hatch test for the detection of benzimidazole resistance in parasitic nematodes. In *Parasitology Research*, 2009, vol. 105, no. 3, p. 825-834. (2008: 1.473 - IF, Q3 - JCR, 0.701 - SJR, Q1 - SJR). ISSN 0932-0113. https://doi.org/10.1007/s00436-009-1466-1
No. of citations: 39

2.2.3. List of 10 most-cited publications published any time with the address of the institute, with number of citations obtained until 2020

[**1**] 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, art. no. 1, 11 pp. (2012: 3.246 - IF, Q1 - JCR, 1.224 - SJR, Q1 - SJR). ISSN 1756-3305. https://doi.org/10.1186/1756-3305-6-1
No. of citations: 253

[**2**] DEPLAZES, Peter** - RINALDI, Laura - ALVAREZ ROJAS, Cristian A. - TORGERSON, Paul R. - HARANDI, Majid Fasihi - ROMIG, Thomas - ANTOLOVÁ, Daniela - SCHURER, Jana M. - LAHMAR, Samia - GRINGOLI, Guiseppe - MAGAMBO, Japhet K. - THOMPSON, Andrew - JENKINS, Emily J. Global distribution of alveolar and cystic echinococcosis. In *Echinococcus and Echinococcosis*. 1st edition, Elsevier L.t.d. Academic Press, the Netherlands, 2017, pp. 315-493. ISBN 978-0-12-811471-1. https://doi.org/10.1016/bs.apar.2016.11.001
No. of citations: 241

[**3**] KENYON, Fiona** - GREER, A.W. - COLES, Gerald - CRINGOLI, Giuseppe - PAPADOPOULOS, Elias - CABARET, Jacques - BERRAG, Boumadiane - VÁRADY, Marián - VAN WYK, Jan - THOMAS, Eurion - VERCRUYSSE, Jozef - JACKSON, Frank. The role of targeted selective treatments in the development of refugia-based approaches to the control of gastrointestinal nematodes of small ruminants. In *Veterinary Parasitology*, 2009, vol. 164, no. 1, p. 3-11. (2008: 2.039 - IF, Q1 - JCR, 1.117 - SJR, Q1 - SJR). ISSN 0304-4017. https://doi.org/10.1016/j.vetpar.2009.04.015
No. of citations: 140

[**4**] TARAGEĽOVÁ, Veronika** - KOČI, Juraj - HANINCOVÁ, Klára - KURTENBACH, K. - DERDÁKOVÁ, Markéta - OGDEN, Nick H. - LITERÁK, I. - KOCIANOVÁ, Elena - LABUDA, Milan. Blackbirds and song thrushes constitute a key reservoir of *Borrelia garinii*, the causative agent of Borreliosis in Central Europe. In *Applied and Environmental Microbiology*, 2008, vol. 74, no. 4, p. 1289-1293. (2007: 4.004 - IF, Q1 - JCR, 2.036 - SJR, Q1 - SJR). ISSN 0099-2240. https://doi.org/10.1128/AEM.01060-07

No. of citations: 93

[**5**] BUSI, Marina - ŠNÁBEL, Viliam - VARCASIA, Antonio - GARIPPA, Giovanni - PERRONE, Vitantonio - DE LIBERATO, Claudio - D'AMELIO, Stefano**. Genetic variation within and between G1 and G3 genotypes of *Echinococcus granulosus* in Italy revealed by multilocus DNA sequencing. In *Veterinary Parasitology*, 2007, vol. 150, no. 1-2, p. 75-83. (2006: 1.900 - IF, Q1 - JCR, 0.932 - SJR, Q1 - SJR). ISSN 0304-4017. https://doi.org/10.1016/j.vetpar.2007.09.003
No. of citations: 89

[**6**] DERDÁKOVÁ, Markéta** - BEATI, L. - PEŤKO, Branislav - STANKO, Michal - FISH, D. Genetic variability within *Borrelia burgdorferi* sensu lato genospecies established by PCR-single-strand conformation polymorphism analysis of the rrfA-rrlB intergenic spacer in *Ixodes ricinus* ticks from the Czech Republic. In *Applied and Environmental Microbiology*, 2003, vol. 69, no. 1, p. 509-516. (2002: 3.691 – IF, Q1 – JCR, 2.062 – SJR, Q1 – SJR). ISSN 0099-2240. https://doi.org/10.1128/AEM.69.1.509-516.2003
No. of citations: 83

[**7**] ŠNÁBEL, Viliam** - ALTINTAS, Nazmiye - D'AMELIO, S. - NAKAO, M. - ROMIG, T. - YOLASIGMAZ, A. - GUNES, K. - TURK, M. - BUSI, M. - HUTTNER, M. - ŠEVCOVÁ, Danica - ITO, A. - ALTINTAS, N. - DUBINSKÝ, Pavol. Cystic echinococcosis in Turkey: genetic variability and first record of the pig strain (G7) in the country. In *Parasitology Research*, 2009, vol. 105, no. 1, p. 145-154. (2008: 1.473 - IF, Q3 - JCR, 0.701 - SJR, Q1 - SJR). ISSN 0932-0113. https://doi.org/10.1007/s00436-009-1376-2
No. of citations: 83

[**8**] LUKEŠ, Július - JIRKŮ, Milan - DOLEŽEL, David. - KRÁĽOVÁ, Ivica - HOLLAR, Laura - MASLOV, Dmitrij**. Analysis of ribosomal RNA genes suggests that trypanosomes are monophyletic. In *Journal of Molecular Evolution*, 1997, vol. 44, no. 5, p. 521-527. (1996: 3.052 – IF, Q1 – JCR). ISSN 0022-2844. https://doi.org/10.1007/PL00006176
No. of citations: 76

[**9**] DUBINSKÝ, Pavol** - HAVASIOVÁ-REITEROVÁ, Katarína - PEŤKO, Branislav - HOVORKA, Ivan - TOMAŠOVIČOVÁ, Oľga. Role of small mammals in the epidemiology of Toxocariasis. In *Parasitology*, 1995, vol. 110, no. 2, p. 187-193. (1994: 1.836 – IF). ISSN 0031-1820.
No. of citations: 74

[**10**] BULLOVÁ, Eva** - LUKÁŇ, Martin - STANKO, Michal - PEŤKO, Branislav. Spatial distribution of *Dermacentor reticulatus* tick in Slovakia in the beginning of the 21st century. In *Veterinary Parasitology*, 2009, vol. 165, no. 3-4, p. 357-360. (2008: 2.039 - IF, Q1 - JCR, 1.117 - SJR, Q1 - SJR). ISSN 0304-4017. https://doi.org/10.1016/j.vetpar.2009.07.023
No. of citations: 68

2.2.4. List of 10 most-cited publications published during the evaluation period (2016-2021) with the address of the Institute, with number of citations obtained until 2021

[**1**] DEPLAZES, Peter** - RINALDI, Laura - ALVAREZ ROJAS, Cristian A. - TORGERSON, Paul R. - HARANDI, Majid Fasihi - ROMIG, Thomas - ANTOLOVÁ, Daniela - SCHURER, Jana M. - LAHMAR, Samia - GRINGOLI, Guiseppe - MAGAMBO, Japhet K. - THOMPSON, Andrew - JENKINS, Emily J. Global distribution of alveolar and cystic echinococcosis. In *Echinococcus and Echinococcosis*. 1st edition, Elsevier L.t.d. Academic Press, the Netherlands, **2017**, pp. 315-493. ISBN 978-0-12-811471-1. https://doi.org/10.1016/bs.apar.2016.11.001
No. of citations: 356

[**2**] BOUWKNEGT, M.** - DEVLEESSCHAUWER, B. - GRAHAM, Heather - ROBERTSON, L. - VAN DER GIESSEN, J. - AKKARI, Hafid - BANU, Teofilia - CAKIR KOC, Rabia - CHALMERS, Rachel - CRETU, C. - DEKSNE, G. - DJURKOVIC-DJAKOVIC, O. - DORNY, P. - DVOROŽŇÁKOVÁ, Emília - ENEMARK, Heidi L. - GERARD, Cedric - GOMEZ MORALES, Maria Angeles - JURHAR PAVLOVA, Maja - KAPEL, Christian - KORTBEEK, Titia - KUCSERA, István - LASSEN, Brian - PETROVIČ, Jelena - RIEHN, Katharina - RODRIGUEZ-LAZARO, David - ROZYCKI,

Miroslaw - SLANY, Michal - STEFANOVSKA, Jovana - SVIBEN, Mario - STOJECKI, Krzysztof - SOTIRAKI, Smaragda - TREVISAN, Chiara - TROELL, Karin - UZELAC, Alexandra - VALLEE, Isabelle - VANTARAKIS, Apostolos - VASILEV, Sasa - VUTOVA, Kamenna - DE WAAL, T. Prioritisation of food-borne parasites in Europe, 2016. In *Eurosurveillance*, **2018**, vol. 23, no. 9, art. no. 17-00161. (2017: 7.127 - IF, Q1 - JCR, 3.727 - SJR, Q1 - SJR). ISSN 1560-7917. https://doi.org/10.2807/1560-7917.ES.2018.23.9.17-00161
No. of citations: 50

[**3**] SASÁKOVÁ, N.** - GREGOVÁ, Gabriela - TAKÁČOVÁ, Daniela - MOJŽIŠOVÁ, Jana - PAPAJOVÁ, Ingrid - VENGLOVSKÝ, Ján - SZABÓOVÁ, Tatiana - KOVÁČOVÁ, Simona. Pollution of surface and ground water by sources related to agricultural activities. In *Frontiers in Sustainable Food Systems*, **2018**, vol. 2, art. 42. ISSN 2571-581X. https://doi.org/10.3389/fsufs.2018.00042
No. of citations: 34

[**4**] KINKAR, Liina - LAURIMÄE, Teivi - ACOSTA-JAMETT, Gerardo - ANDRESIUK, Vanessa - BALKAYA, Ibrahim - CASULLI, Adriano - GASSER, Robin B - VAN DER GIESSEN, Joke - GONZÁLES, Luis Miquel - HAAG, Karen L. - ZAIT, Houria - IRSHADULLAH, Malik - JABBAR, Abdul - JENKINS, David J. - KIA, Eshrat Beigom - MANFREDI, Maria Teresa - MIRHENDI, Hossein - M'RAD, Selim - ROSTAMI-NEJAD, Mohammad - OUDNI-M'RAD, Myriam - PIERANGELI, Nora Beatriz - PONCE-GORDO, Francisco - REHBEIN, Steffen - SHARBATKHORI, Mitra - SIMSEK, Sami - SORIANO, Silvia Viviana - SPRONG, Hein - ŠNÁBEL, Viliam - UMHANG, Gérald - VARCASIA, Antonio - SAARMA, Urmas**. Global phylogeography and genetic diversity of the zoonotic tapeworm *Echinococcus granulosus* sensu stricto genotype G1. In *International Journal for Parasitology*, **2018**, vol. 48, no. 9-10, p. 729-742. (2017: 3.078 - IF, Q1 - JCR, 1.638 - SJR, Q1 - SJR). ISSN 0020-7519. https://doi.org/10.1016/j.ijpara.2018.03.006
No. of citations: 31

[**5**] ČONDLOVÁ, Šárka - HORČIČKOVÁ, Michaela - SAK, Bohumil - KVĚTONOVÁ, Dana - HLÁSKOVÁ, Lenka - KONEČNÝ, Roman - STANKO, Michal - MCEVOY, John - KVÁČ, M.**. *Cryptosporidium apodemi* sp. n. and *Cryptosporidium ditrichi* sp. n. (Apicomplexa: Cryptosporidiidae) in *Apodemus* spp. In *European journal of Protistology*, **2018**, vol. 63, p. 1-12. (2017: 2.430 - IF, Q3 - JCR, 0.897 - SJR, Q2 - SJR). ISSN 0932-4739. https://doi.org/10.1016/j.ejop.2017.12.006
No. of citations: 30

[**6**] KOŠČOVÁ, J.** - HURNÍKOVÁ, Zuzana - PISTL, J. Degree of Bacterial Contamination of Mobile Phone and Computer Keyboard Surfaces and Efficacy of Disinfection with Chlorhexidine Digluconate and Triclosan to Its Reduction. In *International Journal of Environmental Research and Public Health*, **2018**, vol. 15, no. 10, art. no. 2238. (2017: 2.145 - IF, Q2 - JCR, 0.735 - SJR, Q2 - SJR). ISSN 1660-4601. https://doi.org/10.3390/ijerph15102238
No. of citations: 30

[**7**] LAURIMÄE, Teivi - KINKAR, Liina - ROMIG, Thomas - OMER, Rihab A. - CASULLI, Adriano - UMHANG, Gérald - GASSER, Robin B - JABBAR, Abdul - SHARBATKHORI, Mitra - MIRHENDI, Hossein - PONCE-GORDO, Francisco - LAZZARINI, Lorena E. - SORIANO, Silvia Viviana - VARCASIA, Antonio - ROSTAMI-NEJAD, Mohammad - ANDRESIUK, Vanessa - MARAVILLA, Pablo - GONZÁLES, Luis Miquel - DYBICZ, Monika - GAWOR, Jakub - ŠARKÜNAS, Mindaugas - ŠNÁBEL, Viliam - KUZMINA, Tetiana - SAARMA, Urmas**. The benefits of analysing complete mitochondrial genomes: Deep insights into the phylogeny and population structure of *Echinococcus granulosus* sensu lato genotypes G6 and G7. In *Infection Genetics and Evolution*, **2018**, vol. 64, p. 85-94. (2017: 2.545 - IF, Q3 - JCR, 1.278 - SJR, Q1 - SJR). ISSN 1567-1348. https://doi.org/10.1016/j.meegid.2018.06.016
No. of citations: 24

[**8**] DVOROŽŇÁKOVÁ, Emília** - BUCKOVÁ, Barbora - HURNÍKOVÁ, Zuzana - REVAJOVÁ, Viera - LAUKOVÁ, Andrea. Effect of probiotic bacteria on phagocytosis and respiratory burst activity of blood polymorphonuclear leukocytes (PMNL) in mice infected with *Trichinella spiralis*. In *Veterinary Parasitology:*

Special Issue: 14th International Conference on Trichinellosis, **2016**, vol. 231, p. 69-76. (2015: 2.242 - IF, Q1 - JCR, 1.210 - SJR, Q1 - SJR). ISSN 0304-4017. https://doi.org/10.1016/j.vetpar.2016.07.004
No. of citations: 22

[**9**] DIDYK, Yuliya - BLAŇAROVÁ, Lucia - POGREBNIAK, S.G. - AKIMOV, I. - PEŤKO, Branislav - VÍCHOVÁ, Bronislava**. Emergence of tick-borne pathogens (*Borrelia burgdorferi* sensu lato, *Anaplasma phagocytophilum, Ricketsia raoultii* and *Babesia microti*) in the Kyiv urban parks, Ukraine. In *Ticks and Tick-Borne Diseases*, **2017**, vol. 8, no. 2, p. 219–225. (2016: 3.230 - IF, Q1 - JCR, 1.308 - SJR, Q1 - SJR). ISSN 1877-959X. https://doi.org/10.1016/j.ttbdis.2016.10.002
No. of citations: 22

[**10**] KINKAR, Liina - LAURIMÄE, Teivi - ACOSTA-JAMETT, Gerardo - ANDRESIUK, Vanessa - BALKAYA, Ibrahim - CASULLI, Adriano - GASSER, Robin B - GONZÁLES, Luis Miquel - HAAG, Karen L. - ZAIT, Houria - IRSHADULLAH, Malik - JABBAR, Abdul - JENKINS, David J. - MANFREDI, Maria Teresa - MIRHENDI, Hossein - M'RAD, Selim - ROSTAMI-NEJAD, Mohammad - OUDNI-M'RAD, Myriam - PIERANGELI, Nora Beatriz - PONCE-GORDO, Francisco - REHBEIN, Steffen - SHARBATKHORI, Mitra - KIA, Eshrat Beigom - SIMSEK, Sami - SORIANO, Silvia Viviana - SPRONG, Hein - ŠNÁBEL, Viliam - UMHANG, Gérald - VARCASIA, Antonio - SAARMA, Urmas**. Distinguishing *Echinococcus granulosus* sensu stricto genotypes G1 and G3 with confidence: A practical guide. In *Infection, Genetics and Evolution*, **2018**, vol. 64, p. 178-184. (2017: 2.545 - IF, Q3 - JCR, 1.278 - SJR, Q1 - SJR). ISSN 1567-1348. https://doi.org/10.1016/j.meegid.2018.06.026
No. of citations: 21

2.2.5. List of most-cited authors from the Institute (at most 10 % of average FTE researchers per year) and their number of citations in the assessment period (2015– 2020). The cited papers must bear the address of the institute

*Note: average FTE researchers per year – **34.05**; 10% – **3.4***

[**1**] STANKO, Michal – no. of citations: 703
[**2**] ANTOLOVÁ, Daniela – no. of citations: 540
[**3**] VÁRADY, Marián – no. of citations: 509
[**4**] DUBINSKÝ, Pavol – no. of citations: 488

2.2.6. List of most-cited authors from the Institute (at most 10 % of average FTE researchers per year) and their number of citations obtained until 2020. The cited papers must bear the address of the Institute

[**1**] DUBINSKÝ, Pavol – no. of citations: 1,475
[**2**] VÁRADY, Marián – no. of citations: 1,119
[**3**] STANKO, Michal – no. of citations: 1,040
[**4**] PEŤKO, Branislav – no. of citations: 1,016

2.2.7. List of most-cited authors from the Institute (at most 10 % of average FTE researchers per year) and their number of citations obtained until 2021 of their papers published during the evaluation period (2016– 2021). The cited papers must bear the address of the Institute

[**1**] ANTOLOVÁ, Daniela – no. of citations: 435
[**2**] STANKO, Michal – no. of citations: 212
[**3**] VÍCHOVÁ, Bronislava – no. of citations: 177
[**4**] HURNÍKOVÁ, Zuzana – no. of citations: 174

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

- **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 for institute with less than 50 average FTE researchers per year, max. 20 for institutes with 50 – 100 average FTE researchers per year and so on

[**1**] IP SAS participated in five **COST** (European Cooperation in Science and Technology) projects (see details in section 2.4.) covering five network activities:

- Taeniosis/Cysticercosis
- Neglected Vectors and Vector-Borne Infections
- Foodborne Parasites
- Exploratory Research on Myeloid Regulatory Cells
- Combatting Anthelmintic Resistance in Ruminants.

[**2**] IP SAS is a subcontractor of the **BiodivERsA** project (grant scheme ERA-NET; see details in section 2.4.) entitled "*Relationships between functional diversity and food production and quality under ecological intensification".* The project is aimed at the study of the functional diversity of biotic communities relevant to the links between ecological intensification, biodiversity, pollination, pest control, and food production. The aims of the project are to:

- link existing databases of the species composition of animal communities with databases of functional traits
- analyse the effect of practices of ecological intensification on metrics of functional diversity
- develop models that link functional diversity to pollination, pest-control services, and crop plant health.

[**3**] The researchers of IP SAS are members of the following international groups of specialists:

- **European Food Safety Authority**, whose work is undertaken under requests from the European Commission, the European Parliament, and European Union (EU) member states.
- **International Commission on Trichinellosis**, a member of the World Federation of Parasitologists. The commission cooperates with national and international organisations (e.g. the World Health Organization (WHO), the World Organisation for Animal Health (OIE), and the Food and Agriculture Organization (FAO)) for the control and prevention of trichinellosis, a serious zoonotic human infection.
- **EurEchino Network,** which is creating a comprehensive database on human patients diagnosed with life-threatening alveolar echinococcosis.

[**4**] IP SAS had a subcontract with the **Swiss Tropical and Public Health Institute**, **Basel, Switzerland** entitled "*A survey on intestinal parasites prevalence in semi-nomadic population in Slovakia*". The research was funded by **WHO** (reg. no. 2018/842184-0).

[**5**] IP SAS had a contract with **BAYER AG** (Elanco Animal Health Corporation), **Prague, Czech Republic,** on the project "*Epidemiological research on canine dirofilariosis in the Czech Republic and Slovakia*". The research was sponsored by BAYER.

[**6**] IP SAS had a contract with **Austin Davis Biologics Ltd**., **London, UK,** on the project "Anoplocephala *spp. and Cyathostominae testing in horses*" sponsored by Austin Davis Biologics Ltd.

[**7**] IP SAS cooperated with the **Institute of Parasitology, University of Zürich, Switzerland**, on the study "*Sensitivity and specificity of serological ELISA tests for the detection of specific antibodies to filarial nematodes in human sera*". The study aimed to establish and standardise serological methods with sufficient sensitivity and specificity to identify specific antibodies to filarial infection in human sera.

[**8**] International collaboration with the Faculty of Environmental Sciences and Natural Resource Management, **Norwegian University of Life Sciences, Aas, Norway**, focused on the study of:
- the effect of the complexity of the food web on the community structure, decomposition, and production of wood mould in tree hollows
- the effects of long-term N, P, and K treatments of coniferous forests on the community structure of soil nematode communities
- the structure of nematode communities in Norwegian grassland and steppes along an elevational gradient.

[**9**] International collaboration with the **Institute for Sustainable Plant Protection, National Research Council, Bari, Italy**, aimed at identifying the effects of granular or liquid organic materials applied against important plant parasitic nematode species of the genera *Xiphinema* and *Longidorus* in organic vineyards in Italy and on communities of soil free-living nematodes and other species of plant parasitic nematodes.

[**10**] ANTOLOVÁ, Daniela, an expert in the field, was invited by the WHO to participate in the OIE/WHO Sub-regional Workshop on Echinococcosis in Bishkek, Kyrgyzstan, on December 10-11, 2019.

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

[**1**] 12th Czech and Slovak Parasitological Days, Ledeč nad Sázavou, Czech Republic, May 16-20, 2016 (co-organiser)

[**2**] 23rd Helminthological Days, Duchonka, Slovakia, May 8-12, 2017 (**organiser**)

[**3**] 13th Slovak and Czech Parasitological Days – Parasites in the Heart of Europe 2, Košice, Slovakia, May 21-25, 2018 (**organiser**)

[**4**] 9th Acanthocephalan Workshop, Stará Lesná, Slovakia, September 9-13, 2018 (**organiser**)

[**5**] 5th Labuda Days, Smolenice, Slovakia, September 12-14, 2018 (co-organiser)

[**6**] 6th Infectious and Parasitic Diseases of the Animals, Košice, Slovakia, September 13-14, 2018 (co-organiser)

2.3.3. List of edited proceedings from international scientific conferences

[**1**] 23rd Helminthological Days, May 8-12, 2017, Duchonka, Slovakia. Progamme & Abstracts. OROSOVÁ, Martina and ŠPAKULOVÁ, Marta (editors). Košice, Slovak Parasitological Society at SAS, 2017, 68 pp, ISBN 978-80-968473-8-9

[**2**] 13th Slovak and Czech Parasitological Days – Parasites in the Heart of Europe 2, May 21-25, 2018, Košice, Slovakia. Book of Abstracts. MITERPÁKOVÁ, Martina and VASILKOVÁ, Zuzana (editors). Košice, Slovak Society for Parasitology at SAS, 2018, 107 pp, ISBN 978-80-968473-9-6

2.3.4. List of journals edited/published by the institute and information on their indexing in WOS, SCOPUS, other database or no database, incl. impact factor and other metrics of journals in each year of the assessment period

HELMINTHOLOGIA, ISSN 0440-6605 (Print), eISSN 1336-9083 (Electronic), *h*-index 28

Copyright and ownership: IP SAS
Publisher: DE GRUYTER OPEN, Warsaw, Poland
Language: English
Indexed and abstracted in:

- Web of Science - Biological Abstracts
- Web of Science - BIOSIS Previews
- Web of Science - Current Contents/Agriculture, Biology, and Environmental Sciences
- Web of Science - Science Citation Index Expanded
- SCImago (SJR)
- SCOPUS
- DOAJ (Directory of Open Access Journals)
- PubMed / PubMed Central
- AGRICOLA (National Agricultural Library), Baidu Scholar, Cabell's Whitelist, CABI (over 50 subsections), Case, Chemical Abstracts Service (CAS) – Caplus, Chemical Abstracts Service (CAS) - SciFinder, CNKI Scholar (China National Knowledge Infrastructure), CNPIEC - cnpLINKer, Dimensions, EBSCO (relevant databases), EBSCO Discovery Service, Gale/Cengage, Genamics JournalSeek, Google Scholar, IBIDS (National Institutes of Health), J-Gate, JournalGuide, JournalTOCs, KESLI-NDSL (Korean National Discovery for Science Leaders), Microsoft Academic, MyScienceWork, Naver Academic, Naviga (Softweco), Primo Central (ExLibris), ProQuest (relevant databases), Publons, QOAM (Quality Open Access Market), ReadCube, Reaxys, , Semantic Scholar, Sherpa/RoMEO, Summon (ProQuest), TDNet, Ulrich's Periodicals Directory/ulrichsweb, WanFang Data, WorldCat (OCLC)

		2016	2017	2018	2019	2020
Web of Science	IF	0.472	0.417	0.731	0.674	**1.184**
	Q Parasitology	Q4	Q4	Q4	Q4	Q4
	Q Zoology	Q4	Q4	Q3	Q4	Q3
Scopus	Q Parasitology	Q4	Q4	Q4	Q4	Q4
	Q Animal Science and Zoology	Q3	Q3	Q2	Q3	Q3

Note: data for 2021 were not available at the time of the preparation of the Questionnaire.
IF of the journal increased substantially since 2016.

- **National position of the institute**

2.3.5. List of selected activities of national importance

[**1**] IP SAS is a member of the National Expert Scientific Panel on Biological Hazards and Food Hygiene of the Ministry of Agriculture and Rural Development of the Slovak Republic.

[**2**] IP SAS is authorising and validating results of commercial diagnostic laboratories on diagnostics of human trichinellosis, toxocarosis, echinococcosis, and toxoplasmosis.

[**3**] IP SAS performs serological diagnostics of toxocarosis, trichinellosis, echinococcosis, and toxoplasmosis for the departments of infectious diseases and surgery, and for primary care physicians based in the hospitals and medical centers throughout Slovakia (Children Faculty Hospital Košice, University Hospital Martin, University Hospital Košice, and J. A. Reiman Hospital in Prešov).

[**4**] IP SAS provides regular parasitological examinations of companion animals for new and emerging parasitic diseases (dirofilariosis, angiostrongylosis, thelaziosis, babesiosis, and tick-borne bacteriae). The

prophylactic and therapeutic measures are established under the cooperation with private veterinary practices to prevent the spread of parasitic agents.

[**5**] IP SAS was involved in the "Czechoslovakian castration programme" focused on the charitable parasitological examinations of dogs and cats in the Roma settlements.

[**6**] IP SAS performed the diagnostics of parasitic infections in sheep/goats and cattle, including examination of suspected cases for anthelmintic resistance in private agricultural farms throughout Slovakia.

[**7**] IP SAS is providing consulting services in a field of parasitic diseases of cultured and ornamental fishes for the Slovak Fishing Association, private institutions, and general public.

[**8**] IP SAS is performing diagnostics of plant parasitic nematode species *Radopholus similis* and *Radopholus citrophilus* in soil samples and peat upon the requests of the AGRO CS Lučenec - the private producer of organic fertilizers, composts, and agricultural products.

[**9**] Diagnostics of plant parasitic nematode species *Heterodera schachtii* (sugar beet cyst nematode) was carried out in samples of soils upon the request of the Považský cukor Ltd., Trenčianska Teplá – the private sugar refinery.

[**10**] The analysis of soil samples for the occurrence of plant parasitic nematodes from the genera *Globodera*, *Meloidogyne* and *Ditylenchus* upon the request of the Richten Rasen Ltd. – the company developing and cultivating natural turf.

[**11**] Diagnostics of the giant liver fluke *Fascioloides magna* in livers of red deer from the natural focus of fascioloidosis in the Danube floodplain forest under the request of the State Veterinary and Food Administration.

2.3.6. List of journals (published only in the Slovak language) edited/published by the institute and information on their indexing in WOS, SCOPUS, other database or no database, incl. impact factor and other metrics of journals in each year of the assessment period

N/A

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

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

*Notes: authors from IP SAS are underlined; ** - presenting author*

[**1**] HRČKOVÁ, Gabriela** – VENDEĽOVÁ, Emília – MAČÁK-KUBAŠKOVÁ, Terézia – MUDROŇOVÁ, Dagmar. *Mesocestoides vogae* larval cestode – an interesting helminth mode for immunological and pharmacological research. In: 12th Czech and Slovak Parasitological Days, May 16-20, 2016, Ledeč nad Sázavou, the Czech Republic.

[**2**] STANKO, Michal**. Od histórie výskumov ekológie kliešťov v Československu ku globálnym zmenám v súčasnosti. [From the history of the research of ecology of ticks in Czechoslovakia towards the global changes in the present.] In: 12th Czech and Slovak Parasitological Days, May 16-20, 2016, Ledeč nad Sázavou, the Czech Republic.

[**3**] VÁRADY, Marián** – KÖNIGOVÁ, Alžbeta – DOLINSKÁ, Michaela – BABJÁK, Michal. Parazity a antihelmintiká – zvláštny pár. [Parasites and antihelmintics – the strange couple]. In: 12th Czech and Slovak Parasitological Days, May 16-20, 2016, Ledeč nad Sázavou, the Czech Republic.

[**4**] HRČKOVÁ, Gabriela** - MAČAK-KUBAŠKOVÁ, Terézia - BIEDERMANN, David – TUMOVÁ, Lenka. Effects of selected flavonoids on a model eukaryotic parasitic organism vary in hypoxic and aerobic in vitro

systems: possibilities in drug screening. In: 6th International Conference and Exhibition on Pharmacology and Ethnopharmacology, November 6-10, 2017, Vienna, Austria.

[**5**] HURNÍKOVÁ, Zuzana** - KOŁODZIEJ-SOBOĆINSKA, Marta - DVOROŽŇÁKOVÁ, Emília - NIEMCZYNOWICZ, Agnieszka - ZALEWSKI, Andrzej. Double trouble: American mink in Poland – an invasive species and reservoir of *Trichinella* parasites. In: Trichinellosis and Other Foodborne Parasitic Zoonoses. Parasitological conference Białowieża, September 13-15, 2017, Białowieża, Poland.

[**6**] DVOROŽŇÁKOVÁ, Emília** - BUCKOVÁ, Barbora - HURNÍKOVÁ, Zuzana - LAUKOVÁ, Andrea - REVAJOVÁ, Viera. Protective effects of probiotic bacteria against experimental trichinellosis. In: International Conference Theory and Practice of Struggle against Parasitic Diseases, May 15-17, 2018, Moscow, Russia.

[**7**] ŠNÁBEL, Viliam** - GEORGESCU, Stefan Octavian - KUZMINA, Tetiana - CALMA, C.L. - SALAMATIN, Ruslan. Genetic survey of *Echinococcus granulosus* sensu lato and *Echinococcus multilocularis* cestodes in Central Eastern Europe. In: International Conference Theory and Practice of Struggle against Parasitic Diseases, May 15-17, 2018, Moscow, Russia.

[**8**] ANTOLOVÁ, Daniela**. Experience of Echinococcosis Control Programme in Slovakia. OIE/WHO Sub-regional Workshop on Echinococcosis. December 10-11, 2019, Bishkek, Kyrgyzstan.

[**9**] KRÁLOVÁ-HROMADOVÁ, Ivica** - JUHÁSOVÁ, Ľudmila - BAZSALOVICSOVÁ, Eva. Intercontinental traveller *Fascioloides magna*: from no DNA data to complex study. In: 25th Helminthological Days, May 6-10, 2019, Rejčkov, the Czech Republic.

[**10**] KRÁLOVÁ-HROMADOVÁ, Ivica** - JUHÁSOVÁ, Ľudmila - BAZSALOVICSOVÁ, Eva. A tour around two continents – origin and migratory routes of the invasive giant liver fluke *Fascioloides magna*. In: 15th Congress of the Polish Parasitological Society, September 9-12, 2019, Warsaw, Poland.

[**11**] ANTOLOVÁ, Daniela** - MITERPÁKOVÁ, Martina - JAROŠOVÁ, Júlia. *Echinococcus multilocularis* in Slovakia - epidemiological situation in humans and animals. In: Parazytozy zwierzat - aktualne zagrożenia - nove rozwiazania terapeutycznie i profilaktyczne, September 6-9, 2021, Lublin, Poland.

[**12**] HURNÍKOVÁ, Zuzana** - MITERPÁKOVÁ, Martina. Raptorial birds - new hosts for *Trichinella pseudospiralis* in Slovakia. In: Parazytozy zwierzat - aktualne zagrożenia - nove rozwiazania terapeutycznie i profilaktyczne, September, 6-9, 2021, Lublin, Poland.

[**13**] MITERPÁKOVÁ, Martina** - ANTOLOVÁ, Daniela - HURNÍKOVÁ, Zuzana. Dirofilariosis in Slovakia - *Dirofilaria repens* vs. *Dirofilaria immitis*. In: Parazytozy zwierzat - aktualne zagrożenia - nove rozwiazania terapeutycznie i profilaktyczne, September 6-9, 2021, Lublin, Poland.

[**14**] ČEREVKOVÁ, Andrea** - CAGÁŇ Ľudovít. Influence of western corn rootworm seed coating and granular insecticides on soil nematode communities. In: 7th International Conference of Pakistan Phytopathological Society, November 21-23, 2021, Faisalabad, Pakistan.

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

[**1**] OROS, Mikuláš: 12th Czech and Slovak Parasitological Days, May 16-20, 2016, Ledeč nad Sázavou, the Czech Republic (organising committee)

[**2**] BARČÁK, Daniel - OROS, Mikuláš - OROSOVÁ, Martina - PAPAJOVÁ, Ingrid - ŠPAKULOVÁ, Marta: 23rd Helminthological Days, May 8-12, 2017, Duchonka, Slovakia (organising and programme committee)

[**3**] HANZELOVÁ, Vladimíra - OROS, Mikuláš - OROSOVÁ, Martina - PAPAJOVÁ, Ingrid - ŠPAKULOVÁ, Marta: 9th Acanthocephalan Workshop, September 9-13, 2018, Stará Lesná, Slovakia (organising and programme committee)

[**4**] ANTOLOVÁ, Daniela - HURNÍKOVÁ, Zuzana - MITERPÁKOVÁ, Martina - VASILKOVÁ, Zuzana: 13th Slovak and Czech Parasitological Days – Parasites in the Heart of Europe 2, May 21-25, 2018, Košice, Slovakia (organising committee)

[**5**] HROMADOVÁ, Ivica - STANKO, Michal - VÁRADY, Marián - VÍCHOVÁ, Bronislava: 13th Slovak and Czech Parasitological Days – Parasites in the Heart of Europe 2, May 21-25, 2018, Košice, Slovakia (programme committee)

2.3.9. List of researchers who received an international scientific award

[**1**] MAJLÁTHOVÁ, Viktória: The most outstanding poster award at the One Health 9th Tick and Tick-borne Pathogen Conference & 1st Asia Pacific Rickettsia Conference, August 27 – September 1, 2017, Cairns, Queensland, Australia.

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

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

N/A

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

N/A

2.3.12. List of researchers who received a national scientific award

[**1**] BAZSALOVICSOVÁ, Eva: The Presidium of the Slovak Academy of Sciences Award for young researchers (3rd place) (awarded in 2017)

[**2**] KRALJIK, Jasna (1st place); JUHÁSOVÁ, Ľudmila (2nd place), VÍCHOVÁ, Bronislava (3rd place): The Slovak Parasitological Society Award for the best scientific publications of young researches published in 2016 (awarded in 2017)

[**3**] VÍCHOVÁ, Bronislava: The Slovak Academy of Agricultural Sciences Award for the scientific publication with an important societal contribution (awarded in 2017)

[**4**] VÍCHOVÁ, Bronislava: The Slovak Society for Agricultural, Forest, Food and Veterinary Sciences Award for the veterinary medicine publication (awarded in 2017)

[**5**] ŠALAMÚN, Peter: The Slovak Academy of Agricultural Sciences Award for the best scientific publication of young researchers in veterinary medicine discipline (awarded in 2018)

[**6**] MAČÁK-KUBAŠKOVÁ, Terézia (1st place); HEGLASOVÁ, Ivana (2nd place), MATOUŠKOVÁ, Martina (3rd place): The Slovak Parasitological Society Award for the best scientific publications of young researches published in 2017-2018 (awarded in 2019)

[**7**] STANKO, Michal: The Slovak Literary Fund Award for the scientific monography: STANKO, Michal - SLOVÁK, Mirko. História výskumov ekológie kliešťov na území Česka a Slovenska do roku 2000. [The History of the ticks´ ecology research in the territory of the Czech Republic and Slovakia till 2000]. 1st edition. VEDA, Publishing House of the Slovak Academy of Sciences, 2019, 544 pp. ISBN 978-80-224-1752-5 (awarded in 2019)

[**8**] BARČÁK, Daniel (2nd place); JAROŠOVÁ, Júlia (3rd place): The Slovak Parasitological Society Award for the best scientific publications of young researches published in 2019-2020 (awarded in 2021)

[**9**] ANTOLOVÁ, Daniela: The Presidium of the SAS Award for the scientific publication with an extraordinary high number of citations: Deplazes, P., Rinaldi, L., Alvarez Rojas, C.A., Torgerson, P.R., Harandi, M.F., Romig,

T., Antolová, D., Schurer, J.M., Lahmar, S., Cringoli, G., Magambo, J., Thompson, R.C.A., Jenkins, D.J. 2017. Global Distribution of Alveolar and Cystic Echinococcosis. In: Thompson, R.C.A., Deplazes, P., Lymbery, A.J. (Eds.), Advances in Parasitology. Echinococcus and Echinococcosis, Part A, pp. 315–493. ISBN 9780128114711 (awarded in 2021)

[**10**] DUBINSKÝ, Pavol: The Presidium of the SAS Award for the lifelong contribution of prof. Pavol Dubinský to the science at the occasion of his 80th jubilee (awarded in 2019)

2.4. Research grants and other funding resources

(List 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". Add information on the projects which are interdisciplinary, and also on the joint projects with several participating SAS institutes)

- **International projects**

2.4.1. List of major projects of Framework Programmes of the EU (which pilar), NATO, COST, etc.

[**1**] Project title: ***European Network on Taeniosis/Cysticercosis*** (Acronym: CYSTINET)
Type of project and grant number: **COST**; Action TD1302
Duration: 11/2013 – 11/2017
Funding for the institute: 13,788 €
Project coordinator: Institute of Tropical Medicine, Antwerp, Belgium (14 cooperating EU countries)
Responsible person from IP SAS: Marián Várady – "W"

[**2**] Project title: ***European Network for Neglected Vectors and Vector-Borne Infections*** (Acronym: EURNEGVEG)
Type of project and grant number: **COST**; Action TD1303
Duration: 11/2013 – 11/2017
Funding for the institute: 15,048 €
Project coordinator: University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania (28 cooperating EU countries)
Responsible person from IP SAS: Viktória Majláthová – "W"

[**3**] Project title: ***European Network for Foodborne Parasites*** (Acronym: EURO-FBP)
Type of project and grant number: **COST**; Action FA1408
Duration: 03/2015 – 03/2019
Funding for the institute: 14,083 €
Project coordinator: Norges Miljo-Og Biovitenskaplige Universitet Parasitology, Food Safety and Infection Biology, Oslo, Norway (36 cooperating EU countries)
Responsible person from IP SAS: Emília Dvorožňáková – "W"

[**4**] Project title: ***European Network of Investigators Triggering Exploratory Research on Myeloid Regulatory Cells*** (Acronym: Mye-EUNITER)
Type of project and grant number: **COST**; Action BM4114
Duration: 05/2015 – 11/2018
Funding for the institute: 13,424 €
Project coordinator: University Hospital Essen, Department of Otorhinolaryngology, Essen, Germany (41 cooperating EU countries)
Responsible person from IP SAS: Gabriela Hrčková – "W"

[**5**] Project title: ***Combatting anthelmintic resistance in ruminants*** (Acronym: COMBAR)
Type of project and grant number: **COST**; Action CA16230

Duration: 09/2017 – 09/2021
Funding for the institute: 14,920 €
Project coordinator: KREAVET, Kruibeke, Belgium (36 cooperating EU countries)
Responsible person from IP SAS: Marián Várady – "W"

Add information on your activities in international networks

• ***European Network on Taeniosis/Cysticercosis***

The tapeworms *Taenia solium* (pork tapeworm) and *Taenia saginata* (beef tapeworm) are causative agents of cysticercosis and taeniosis, zoonotic parasitoses important to public health. These zoonoses also have substantial economic impacts on the health and meat sectors within and outside the EU. The main objective of this action was to build a strong, extensive, multi-disciplinary scientific network for the development of innovative diagnostic and cost-efficient control tools, the assessments of disease burden and economic impact, and the development of harmonised procedures for reporting and management. IP SAS focused on assessing risk and the detection and control of cysticercosis in the territory of Slovakia. The goal of the Institute was to collect cysticercus cysts from slaughterhouses and to molecularly identify and immunologically characterise the cysts.

• ***European Network for Neglected Vectors and Vector-Borne Infections***

The main objective of the action was to establish a powerful transboundary network of partner institutions across Europe that are involved in education and research of arthropod-transmitted infectious diseases of humans and other animals, a network addressing the growing importance of vector-borne diseases (VBD) at a time of global change, all integrated under the One Health concept and representing the complexity and demands of current high-end research. The project intended to implement the "One Health" interdisciplinary and transdisciplinary concept in the field of vectors and VBD and within its various components: research, diagnosis and surveillance, health policies, and education. Appropriate laboratory diagnostic methods and environmental monitoring protocols were selected as standard working approaches to the surveillance of vectors and VBD. IP SAS provided biological, molecular, and genetic data on vectors, reservoir hosts, and VBD from various biotopes in Slovakia.

• ***European Network for Food-borne Parasites***

The main objective of the European Network for Food-borne Parasites was to decrease the impact on human health of food-borne parasites (FBPs) by establishing a risk-based control programme for FBPs containing robust and appropriate protective strategies. The network used an interdisciplinary, One Health perspective to assimilate information, coordinate research, and harmonise diagnostics, surveillance, analytical methods, potential interventions, and the mapping of global trends of FBPs. The project focused on how to address FBPs, optimising efforts and resources to control FBPs in Europe and globally. IP SAS detected parasites of the highest regional importance (*Toxoplasma gondii*, *Trichinella* spp., *Echinococcus granulosus*, and *Echinococcus multilocularis*) and focused on the strategic control of the FBPs. IP SAS performed the surveillance of efficient and standardised diagnostic methods from European laboratories, collected epidemiological data on FBPs from human and veterinary diagnostics, and identified areas of risk in Slovakia.

• ***European Network of Investigators Triggering Exploratory Research on Myeloid Regulatory Cells***

The main objective of the project was to study an interesting immunological topic, myeloid-derived regulatory immune cells, i.e. dendritic cells, macrophages, monocytes, and granulocytes, which play suppressive regulatory roles during various types of diseases, mostly cancer but also parasitic diseases. An extensive understanding of the molecular and biological signatures of these suppressive cells in various diseases will help in the design of an effective therapeutic intervention. Monitoring individual cell types in the course of diseases has also high diagnostic value for prognosis. IP SAS contributed to this objective by characterising myeloid regulatory cells in the course of an infection with a model flatworm in mice. Novel additional data were provided on commercially available anthelmintics used in human and veterinary medicine and on the suppressive functions of myeloid regulatory cells, leading to higher efficacy and alleviated pathology during disease.

• ***Combatting Anthelmintic Resistance in Ruminants***
Helminth parasitic pathogens cause severe diseases that are amongst the most important diseases of grazing ruminants limiting production. The frequent use of anthelmintics to control these infections has led to the selection of drug-resistant helminth populations. Anthelmintic resistance occurs in all major species of helminths across Europe and globally. The international COMBAR COST project was focussed on preventing anthelmintic resistance in helminth parasites of ruminants in Europe and has disseminated current knowledge amongst all relevant stakeholders. COMBAR integrated novel developments in (i) diagnostic testing, (ii) vaccines to protect animals from infection, (iii) antiparasitic forages, (iv) selective treatment strategies, and (iv) decision support tools. IP SAS participated in the development of a plan for the application of new diagnostic methods in the form of commercial tests and diagnostic kits that were subjected to SWOT analysis. IP SAS documented cases of anthelmintic resistance in parasites of small ruminants in collaboration with research institutes in Poland, Romania, and the Czech Republic.

- **National projects, incl. international projects with only national funding**

2.4.2. List of ERA-NET projects funded from SAS budget

[**1**] Project title: ***Relationships between functional diversity and food production and quality under ecological intensification***
Type of project and grant number: **ERA-NET**; BiodivERsA 2018-B-896
Duration: 04/2020 – 03/2024
Total funding / funding for the institute: 242,936 € / 10,400 €
Project coordinator: Brandenburg University of Technology, Cottbus-Senftenber, Germany (7 cooperating EU countries)
Responsible person from IP SAS: Andrea Čerevková – "I"

2.4.3. List of projects of the Slovak Research and Development Agency, APVV

[**1**] Project title: ***Small mammals as a potential source of zoonotic bacteria and resistence to antibiotic***
Grant number: APVV-14-0274
Duration: 07/2015 – 06/2019
Total funding / funding for the institute: 168,032 € / 96,101 €
Project coordinator: Institute of Animal Physiology, Centre of Biosciences SAS, Košice
Partner institution: IP SAS
Responsible person from IP SAS: Michal Stanko – „W"

[**2**] Project title: ***Parasite resistance to anthelminthics – Challenges, perspectives and solutions***
Grant number: APVV-14-0169
Duration: 07/2015 – 06/2019
Total funding / funding for the institute: 247,553 € / 149,224 €
Project coordinator: IP SAS
Partner institution: Institute of Animal Physiology, Centre of Biosciences SAS, Košice
Responsible person from IP SAS: Marián Várady – „C"

[**3**] Project title: ***Antitick protection using modified polypropylen fibres with an acaricidial effect***
Grant number: APVV-15-0419
Duration: 07/2016 – 12/2018
Total funding / funding for the institute: 247,416 € / 125,000 €
Project coordinator: IP SAS
Partner institution 1: Faculty of Science, University of Pavol Jozef Šafárik, Košice
Partner institution 2: Chemosvit Fibrochem Company, Svit
Responsible person from IP SAS: Branislav Peťko – „C"

[**4**] Project title: ***Genetic diversity of selected medically important emerging and re-emerging pathogens with zoonotic potential***
Grant number: APVV-15-0134
Duration: 07/2016 – 06/2019
Total funding / funding for the institute: 238,804 € / 57,800 €
Project coordinator: Faculty of Medicine, University of Pavol Jozef Šafárik , Košice
Partner institution: IP SAS
Responsible person from IP SAS: Michal Stanko – „W“

[**5**] Project title: ***Usage of next-generation sequencing for virome analysis of medically and economically relevant organisms***
Grant number: APVV-15-0232
Duration: 07/2016 – 06/2019
Total funding / funding for the institute: 248,531 € / 23,878 €
Project coordinator: Institute of Virology, Biomedical Research Center SAS, Bratislava
Partner institution: IP SAS
Responsible person from IP SAS: Michal Stanko – „W“

[**6**] Project title: ***Standardisation of new approaches in the diagnostic of important helminthic diseases of humans and their application into practice in the light of actual epidemiological and social conditions of Slovakia***
Grant number: APVV-15-0114
Duration: 07/2016 – 12/2020
Total funding / funding for the institute: 236,900 € / 175,460 €
Project coordinator: IP SAS
Partner institution: Jessenius Faculty of Medicine, Comenius University in Bratislava, Martin
Responsible person from IP SAS: Daniela Antolová – „C“

[**7**] Project title: ***Emerging fish-borne zoonoses in Europe: molecular diagnostic, origin and distribution of Diphyllobothrium***
Grant number: APVV-15-0004
Duration: 07/2016 – 12/2020
Funding for the institute: 248,227 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Ivica Hromadová – „C“

[**8**] Project title: ***Vegetation, soil microorganisms and carbon sequestrations in forest soils***
Grant number: APVV-15-0176
Duration: 07/2016 – 06/2020
Total funding / funding for the institute: 230,116 € / 40,279 €
Project coordinator: Technical University in Zvolen, Zvolen
Partner institution: IP SAS
Responsible person from IP SAS: Marek Renčo – „W“

[**9**] Project title: ***Sheep, goats and tick-borne encephalitis virus***
Grant number: APVV-16-0518
Duration: 07/2017 – 06/2021
Total funding / funding for the institute: 250,000 € / 75,000 €
Project coordinator: Institute of Virology, Biomedical Research Center SAS, Bratislava
Partner institution: IP SAS
Responsible person from IP SAS: Bronislava Víchová – „W“

[**10**] Project title: ***Clarification of the immunomodulatory effects of DLE (dialyzable leukocyte extract) in the therapy of mice with parasitic infections of immunosuppressive character***
Grant number: APVV-17-0410
Duration: 08/2018 – 06/2022
Funding for the institute: 150,000 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Gabriela Hrčková – „C“

[**11**] Project title: ***Functional food based on goats milk and its benefit on health***
Grant number: APVV-17-0028
Duration: 08/2018 – 06/2022
Total funding / funding for the institute: 249,998 € / 30,000 €
Project coordinator: Institute of Animal Physiology, Centre of Biosciences SAS, Košice
Partner institution: IP SAS
Responsible person from IP SAS: Emília Dvorožňáková – „W“

[**12**] Project title: ***Integrated monitoring and environmental risk assessment of PCBs and mercury contaminants in the Zemplín Region (Slovakia), one of the most ecologically threatened territories in Europe***
Grant number: APVV-18-0467
Duration: 07/2019 – 06/2023
Funding for the institute: 249,454 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Mikuláš Oros – „C“

[**13**] Project title: ***Risk assessment of the parasitozoonoses occurrance using multicriteria analysis approaches***
Grant number: APVV-18-0351
Duration: 07/2019 – 06/2023
Total funding / funding for the institute: 248,556 € / 173,918 €
Project coordinator: IP SAS
Partner institution: Technical University, Košice
Responsible person from IP SAS: Ingrid Papajová – „C“

[**14**] Project title: ***Alternative parasite control of small ruminant***
Grant number: APVV-18-0131
Duration: 07/2019 – 06/2023
Total funding / funding for the institute: 241,058 € / 145,859 €
Project coordinator: IP SAS
Partner institution: Institute of Animal Physiology, Centre of Biosciences SAS, Košice
Responsible person from IP SAS: Marián Várady – „C“

[**15**] Project title: ***Soil microbiota in natural forest ecosystems: its response to changing biotic and abiotic factors of habitats***
Grant number: APVV-19-0142
Duration: 07/2020 – 06/2024
Total funding / funding for the institute: 120,000 € / 25,654 €
Project coordinator: Technical University, Zvolen
Partner institution 1: National Forest Centre, Zvolen
Partner institution 2: IP SAS
Responsible person from IP SAS: Marek Renčo – „W“

2.4.4. List of projects of the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education, VEGA (for funding specify only total sum obtained from all VEGA grants in particular year)

[**1**] Project title: ***Natural foci in urban environment - the case of the Košice agglomeration: structure and dynamics in space and in time***
Grant number: VEGA 2/0059/15
Duration: 01/2015 – 12/2018
Funding for the institute: 21,625 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Michal Stanko – „C“

[**2**] Project title: ***Modulatory effects of probiotic bacteria on the host immunity to a parasitic zoonosis caused by Trichinella spiralis***
Grant number: VEGA 2/0081/15
Duration: 01/2015 – 12/2018
Funding for the institute: 21,730 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Emília Dvorožňáková – „C“

[**3**] Project title: ***Wild ruminants as potential risk factor for transmission of anthelmintic resistant parasites between small ruminant farms***
Grant number: VEGA 2/0120/16
Duration: 01/2016 – 12/2018
Total funding / funding for the institute: 47,829 € / 29,182 €
Project coordinator: IP SAS
Partner institutions: University of Veterinary Medicine and Pharmacy, Košice
Responsible person from IP SAS: Alžbeta Königová – „C“

[**4**] Project title: ***Cytomorphological aspects of reproduction and phylogeny in the parasitic Platyhelminthes***
Grant number: VEGA 2/0104/16
Duration: 01/2016 – 12/2019
Funding for the institute: 23,895 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Magdaléna Bruňanská – „C“

[**5**] Project title: ***Newly emerging parasitic and vector-borne diseases in dogs, their epidemiology and diagnostic***
Grant number: VEGA 2/0018/16
Duration: 01/2016 – 12/2019
Funding for the institute: 39,543 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Martina Miterpáková – „C“

[**6**] Project title: ***Soil nematodes and microorganisms: indicators of impact of non-native plant species invasion to the ecosystem***
Grant number: VEGA 2/0013/16
Duration: 01/2016 – 12/2019
Total funding / funding for the institute: 38,919 € / 29,341 €

Project coordinator: IP SAS
Partner institution: Faculty of Humanities and Natural Sciences, University of Prešov, Prešov
Responsible person from IP SAS: Marek Renčo – „C“

[**7**] Project title: ***Fish tapeworms (Cestoda) in North America: new knowledge on evolutionary and medically important parasites***
Grant number: VEGA 2/0159/16
Duration: 01/2016 – 12/2019
Funding for the institute: 38,865 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Mikuláš Oros – „C“

[**8**] Project title: ***The structure and dynamics of montane natural foci of tick-borne diseases***
Grant number: VEGA 2/0126/16
Duration: 01/2016 – 12/2019
Total funding / funding for the institute: 54,297 € / 27,766 €
Project coordinator: IP SAS
Partner institution: Catholic University, Ružomberok
Responsible person from IP SAS: Bronislava Víchová – „C“

[**9**] Project title: ***Population-genetic characterization of invasive parasitic species (Platyhelminthes); determination of their origin and migratory routes***
Grant number: VEGA 2/0134/17
Duration: 01/2017 – 12/2020
Funding for the institute: 37,053 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Eva Čisovská Bazsalovicsová – „C“

[**10**] Project title: ***The impact of anthropogenic contamination on the occurrence of the microbial and parasitic organisms in environment within urban and rural ecosystems***
Grant number: VEGA 2/0125/17
Duration: 01/2017 – 12/2020
Total funding / funding for the institute: 63,697 € / 33,267 €
Project coordinator: IP SAS
Partner institution: University of Veterinary Medicine and Pharmacy, Košice
Responsible person from IP SAS: Ingrid Papajová – „C“

[**11**] Project title: ***Effect of model tapeworm*** **Mesocestoides vogae** ***infection on the expression and functions of selected regulatory molecules in myeloid cells in mice***
Grant number: VEGA 2/0091/17
Duration: 01/2017 – 12/2020
Funding for the institute: 28,589 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Gabriela Hrčková – „C“

[**12**] Project title: ***Transmission and risk analyses of epidemiologically important helminths using genetic and biochemical markers***
Grant number: VEGA 2/0162/17
Duration: 01/2017 – 12/2020
Funding for the institute: 21,463 €
Project coordinator: IP SAS

Partner institution: N/A
Responsible person from IP SAS: Viliam Šnábel – „C“

[**13**] Project title: ***Genetic analysis of selected emerging and re-emerging pathogens with zoonotic potential in animals and humans***
Grant number: VEGA 1/0084/18
Duration: 01/2018 – 12/2021
Total funding / funding for the institute: 57,708 € / 13,532 €
Project coordinator: Faculty of Medicine, University of Pavol Jozef Šafárik, Košice
Partner institution: IP SAS
Responsible person from IP SAS: Michal Stanko – „W“

[**14**] Project title: ***Relictual forms of arthropods (Arthropoda) in the Western Carpathians – morphology, ecology and phylogeny***
Grant number: VEGA 1/0346/18
Duration: 01/2018 – 12/2021
Total funding / funding for the institute: 75,353 € / 9,673 €
Project coordinator: Faculty of Science, University of Pavol Jozef Šafárik, Košice
Partner institution: IP SAS
Responsible person from IP SAS: Dana Miklisová – „W“

[**15**] Project title: ***Diagnostic challenges and forgotten parasites of domestic animals***
Grant number: VEGA 2/0099/19
Duration: 01/2019 – 12/2021
Funding for the institute: 42,611 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Marián Várady – „C“

[**16**] Project title: ***Immunomodulatory properties of probiotic enterococci and their enterocins in the antiparasitic defence of the host with experimental trichinellosis***
Grant number: VEGA 2/0056/19
Duration: 01/2019 – 12/2022
Funding for the institute (2019 – 2021): 23,961 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Emília Dvorožňáková – „C“

[**17**] Project title: ***Molecular epidemiology and risk of spread of wildlife parasites in actual ecological conditions of Slovakia***
Grant number: VEGA 2/0043/19
Duration: 01/2019 – 12/2022
Total funding / funding for the institute (2019 – 2021): 47,202 € /21,348 €
Project coordinator: University of Veterinary Medicine and Pharmacy, Košice
Partner institution: IP SAS
Responsible person from IP SAS: Zuzana Hurníková – „W“

[**18**] Project title: ***Alternative methods for assessing contamination rates of aquatic ecosystem using fish and their parasites***
Grant number: VEGA 2/0126/20
Duration: 01/2020 – 12/2023
Funding for the institute (2020-2021): 31,884 €
Project coordinator: IP SAS
Partner institution: N/A

Responsible person from IP SAS: Mikuláš Oros – „C“

[**19**] Project title: ***Cestodoses with zoonotic potential in Slovakia – negligible risk or serious threat?***
Grant number: VEGA 2/0107/20
Duration: 01/2020 – 12/2023
Funding for the institute (2020-2021): 19,913 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Daniela Antolová – „C“

[**20**] Project title: ***Direct and indirect impact of invasive plant species on soil micro and mesofauna biodiversity***
Grant number: VEGA 2/0018/20
Duration: 01/2020 – 12/2023
Total funding / funding for the institute (2020-2021): 35,273 € / 15,942 €
Project coordinator: IP SAS
Partner institution: Faculty of Humanities and Natural Sciences, University of Prešov, Prešov
Responsible person from IP SAS: Marek Renčo – „C“

[**21**] Project title: ***Biogeography and migratory routes of zoonotic tapeworms Dibothriocephalus latus and D. dendriticus (Cestoda: Diphyllobothriidea)***
Grant number: VEGA 2/0027/21
Duration: 01/2021 – 12/2024
Funding for the institute (2021): 10,391 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Ivica Hromadová –„C“

[**22**] Project title: ***Modulation of imunity by albendazole and the role of selected miRNAs in experimental alveolar echinococcosis***
Grant number: VEGA 2/0033/21
Duration: 01/2021 – 12/2024
Funding for the institute (2021): 9,958 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Gabriela Hrčková – „C“

[**23**] Project title: ***Pet animals as effective sentinels of pathogens´ circulation with specific emphasis on vector-borne and zoonotic species***
Grant number: VEGA 2/0014/21
Duration: 01/2021 – 12/2024
Funding for the institute (2021): 10,531 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Martina Miterpáková – „C“

[**24**] Project title: ***Microbial and parasitic organisms spread under the influence of global climate, environmental and social changes***
Grant number: VEGA 2/0138/21
Duration: 01/2021 – 12/2024
Funding for the institute (2021): 6,413 €
Project coordinator: IP SAS
Partner institution: N/A
Responsible person from IP SAS: Ingrid Papajová - „C“

2.4.5. List of projects supported by EU Structural Funds

N/A

2.4.6. List of other projects funded from national resources

Notes: SAS – Slovak Academy of Sciences, CAS – Czech Academy of Sciences, PAS – Polish Academy of Sciences, BAS – Bulgarian Academy of Sciences
***R** – refundation of travel expenses only*

[**1**] Project title: ***Studies on the structure and dynamics of the montane natural foci of tick-borne diseases under the impact of global climate changes***
Type of project: APVV – Bilateral project financed by APVV
Grant number: SK-CN-2015-0010
Duration: 01/2016 – 12/2017
Funding for the institute: 8,000 €
Partner institution: Hebei Normal University, Hebei, **China**
Responsible person from IP SAS: Bronislava Víchová

[**2**] Project title: ***Population genetics and phylogeography of invasive parasitic species***
Type of project: Academic Exchange Agreement (MAD) financed by SAS / CAS
Grant number: SAV-AVČR-16-20
Duration: 01/2016 – 12/2017
Funding for the institute: 3,065 €
Partner institution: Institute of Parasitology, Biology Centre, Czech Academy of Sciences, České Budějovice, **Czech Republic**
Responsible person from IP SAS: Eva Čisovská Bazsalovicsová

[**3**] Project title: ***Mechanisms of antiparasitic effects of silymarin flavonoligans on model larval cestode* Mesocestoides vogae**
Type of project: Academic Exchange Agreement (MAD) financed by SAS / CAS
Grant number: SAV-AVČR-16-13
Duration: 01/2016 – 12/2017
Funding for the institute: 3,065 €
Partner institution: Institute of Microbiology, Czech Academy of Sciences, Prague, **Czech Republic**
Responsible person from IP SAS: Gabriela Hrčková

[**4**] Project title: ***Dominant rodents in large towns and their potential risk as reservoirs of infectious agents***
Type of project: Academic Exchange Agreement (MAD) financed by SAS / CAS
Grant number: SAV-AVČR-16-22
Duration: 01/2016 – 12/2017
Funding for the institute: 3,065 €
Partner institution: Institute of Parasitology, Biology Centre, Czech Academy of Sciences, České Budějovice, **Czech Republic**
Responsible person from IP SAS: Ladislav Mošanský

[**5**] Project title: ***Immunological and molecular diagnostics of parasitic diseases of rodents living in different ecosystems of the national parks in Poland and Slovakia***
Type of project: Academic Exchange Agreement (MAD) financed by SAS / PAS
Grant number: SAV-PAV-9/2016
Duration: 01/2016 – 12/2018
Funding for the institute: R
Partner institution: Mammal Research Institute, Polish Academy of Sciences, Białowieża, **Poland**
Responsible person from IP SAS: Emília Dvorožňáková

[**6**] Project title: ***Tick-borne diseases zoonotic foci in urban habitats of Poland and Slovakia***
Type of project: Academic Exchange Agreement (MAD) financed by SAS / PAS
Grant number: SAV-PAV-12/2016
Duration: 01/2016 – 12/2018
Funding for the institute: R
Partner institution: Stefański Institute of Parasitology, Polish Academy of Sciences, Warsaw, **Poland**
Responsible person from IP SAS: Michal Stanko

[**7**] Project title: ***Joint investigation of fish parasite diversity in the Yangtze River basin: uncovering the hidden species diversity and exotic invasions***
Type of project: APVV – Bilateral project financed by APVV
Grant number: SK-CN-2017-0007
Duration: 01/2018 – 12/2019
Funding for the institute: 8,000 €
Partner institution: Freshwater Fisheries Research Center, Chinese Academy of Sciences, Wuxi, **China**
Responsible person from IP SAS: Mikuláš Oros

[**8**] Project title: ***Emerging and Re-emerging Zoonotic Parasitoses Caused by Fish-Borne Parasites: Health Risks Associated with Consumption of Fish***
Type of project: Joint Research Projects (JRP) financed by SAS
Grant number: SAS-MOST JRP 2016/7
Duration: 03/2017 – 02/2020
Funding for the institute: 25,000 €
Partner institution: Taipei Medical University, Taipei, **Taiwan**
Responsible person from IP SAS: Mikuláš Oros

[**9**] Project title: ***Parasites in domestic and wild carnivores from Slovakia and Bulgaria in the era of global changes***
Type of project: Academic Exchange Agreement (MAD) financed by SAS / BAS
Grant number: SAV-BAS
Duration: 01/2018 – 12/2021
Funding for the institute: 2,035 €
Partner institution: Institute of Experimental Pathology and Parasitology, Bulgarian Academy of Sciences, Sofia, **Bulgaria**
Responsible person from IP SAS: Zuzana Hurníková

[**10**] Project title: ***Transmission patterns and genetic polymorphisms of zoonotic*** **Echinococcus** ***tapeworms in central Europe***
Type of project: German Academic Exchange Service (DAAD) financed by DAAD
Grant number: DAAD 57453104
Duration: 01/2019 – 12/2021
Funding for the institute: 7,300 €
Partner institution: University of Hohenheim, Department of Parasitology, Stuttgart, **Germany**
Responsible person from IP SAS: Viliam Šnábel

[**11**] Project title: ***Wild carnivores as a reservoir of zoonotic diseases in the north-eastern Poland***
Type of project: Academic Exchange Agreement (MAD) financed by SAS / PAS
Grant number: SAV-PAV
Duration: 01/2019 – 12/2022
Funding for the institute: R
Partner institution: Mammal Research Institute, Polish Academy of Sciences, Białowieża, **Poland**
Responsible person from IP SAS: Emília Dvorožňáková

[**12**] Project title: ***In vivo activity of silymarin flavonoligans on model infection induced with cestode*** **Mesocestoides vogae** ***in mice***
Type of project: Academic Exchange Agreement (MAD) financed by SAS / CAS
Grant number: SAV-AVČR-18-24
Duration: 01/2018 – 12/2021
Funding for the institute: R
Partner institution: Institute of Microbiology, Czech Academy of Sciences, Prague, **Czech Republic**
Responsible person from IP SAS: Gabriela Hrčková

[**13**] Project title: ***Classical and molecular karyology of*** **Diphyllobothrium** ***parasites: detection of phylogenetically informative markers***
Type of project: Academic Exchange Agreement (MAD) financed by SAS / CAS
Grant number: SAV-AVČR-18-20
Duration: 01/2018 – 12/2021
Funding for the institute: R
Partner institution: Institute of Entomology, Biology Centre, Czech Academy of Sciences, České Budějovice, **Czech Republic**
Responsible person from IP SAS: Martina Orosová

[**14**] Project title: ***The place of carnivores in transmission diseases of zoonotic foci***
Type of project: Academic Exchange Agreement (MAD) financed by SAS / PAS
Grant number: SAV-PAV
Duration: 01/2019 – 12/2021
Funding for the institute: R
Partner institution: Stefański Institute of Parasitology, Polish Academy of Sciences, Warsaw, **Poland**
Responsible person from IP SAS: Bronislava Víchová

[**15**] Project title: ***Comparative cytogenetic analysis of the thorny-headed worm*** **Acanthocephalus lucii** ***from the industrially polluted area of Zemplín Region and the natural volcanic lake Morské Oko***
Type of project: Mobility financed by SAS
Grant number: SAV-AVČR-21-03
Duration: 01/2021 – 12/2022
Funding for the institute: 3,000 €
Partner institution: Institute of Entomology, Biology Centre, Czech Academy of Sciences, České Budějovice, **Czech Republic**
Responsible person from IP SAS: Martina Orosová

[**16**] Project title: ***Population genetics and biogeography of a zoonotic tapeworm*** **Dibothriocephalus latus**
Type of project: Mobility financed by SAS
Grant number: SAV-AVČR-21-11
Duration: 01/2021 – 12/2022
Funding for the institute: 3,000 €
Partner institution: Institute of Parasitology, Biology Centre, Czech Academy of Sciences, České Budějovice, **Czech Republic**
Responsible person from IP SAS: Eva Čisovská Bazsalovicsová

2.4.7. List of projects funded from private funds

N/A

2.4.8. List of projects funded from other competitive funds

N/A

2.5. PhD studies and educational activities

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

The IP SAS is an external educational organisation of two accredited study programmes:
[**1**] **Zoology** - study field **1536 Biology** guaranteed by the Faculty of Science, Comenius University in Bratislava, Slovakia
[**2**] **Parasitic diseases of animals** - study field **4318 Veterinary medicine** guaranteed by the University of Veterinary Medicine and Pharmacy in Košice, Slovakia

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

PhD study	2016			2017			2018			2019			2020			2021		
Number of potential PhD supervisors	28			25			29			27			26			24		
PhD students	number, end of year	defended thesis	students quitted	number, end of year	defended thesis	students quitted	unumber, end of yea	defended thesis	students quitted	number, end of year	defended thesis	students quitted	number, end of year	defended thesis	students quitted	number, end of year	defended thesis	students quitted
Internal total	15	1	0	14	3	0	12	4	0	11	2	0	9	4	1	11	1	0
from which foreign citizens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
External	3	0	1	2	0	0	2	0	0	1	0	0	2	0	0	1	1	0
Other supervised by the research employees of the institute																		

2.5.3. PhD carrier path – Information on the next career steps of the PhD graduates who received their degree from the institute

A total of 15 PhD students successfully finished their studies during 2016 – 2021. Seven students were selected by the scientific board of IP SAS as prospective young researchers and were offered postdoctoral positions at IP SAS. One student (Daniel Barčák) was successful in a strong competition and obtained the Fund of Štefan Schwarz provided by the Presidium of the SAS. Four students were competent in other scientific/academic institutions, two students currently work in non-scientific institutions, and two students are on maternity leave.

Year of graduation	Name of the PhD student	Current working position
2016	Jasna Kraljik [c]	Pharmaceutical company, Bratislava
2017	Ľudmila Juhásová [a]	IP SAS, Košice
2017	Jana Pipíková [b]	Institute of Chemistry, SAS, Bratislava
2017	Daniel Barčák [a]	IP SAS, Košice
2018	Barbora Bucková [c]	Brewery Plzeňský Prazdroj Slovensko, a.s., Veľký Šariš
2018	Viktória Čabanová [b]	Institute of Virology, SAS, Bratislava
2018	Blažena Vargová [b]	University of Veterinary Medicine and Pharmacy, Košice
2018	Michal Babják [a]	IP SAS, Košice
2019	Terézia Mačak-Kubašková [a]	IP SAS, Košice
2019	Martina Matoušková [b]	Faculty of Science, University of P. J. Šafárik, Košice
2020	Ivana Heglasová [d]	maternity leave/not employed
2020	Júlia Jarošová [a]	IP SAS, Košice
2020	Alžbeta Radačovská [a]	IP SAS, Košice
2020	Miroslava Fecková [d]	maternity leave/not employed
2021	Júlia Šmigová [a]	IP SAS, Košice

[a] postdoc at IP SAS; [b] postdoc at university or SAS institution; [c] business/company; [d] not employed/maternity leave

2.5.4. Summary table on educational activities

Teaching	2016	2017	2018	2019	2020	2021
Lectures (hours/year)*	117	178	150	192	166	262
Practicum courses (hours/year)*	76	154	134	16	0	4
Supervised diploma and bachelor thesis (in total)	26	18	18	12	7	10
Members in PhD committees (in total)	7	5	2	2	1	5
Members in DrSc. committees (in total)	0	0	0	1	0	1
Members in university/faculty councils (in total)	3	2	2	2	2	2
Members in habilitation/inauguration committees (in total)	1	1	0	1	0	2

2.5.5. List of published university textbooks

[**1**] ANTOLOVÁ, Daniela - BADALÍK, Ladislav - BAKOSS, P. - BAŠKA, Tibor - BUCHVALD, J. - ČATÁR, Gustáv - ČISLÁKOVÁ, L. - DUBINSKÝ, Pavol - GURYČOVÁ, Darina - JALILI, N.A. - JAREKOVÁ, J. - HUDEČKOVÁ, Henrieta - KMEŤOVÁ, Marta - KOCIANOVÁ, Elena - KRIŠTÚFKOVÁ, Zuzana - LABUDA, Milan - MAĎAR, Rastislav - MACHÁČOVÁ, E. - MIKAS, J. - MITROVÁ, Eva - SOLOVIČ, I. - STRAKA, Štefan - ŠTEFKOVIČOVÁ, Mária - ŠPALEKOVÁ, M. - VOLLEKOVÁ, Anna - VÝROSTEKOVÁ, V. *Špeciálna epidemiológia*. Sylvia Bazovská (editor), 2nd edition, Univerzita Komenského v Bratislave, Bratislava, 2017, 366 pp, ISBN 978-80-223-4179-0

2.5.6. Number of published academic course books

N/A

2.5.7. List of joint research laboratories/facilities with universities

[**1**] Cooperation Agreement with the University of Naples Federico II, Naples, Italy focused on bilateral mobility of researchers and PhD students and joint research projects.

[**2**] Cooperation Agreement with the University of Life Sciences in Poznan, Poland. The cooperation is aimed at bilateral mobility of researchers and PhD students and educational activities.

[**3**] Cooperation Agreement with the Faculty of Science, Comenius University in Bratislava; IP SAS is an external educational organization for the study programme **Zoology** guaranteed by the Comenius University.

[**4**] Cooperation Agreement with the University of Veterinary Medicine and Pharmacy in Košice; IP SAS is an external educational organization for the study programme **Parasitic diseases of animals** guaranteed by the University of Veterinary Medicine and Pharmacy.

[**5**] Partnership and Cooperation Agreement between IP SAS and the Faculty of Science and the Faculty of Medicine of the University of Pavol Jozef Šafárik (UPJŠ) in Košice. The cooperation is aimed at joint projects, organizing conferences, carrying out research in laboratories, field works, and teaching university students.

[**6**] Partnership Agreement between the IP SAS and the University of Prešov, Prešov, is focused on the ecology of parasites via operating the joint research and cooperation in education of university students.

2.5.8. Supplementary information and/or comments on doctoral studies and educational activities – focused on what changes have occurred since the last evaluation in 2016

The interest of students to conduct their PhD studies at IP SAS has been constantly high. The Presidium of the SAS is allocating finances (fellowships) for each SAS institution based on the number of supervisors. The number of students in this strategy who can be accepted each year to IP SAS has varied between 2 and 4. IP SAS succeeded in accepting the maximum number of PhD students approved by the Presidium.

In the previous accreditation period of 2012 – 2015, a total of 11 students finished their PhD studies with defence, and six students quit their studies. The overall balance of the PhD programme was much better in the accreditation period of 2016 – 2021. A total 15 students finished their PhD programmes, and only one student did not finish her study due to family reasons (two successive maternity leaves).

The following strategies were accepted at IP SAS to increase the quality of PhD studies in the new accreditation period (2016 – 2021):

- PhD students are evaluated on yearly bases (usually in September). The evaluation is focused on their scientific activities, field work, laboratory experiments, stays abroad, and publication records. Students are encouraged to discuss problems accompanying their PhD studies.
- PhD students are well informed that the number of published papers, which is required by the university for the successful defence of their PhD work (usually 1 or 2), is not sufficient for future acceptance to postdoctoral study at IP SAS. PhD students are consequently finishing their studies with an average of 5 – 6 scientific papers, with the highest number of articles of 13 (in 2018).
- the scientific board of IP SAS is evaluating PhD students in their 4th year of the PhD programme, and the best candidates are recommended for further postdoctoral programmes.
- IP SAS specifies basic requirements for future postdoctoral fellows: a working stay abroad or a publication record suitable for competition for the Štefan Schwarz Fund.

2.6. Societal impact

2.6.1. The most important case studies of the research with direct societal impact, max. 4 for institute with up to 50 average FTE researchers per year, 8 for institutes with 50 – 100 average FTE researchers per year and so on. Structure: Summary of the impact; Underpinning research; References to the research; Details of the impact; Sources to corroborate the impact. One page per one case study

[1] **Title: *Epidemiology, diagnostics, and prevention of* Echinococcus multilocularis *in Slovakia***

Summary of the impact

Long-term epidemiological studies of *Echinococcus multilocularis* in different species of definitive and intermediate hosts, including humans, have been conducted at IP SAS. Localities representing a high risk of human infection were identified. The Laboratory of Human Parasitology places special emphasis on increasing the quality and availability of diagnostics of human alveolar echinococcosis (AE) in the country. Specific antigens of *E. multilocularis* and *E. granulosus* suitable for serological diagnosis of AE (ELISA, Western blot methods) were prepared and subsequently tested for sensitivity, specificity, and suitability in diagnostics in comparison with the most frequently used commercially available kits in Slovakia. Guidelines for the diagnosis of AE and larval toxocarosis were prepared and distributed to physicians and laboratories.

Underpinning research

AE caused by larval stages of *E. multilocularis* is a serious zoonotic disease, lethal in 90 – 100% of cases within 10 – 15 years if left untreated. In 2004, FAO and WHO ranked *E. multilocularis* as the 3rd most important food-borne parasitoses. AE and *E. multilocularis* are studied at IP SAS from different aspects: monitoring the occurrence and spread of the tapeworm in Slovakia, and AE diagnostics. Reliable diagnostic methods are needed because a high level of cross-reactivity was identified between *E. multilocularis* and *E. granulosus* in some frequently used commercial tests in Slovakia. The research at IP SAS led to the validation and application of more specific diagnostic tests in clinical practice.

References to the research

A total of 20 scientific publications and >20 publications aimed at the general public and specialists were published during 2016 – 2022, e.g.:

- Jarošová *et al*. The fox tapeworm, *Echinococcus multilocularis*, in grey wolves and dogs in Slovakia – epidemiology and genetic analysis. Journal of Helminthology, 2020, 94: e168.
- Šnábel *et al*. On the geographic genetic variants of the cestode *Echinococcus multilocularis* with reference to the original descriptions from Bowles et al. (1992) and Bowles and McManus (1993), and their use. Parasitology International, 2020, 75:102039.
- Šimeková *et al*. Contribution to the diagnosis and treatment of life-threatening parasitosis caused by the parasite *Echinococcus multilocularis*. Vector-Borne and Zoonotic Diseases, 2017, 17:225-228.

Details of the impact

- Serological and molecular techniques were standardised and implemented into practice. The methods are widely used at IP SAS to diagnose AE in human patients in collaboration with physicians and diagnostic laboratories throughout the country.
- IP SAS is the only institution in Slovakia providing the molecular diagnosis and confirmation of human cases of alveolar and cystic echinococcosis.

Sources to corroborate the impact

- A survey of the occurrence of *Echinococcus* spp. has been annually provided to the Public Health Authority and the Ministry of Agriculture and Rural Development of the Slovak Republic. Outputs are subsequently included in the Epidemiological Information System.
- Guidelines for the diagnosis of AE and larval toxocarosis were published for physicians and laboratories: ANTOLOVÁ, Daniela. Diagnostics of larval toxocarosis and alveolar echinococcosis in humans. Guidelines. Institute of Parasitology SAS, 2021, ISBN 978-80-89707-10-2, 14 pp.

[**2**] **Title:** ***From dogs to humans via mosquitoes – full-scale epidemiological study of newly emerged canine dirofilariosis in Slovakia***

Summary of the impact

IP SAS has conducted a comprehensive epidemiological survey on a newly emerged helminth zoonosis, dirofilariosis. Highly endemic areas of the infection were identified after the examination of more than 7,000 dogs. Preventive and control measures were developed and implemented under cooperation with veterinary practitioners and pharmaceutical companies. Highly specific procedures for the diagnosis and validation of human subcutaneous, ocular, and pulmonary dirofilariosis were standardised and implemented into practice in collaboration with human practitioners (infectologists and pathologists) and diagnostic laboratories.

Underpinning research

Canine dirofilariosis, caused by *Dirofilaria repens* and *Dirofilaria immitis,* has been considered the fastest spreading parasitic infection of dogs (and humans) in central Europe during the last decade. The distribution of dirofilarial species is affected by the currently highly discussed climate change but also by globally increasing trade, human travel activities, animal migration, and urbanisation. Three partial objectives have been identified in studies at IP SAS. The first objective was focused on dirofilariosis in veterinary medicine and included the full-scale monitoring of dirofilarial species in dogs and wild carnivores. The second research goal, xenomonitoring, was aimed at detecting the spectrum of mosquito vectors transmitting the filarial parasites under the actual ecological conditions of Slovakia. This goal represented the first major research in the field of medical entomology in Slovakia. The third objective was directed to the diagnosis of human infections.

References to the research

More than 20 scientific publications and 20 popularisation papers were published on the topic, e.g.:

- Miterpáková *et al*.: Heartworm on the rise - new insights into *Dirofilaria immitis* epidemiology. In Parasitology Research, 2018, 117:2347-2350.
- Miterpáková *et al*.: *Dirofilaria immitis*. Pulmonary Dirofilariasis, Slovakia. In Emerging Infectious Diseases, 2022, 28:482-485.

Details of the impact

- Awareness of dirofilariosis amongst veterinary and human practitioners, breeders of dogs, and the lay public has greatly increased.
- Diagnostic methods and preventive and therapeutic procedures were standardised and applied to veterinary practice.
- IP SAS provided charitable diagnostics for veterinary practitioners and breeders of dogs.
- IP SAS became the only institution in Slovakia providing molecular diagnostics and confirmation of human cases of dirofilariosis.

Sources to corroborate the impact

- Workshop for veterinary practitioners in cooperation with the companies Bayer Animal Health and Laboklin: https://sk.laboklin.info/wp-content/uploads/Laboklin_22.3.2018-hotove2-PDF.pdf.
- Presentations for the lay public and owners of dogs:
https://vedanadosah.cvtisr.sk/tag/martina-miterpakova/
- The results of a *Dirofilaria* survey were analysed and summarised for the Ministry of Agriculture and Rural Development of the Slovak Republic:
file:///D:/Pouzivatelia/Miterpakova/Downloads/summary_report_of_zoonoses_alimentary_and_water-borne_infections_in_the_slovak_republic_in_2020.pdf

[**3**] **Title:** ***Canine babesiosis, the spread of new*** **Babesia** ***species in Slovakia – new treatment protocol***

Summary of the impact

Babesia canis, a causative agent of canine babesiosis, was molecularly confirmed in naturally infected dogs and tick vectors. An increased number of cases of babesiosis, however, did not respond to traditional antibabesial therapy. Detailed molecular and genetic studies identified the presence of a new species, *Babesia gibsoni*, circulating in the environment and causing infection for which treatment was problematic and accompanied by frequent clinical relapses. IP SAS with the cooperation with the University of Veterinary Medicine and Pharmacy designed an effective and safe therapy for the treatment of babesiosis in dogs naturally infected with *B. gibsoni*. The dogs received a combined therapy that gradually improved the haematological and biochemical parameters of infected animals. Relapses and clinically apparent adverse effects were not reported either during or after treatment. The combined treatment led to the successful elimination of parasitaemia in chronically infected dogs.

Underpinning research

Canine babesiosis was considered an imported tick-transmitted disease until the first case of autochthonous canine babesiosis was detected in Slovakia in 2002. The number of cases has since increased every year. It was found that *Babesia canis* is not the only causative agent of canine babesiosis in Slovakia, indicating the need for differential diagnosis in all dogs with haemolytic anaemia and febrile conditions. IP SAS performed the first molecular characterisation of *B. gibsoni* in dogs, suggesting that *B. gibsoni* was previously probably underdiagnosed in Slovakia. Veterinarians were alerted of a new infection, and accurate identification and therapy were set up.

References to the research

Six scientific papers were published, and many presentations and lectures were given for the general public, e.g.:

- Víchová *et al*. First molecular identification of *Babesia gibsoni* in dogs from Slovakia, central Europe. Ticks and Tick-borne Diseases, 2016, 7:54-59.
- Karasová *et al.* Clinical Efficacy and Safety of Malarone®, Azithromycin and Artesunate combination for treatment of *Babesia gibsoni* in naturally infected dogs. Animals, 2022, 12:708.

Details of the impact

- The differential diagnostics based on molecular identification confirmed the spread of a new species of canine piroplasma.
- Traditional treatment of canine babesiosis was not successful in infections caused by *Babesia gibsoni*.
- A new combined therapy improved the health of infected dogs and led to the successful elimination of parasitaemia in chronically infected individuals. No relapses of infection were observed for more than 720 days after treatment.

Sources to corroborate the impact

Presentations for the lay public and owners of dogs, and interviews for regional newspapers.
https://www.kosiceonline.sk/cudne-spravanie-psa-moze-mat-na-svedomi-babezioza.
The results of a *Babesia* survey were analysed and summarised for the Ministry of Agriculture and Rural Development of the Slovak Republic.

2.6.2. List of the most important studies and/or other activities commissioned for the decision-making authorities, the government and NGOs, international and foreign institutes (title, name of institution, contract value, purpose (max 20 words))

[**1**] Title: ***Summary Report of Zoonoses, Food-Borne and Water-Borne Diseases in the Slovak Republic***
Institution: Ministry of Agriculture and Rural Development of the Slovak Republic, National Contact Point of European Food Safety Authority (EFSA)
Contract value: Without charge
Purpose: IP SAS regularly prepares reports about the occurrence and spread of serious and emerging parasitic diseases. Reported data are published annually.

[**2**] Title: ***Risk assessment of* Toxoplasma gondii *in the food chain***
Institution: EFSA National Contact Point, Ministry of Agriculture and Rural Development of the Slovak Republic
Contract value: 7,000 €
Purpose: Identification of the risk factors of *Toxoplasma gondii* infection based on monitoring of toxoplasmosis in domestic and wild animals aimed at the consumption and food production.

[**3**] Title: ***Education and training of professionals working with laboratory animals***
Institution: State Veterinary and Food Administration of the Slovak Republic
Contract value: Without charge
Purpose: Activity is based on the legislative standards of the Slovak Republic.
Lecturer from IP SAS: HURNÍKOVÁ, Zuzana

[**4**] Title: ***Molecular epidemiology and risk of spread of wildlife parasites under current ecological conditions in Slovakia***
Institution: the State Forests Organisation of the Tatra National Park
Contract value: 2,450 €
Purpose: Monitoring, species identification and genotyping of oribatid mites in selected localities of the Tatra Mountains; detection of developmental stages of Anoplocephalidae tapeworms.

[**5**] Title: ***Proficiency testing of the detection of* Trichinella *larvae in meat***
Institution: State Veterinary and Food Administration of the Slovak Republic
Contract value: 2,381 €
Purpose: IP SAS prepared, organized, and evaluated the proficiency tests of the digestion method of routine after-slaughter meat inspection for zoonotic roundworm *Trichinella* carried out by the certified laboratories.

[**6**] Title: ***Proficiency tests of the detection of* Dirofillaria *spp. in blood samples of dogs***
Institution: State Veterinary and Food Administration of the Slovak Republic
Contract value: Without charge
Purpose: IP SAS prepared, organized, and evaluated the proficiency tests of the detection of *Dirofillaria* microfilariae in blood samples of dogs carried out by the Laboratory of Parasitology and Mycology of the State Veterinary and Food Institute.

2.6.3. List of contracts and research projects with industrial and other commercial partners, incl. revenues (study title, name of institution, contract value, country of partner, purpose (max 20 words))

[**1**] Title: ***Epidemiological research of canine dirofilariosis in the Czech Republic and Slovakia*** – *Contract research*
Institution: BAYER Animal Health Company, Prague, Czech Republic
Contract value: 2,194 €
Country of partner: Czech Republic

Purpose: IP SAS performed full-area screening of dogs for dirofilarial infections on demand of pharmaceutical company BAYER Animal Health.

[**2**] Title: ***Diagnosis of horse parasites (*Anoplocephala *spp. and Cyathostominae)*** *– Research project*
Institution: Austin Davis Biologics Ltd., London, UK
Contract value: Without charge
Country of partner: England
Purpose: Antibodies against intestinal horse tapeworms of the genus *Anoplocephala* and small horse strongyles (cyathostomins) were analysed in samples of serum and saliva from farmed horses throughout Slovakia.

[**3**] Title: ***Parasitological examination of football pitch grass*** *– Contract research*
Institution: Florest Ltd., Malacky, Slovakia
Contract value: 200 €
Country of partner: Slovakia
Purpose: The plant parasitic nematodes were analysed in the grass of the football playground (ŠK Slovan Bratislava Football Club) upon request of Florest Ltd. company.

[**4**] Title: ***Efficiency and safety innovation of the preparation of immunomodulatory product Transfer factor*** *– Research project*
Institution: Imuna Pharm Ltd., Šarišské Michaľany, Slovakia
Contract value: Without charge
Country of partner: Slovakia
Purpose: The commercial product Immodin ("transfer factor") was tested as potential adjuvant in the therapy of parasitic infections in humans and animals.

2.6.4.1 List of intangible fixed assets (internally registered IP (confidential know-how), patent applications, patents granted, trademarks registered) denoting background IPR

N/A

2.6.4.2 List of licences sold abroad and in Slovakia, incl. revenues (background IPR identification, name of institution, contract value, country of partner, purpose (max 20 words))

N/A

2.6.5. Summary of relevant activities, max. 300 words (describe the pipeline of valorization in terms of Number of disclosure, Number of registered IP internally, number of CCR/LIC contracts and their respective summary values, the support you are receiving in specific points internally at the institute, at SAS, externally – also the limitations and drawbacks.

N/A

2.7. Popularisation of Science (outreach activities)

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

• ***selected popularisation publications***

[**1**] JAROŠOVÁ, Júlia - ANTOLOVÁ, Daniela. Parazity v úľoch [Parasites in the hives]. In Quark, 2017, č. 8, s. 44-45. ISSN 1337-8422.

[**2**] RENČO, Marek. Hrčkotvorné háďatká - paraziti mnohých druhov rastlín [Root-knot nematodes - parasites of various plant species]. In Naše pole, 2017, roč. 21, č. 2, s. 32-33. ISSN 1336-2666.

[**3**] JUHÁSOVÁ, Ľudmila - KRÁLOVÁ-HROMADOVÁ, Ivica - BAZSALOVICSOVÁ, Eva. Európu straší fascioloidóza [Europe is frightened by Fascioloidosis]. In Poľovníctvo a rybárstvo, 2017, roč. 69, č. 6, s. 34-35. ISSN 0231-8768.

[**4**] BYSTRIANSKA, Júlia - KORIM, Peter - ŠOLTYS, Jindřich - PAPAJOVÁ, Ingrid. Veterinárna starostlivosť a výskyt ochorení u policajných služobných psov [Veterinary care and the occurrence of diseases in police service dogs]. In Pes a mačka, 2019, roč. XIX, č. 11, s. 35-40. ISSN 1335-7778.

[**5**] KÖNIGOVÁ, Alžbeta. Ivermektín vo veterinárnej a humánnej medicíne [Ivermectine in Human and Veterinary Medicine]. In Lekárnik, 2020, roč. XXV., č. 11, s. 40. ISSN 1335-424X.

- ***popularisation lectures for general public***

[**6**] MITERPÁKOVÁ Martina: Nebezpečné známosti našich psov [Dangerous acquaintances of our dogs]. May 31, 2017. https://vedanadosah.cvtisr.sk/priroda/biologia/video-nebezpecne-znamosti-nasich-psov/

[**7**] PEŤKO, Branislav: About ticks and tick-borne diseases. May 11, 2017.
https://vedanadosah.cvtisr.sk/priroda/biologia/video-obavany-strasiak-leta-kliest/

- ***participation on exhibitions***

[**8**] **The Night of the European Researchers** - The festival of science. IP SAS participated at the event with popularisation lectures and exhibitions in 2016, 2017, 2018, 2019, and 2021.

[**9**] **The Long Night of the Museums and Galleries** - Researchers from IP SAS attended the exhibition in cooperation with the Tatra National Park (TANAP) Museum in 2016 and 2017.

[**10**] **The Day of Fascination with Plants** - The event is organised under the patronage of the European Plant Science Organisation. Researchers from IP SAS participated at the exhibition prepared by the Tatra National Park Museum and the Botanical garden of Tatra nature in 2017.

[**11**] **Agrokomplex Exhibition** - International agricultural and food exhibition, Nitra, Slovakia. In 2018, IP SAS and the partners from Chemosvit Group obtained the Golden Sickle Award for their tick-free yarn "PROLEN TickFREE" in the Research & Innovations category.

[**12**] **Open Day at IP SAS** - The event is organised annually in the framework of the National Science and Technology Week. The high schools students have the opportunity to participate at the lectures and exhibitions prepared by the researchers from IP SAS.

- **Telecommunication media**

[**13**] OROS, Mikuláš: Dangerous parasites of salmon fish. Interview for "Plus 7 dní" - a popular weekly magazine. February 19, 2017. https://plus7dni.pluska.sk/relax/nebezpecne-parazity-cihaju-aj-obycajnom-lososovi

[**14**] ANTOLOVÁ, Daniela: Interview about human parasites. RTVS (Radio and Television, Slovakia; Radio Regina). August 17, 2017. https://www.rtvs.sk/radio/archiv/1541/733035

[**15**] ANTOLOVÁ, Daniela and MITERPÁKOVÁ, Martina: Interviews about zoonotic parasitic infections for the internet-portal "preventivne.sk" (the portal focused on human health administered by the "Všeobecná zdravotná poisťovňa, a.s." - Public Health Insurance Company), 2018.
https://www.preventivne.sk/zaujalo-nas/parazit-ako-rakovina-nakazit-mozete-aj-vo-vlastnej-zahradke.html
https://www.preventivne.sk/zaujalo-nas/ustipol-ho-komar-po-case-si-vytiahol-z-oka-cerva.html

- **Video presentations**

[**16**] HROMADOVÁ, Ivica - The Scientific Podcast. 2021. https://www.youtube.com/watch?v=QQ9EaDs7ZVg

[**17**] HROMADOVÁ, Ivica and ANTOLOVÁ, Daniela: Institute of Parasitology of the Slovak Academy of Sciences - The promotional video. 2021. https://www.youtube.com/watch?v=ZpGQOamzzjQ

2.7.2. Table of outreach activities according to institute annual reports

Outreach activities	2016	2017	2018	2019	2020	2021	total
Articles in press media/internet popularising results of science, in particular those achieved by the Organization	17	18	10	8	8	22	83
Appearances in telecommunication media popularising results of science, in particular those achieved by the Organization	19	5	3	0	2	4	33
Public popularisation lectures	4	13	1	5	0	0	23

2.8. Background and management. Infrastructure and human resources, incl. support and incentives for young researchers

2.8.1. Summary table of personnel

2.8.1.1. Professional qualification structure (as of 31 December 2021)

	Degree/rank				Research position		
	DrSc./DSc	CSc./PhD.	professor	docent/ assoc. prof.	I.	II.a.	II.b.
Male	2	7	2	1	2	5	2
Female	3	21	0	2	3	14	5

I. – director of research with a degree of doctor of science/DrSc.
II.a – Senior researcher
II.b – PhD holder/Postdoc

2.8.1.2. Age and gender structure of researchers (as of 31 December 2021)

Age structure of researchers	< 31		31-35		36-40		41-45		46-50		51-55		56-60		61-65		> 65	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Male	0.0	0.0	2.0	2.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	1.1	0.0	0.0
Female	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	4.0	5.0	5.0	3.0	3.0	2.0	2.0	0.0	0.0

A – number; B – FTE

2.8.2. Postdoctoral fellowships (list of positions with holder name, starting date, duration. Add brief information about each fellow's career path before and after receiving PhD degree, etc.)

2.8.2.1. MoRePro and SASPRO fellowships

N/A

2.8.2.2. Štefan Schwarz fellowships

Note: Until 2017, the Presidium of the SAS provided the Štefan Schwarz fellowship to excellent postdoctoral fellows for four years. After 2017, the fellowship has been given only for two years, with a possible extension for another (3rd) year only to the best students depending on their publication record.

A total of seven holders of the Štefan Schwarz fellowship were at IP SAS. Five students obtained the fellowship for four years, and all but one student completed the fellowship to its full length. Two students obtained the fellowship after 2017, both of whom succeeded in prolonging their fellowships for the 3rd year.

[**1**] Holder name: **BAZSALOVICSOVÁ, Eva**
Duration of the fellowship: May 1st 2012 – April 30th 2016
Completion of the fellowship: 4 years of the fellowship completed

Career path
PHD STUDY: IP SAS
Working stays abroad during PhD study
- Laboratory of Molecular Ecology and Evolution, Institute of Parasitology, Biology Centre, Czech Academy of Sciences, České Budějovice, **Czech Republic**; several short-term stays in 2008, 2009, and 2010
- Department of Entomology, the Natural History Museum, London, **United Kingdom**; short-term stay in 2011

POST-DOC: IP SAS
Working stays abroad after PhD study
- Laboratory of Helminthology and Laboratory of Molecular Ecology and Evolution, Institute of Parasitology, Biology Centre, Czech Academy of Sciences, České Budějovice, **Czech Republic**; 3-months stay in 2012; several short-term stays in 2014, 2015, 2016, 2017, and 2021
- Section for Parasitology, Department of Biomedical Sciences and Veterinary Public Health, Swedish University of Agricultural Sciences, Uppsala, **Sweden**; 1-month stay in 2012; short-term stay in 2015
- Freshwater Fisheries Research Centre of Chinese Academy of Fishery Sciences, Wuxi Fishery College of Nanjing Agricultural University, Wuxi, **China**; short-term stay in 2013
- Instytut Biologii Ssaków, Polska Akademia Nauk, Białowieża, **Poland**; short-term stay in 2017
- Division of Hydrobiology, Ichthyology and Biotechnology of Breeding, West Pomeranian University of Technology, Szczeczin, **Poland**; short-term stay in 2018
- Natural History Museum, Geneva, **Switzerland**; short-term stay in 2018
- Department of Biology, University of Bergen, Bergen, **Norway**; short-term stay in 2018
- Institute for Experimental Pathology, University of Iceland Keldur, Reykjavík, **Iceland**; short-term stay in 2019

CURRENT POSITION: Senior researcher at IP SAS; the Laboratory of Population Genetics

[**2**] Holder name: **ŠPILOVSKÁ, Silvia**
Duration of the fellowship: January 1st 2014 – December 31st 2017
Completion of the fellowship: fellowship not completed due to the termination of the contract of the holder on own request from family reasons (triple maternity leave)

[**3**] Holder name: **ŠALAMÚN, Peter**
Duration of the fellowship: May 1st 2015 – April 30th 2019
Completion of the fellowship: 4 years of the fellowship completed

Career path
PHD STUDY: IP SAS
POST-DOC: IP SAS
CURRENT POSITION: IT company; the contract of the holder with IP SAS was terminated in 2021.

[**4**] Holder name: **OROSOVÁ, Martina**
Duration of the fellowship: January 1st 2011 – June 15th 2019
Completion of the fellowship: 4 years of the fellowship completed
Note: the duration of the fellowship was prolonged owing to 2 interruptions due to 2 maternity leaves: April 28th 2012 – March 31st 2013 and August 13th 2014 – December 31st 2016

Career path
PHD STUDY: University of Veterinary Medicine and Pharmacy, Košice
POST-DOC: Institute of Parasitology, Biological Centre, Czech Academy of Sciences, České Budějovice, Czech Republic; 2.5-years stay (2008-2010)
Working stays abroad after PhD study

- Laboratory of Helminthology, Institute of Parasitology, and Laboratory of Molecular Cytogenetics, Institute of Enthomology, Biology Centre, Czech Academy of Sciences, České Budějovice, **Czech Republic**; several short-term stays in 2011, 2012, 2016, 2017, 2018, 2019, and 2021
- The University of Kansas and Department of Biology, State University of New York, Lawrence, Albany, **USA**; short-term stay in 2011
- Department of Veterinary Medical Sciences, University of Bologna, Bologna, **Italy**; short-term stay in 2017, and 2018
- Department of Arctic and Marine Biology, The Arctic University of Norway, Tromso, **Norway**; short-term stay in 2017
- Department of Molecular Parasitology and Tropical Diseases, Taipei Medical University, Taipei, **Taiwan**; short-term stay in 2018
- Freshwater Fisheries Research Center, Wuxi, **China**; short-term stays in 2018 and 2019
- National Chiayi University, Department of Biological Resources, Chiaya, **Taiwan**; short-term stay in 2019

CURRENT POSITION: Senior researcher at IP SAS; the Laboratory of Ichthyoparasitology

[**5**] Holder name: **URDA DOLINSKÁ, Michaela**
Duration of the fellowship: May 1st 2015 – December 31st 2020
Completion of the fellowship: 4 years of the fellowship completed
Note: the duration of the fellowship was prolonged owing to 2 interruptions due to 2 maternity leaves: May 1st 2015 – August 31st 2015 and September 12th 2016 – January 7th 2018

Career path
PHD STUDY: IP SAS
Working stays abroad during PhD study

- University of Naples Federico II., Napoli Eboli, **Italy**; short-term stay in 2011
- Faculty of Veterinary Medicine, University of Gent, Ghent, **Belgium**; short-term stay in 2011
- Faculty of Veterinary Medicine, Complutense University, Madrid, **Spain**; short-term stay in 2012

POST-DOC: IP SAS
CURRENT POSITION: Senior researcher at IP SAS; the Laboratory of Therapy of Parasitic Infections

[**6**] Holder name: **BRÁZOVÁ, Tímea**
Duration of the fellowship: May 1st 2017 – December 31st 2021
Completion of the fellowship: the initial length of the fellowship was 2 years; the fellowship was extended for one more year; 3 years of the fellowship completed

Career path
PHD STUDY: IP SAS
Working stays abroad during PhD study

- Laboratory of Parasitology, Department of Microbiology and Parasitology, Faculty of Pharmacy, University of Barcelona, Barcelona, **Spain**; short-term stay in 2009
- Laboratory of Electron Microscopy, Institute of Parasitology, Biology Centre, Czech Academy of Sciences, České Budějovice, **Czech Republic**; short-term stays in 2010 and 2011

- Natural History Museum, Department of Mineralogy, Wet Chemistry Laboratory, London, **United Kingdom**; short-term stay in 2010
- I. D. Papanin Institute for Biology of Inland Waters, RAS, Yaroslavl region, Borok, **Russia**; short-term stay in 2012
- Laboratorio de Parasitología CINVESTAV Unidad Mérida, Merida, Yucatán, **Mexico**; short-term stay in 2012
- „Element trace analysis school" – methodological training in the methods of atomic absorption spectrophotometry and microwave decomposition of samples, BRNO – Kohoutovice, **Czech Republic**; short-term stay in 2013

POST-DOC: IP SAS
CURRENT POSITION: Senior researcher at IP SAS; the Laboratory of Ichthyoparasitology

[**7**] Holder name: **BARČÁK, Daniel**
Duration of the fellowship: June 1st 2020 – till present
Completion of the fellowship: the initial length of the fellowship was 2 years; the fellowship was extended for one more year since May 1st 2022

Career path
PHD STUDY: IP SAS
Working stays abroad during PhD study
- Institute of Parasitology, Biology Centre, Czech Academy of Sciences, České Budějovice, **Czech Republic**; short-term stays in 2013, 2015, and 2016
- Faculty of Science, Udon Thani Rajabhat University, Udon Thani, **Thailand**; short-term stay in 2015
- Faculty of Biosciences and Aquaculture, Nord University, Bodø, **Norway;** short-term stay in 2015
- Department of Veterinary Medical Sciences, University of Bologna, Ozzano Dell Emilia, **Italy**; short-term stay in 2016
- Department of Molecular Parasitology and Tropical Diseases, Taipei, **Taiwan**; short-term stay in 2017

POST-DOC: IP SAS
Working stays abroad after PhD study
- Institute of Parasitology, Biology Centre, Czech Academy of Sciences, České Budějovice, **Czech Republic**; short-term stays in 2017, 2018, and 2019
- Department of Animal Physiology, University of Agricultural Science and Veterinary Medicine Cluj-Napoca, Tulcea, **Romania**; short-term stays in 2018 and 2019
- Freshwater Fisheries Research Center, Wuxi, **China**; short-term stays in 2018 and 2019
- Department of Molecular Parasitology and Tropical Diseases, Taipei Medical University, Taipei, **Taiwan**; short-term stay in 2018
- Department of Biological Resources, National Chiayi University, Chiayi, **Taiwan**; short-term stay in 2019

CURRENT POSITION: Researcher at IP SAS; the Laboratory of Ichthyoparasitology

2.8.2.3. Postdoctoral positions from other resources (specify)

N/A

2.8.3. Important research infrastructure introduced during the evaluation period with the information about the sources of funding *(max. 2 pages)*

The vast majority of the infrastructure of the Institute was purchased during the previous evaluation period (2012 – 2015), during which six EU projects were implemented in the Institute. In the last accreditation period, basic equipment was introduced mainly to the laboratories using techniques of molecular biology (e.g. centrifuges, electrophoretic systems, vortex shakers, thermomixers, gradient thermal cyclers, ultra-low freezers, fully automated documentation systems for molecular biology, PCR workstations, and ozonisers). A laboratory studying the molecular ecology of vectors purchased a thermovision camera, a GPS system, a field microscope, climaboxes, and an olfactometer. All equipment was purchased from the VEGA and APVV projects.

The infrastructure of the Institute meets the demands of individual research groups. Infrastructure that is used only occasionally is not based at IP SAS but is used under cooperation with partner academic or

university institutions. High prices, expensive maintenance and service, and the rare/occasional use of the bellow equipment are reasons why sharing this equipment under cooperation or as commercial services is more economical for IP SAS.

Laboratory equipment utilized under cooperation with other institutions or as payed commercial services

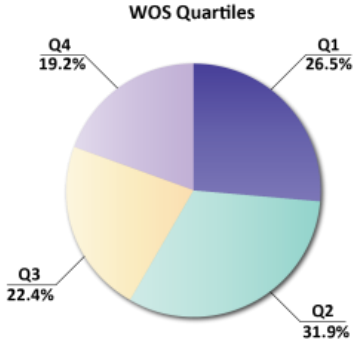
Equipment	Institution	Purpose of utilization
DNA sequencer	University of Veterinary Medicine and Pharmacy, Košice Faculty of Science, Comenius University, Bratislava	Sanger sequencing of DNA fragments; fragment analysis of microsatellite loci
NGS sequencer	Faculty of Science, Comenius University, Bratislava	Microsatellite library screening
Confocal laser scanning microscope	Faculty of Science, University of P. J. Šafárik, Košice	3-D reconstruction of nervous system, secretory glands and excretory system tapeworms
Gas chromatograph	State Veterinary and Food Institute, Košice	Chemical analysis of polychlorinated biphenyl congeners
Flow cytometer	University of Veterinary Medicine and Pharmacy, Košice	Cell populations phenotyping; quantitative determination of the phagocytic activity and the oxidative burst activity of leukocytes

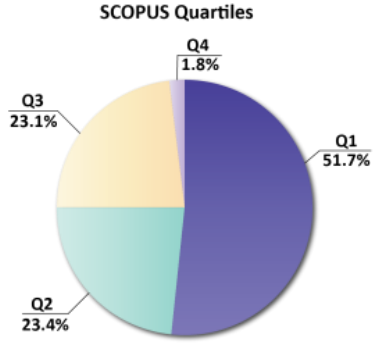
In contrast, IP SAS is providing a **scanning electron microscope** to colleagues from the Faculty of Science, University of P. J. Šafárik, Košice, and from the University of Veterinary Medicine and Pharmacy, Košice. The microscope can capture detailed pictures of conductive surfaces of both dehydrated biological and non-biological samples with an approximate magnification up to 20,000×.

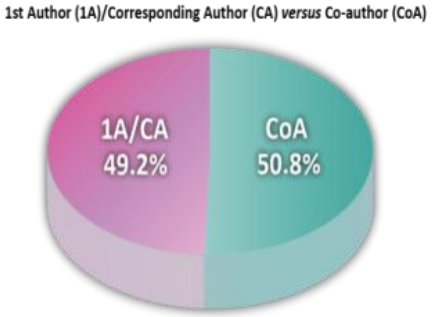
2.9. Supplementary information and/or comments on all items 2.1 – 2.8 (max. 2 pages in total for the whole section)

• ***Summary of publication activity during 2016 – 2021***

A total of **338** scientific papers were published in journals registered in the Current Contents Connect, Web of Science Core Collection, and Scopus (categories ADCA, ADCB, ADDA, ADDB, ADMA, ADMB, ADNA, and ADNB) during 2016 – 2021. Each IP SAS publication is categorised by the central library of SAS according to the quartiles (Q) based on the Web of Science (WoS) and Scopus databases. According to **WoS**, the majority of scientific papers belonged to category Q2 (31.9%), but the number of papers of categories Q1 and Q3 was more balanced, at 26.5% and 22.4% respectively. The lowest number of papers were published in Q4 journals (19.2%). Category Q1+Q2 represented 58.4%. Categorisation based on **Scopus** differed markedly; the vast majority of papers were published in Q1 journals (51.7%), and the number of papers published in Q2 and Q3 journals was similar (23.4% and 23.1%, respectively). Only 1.8% of the papers were published in Q4 journals. Category Q1+Q2 represented 75.1%. The ratio between the number of publications authored by researchers from IP SAS (first and/or corresponding author from IP SAS) was well balanced with the number of publications in which IP SAS scientists were co-authors within Slovak or international teams of researchers (49.2 vs 50.8%, respectively).







• ***Comparison of publication activity for 2016 – 2021 with the previous accreditation period***

2012 – 2015 (4 year period)			2016 – 2021 (6 year period)		
Publications*	Average FTE	Publication/researcher/year	Publications*	Average FTE	Publication/researcher/year
193	**33.4**	**1.44**	**338**	**28.67**	**1.96**

* categories ADCA, ADCB, ADDA, ADDB, ADMA, ADMB, ADNA, ADNB

The average number of **1.44** publications/researcher/year for the accreditation period 2012 – 2015 increased to **1.96** in the accreditation period 2016 – 2021.

The median impact factor (MIF) for the field of Parasitology is **2.285** (October 2021). IP SAS researchers published in the following journals with IF>3 in the accreditation period 2012 – 2015:

- IF 4 – 5: Ecography, Eurosurveillance, PloS Neglected Tropical Diseases
- IF 3 – 4: International Journal for Parasitology, Parasites and Vectors, Infection Genetics and Evolution

The number and range of journals with a higher IF was broader in the accreditation period 2016 – 2021:

- IF 8 – 9: Emerging Infectious Diseases, Environmental Pollution
- IF 7 – 8: Eurosurveillance
- IF 5 – 6: Scientific Data
- IF 4 – 5: Soil Biology & Biochemistry, Science of the Total Environment, Chemosphere, Molecular Phylogenetics and Evolution, Scientific Reports, International Journal for Parasitology, Journal of Biogeography
- IF 3 – 4: PloS Neglected Tropical Diseases, Advances in Parasitology, Biodiversity and Conservation, Frontiers in Veterinary Science, Global Ecology and Conservation, Parasites and Vectors, Ticks and Tick-borne Diseases, Forest Ecology and Management, Acta Tropica

• ***International cooperation***

IP SAS has been cooperating with scientists throughout Europe in four dominant fields:

[**1**] the morphology, phylogeny, population genetics, and cytogenetics of fish parasites has been studied under strong cooperation with the Institute of Parasitology, Biology Centre, Czech Academy of Sciences, České Budějovice, Czech Republic; 31 common publications were published during 2016 – 2021, e.g.:

• KUCHTA, Roman** - **OROS, Mikuláš** - FERGUSON, Jayde - SCHOLZ, Tomáš. *Diphyllobothrium nihonkaiense* tapeworm larvae in salmon from North America. In Emerging Infectious Diseases, 2017, vol. 23, no. 2, p. 351-353. (2016: **8.222** - IF, **Q1** - JCR, 3.428 - SJR, **Q1** - SJR). ISSN 1080-6040. https://doi.org/10.3201/eid2302.161026

• KUCHTA, Roman** - **RADAČOVSKÁ, Alžbeta** - **BAZSALOVICSOVÁ, Eva** - VIOZZI, Gustavo - SEMENAS, Liliana - ARBETMAN, Marina - SCHOLZ, Tomáš. Host switching of zoonotic broad fish tapeworm (*Dibothriocephalus latus*) to Salmonids, Patagonia. In Emerging Infectious Diseases, 2019, vol. 25, no. 11, p. 2156-2158. (2018: **7.185** - IF, **Q1** - JCR, 3.140 - SJR, **Q1** - SJR). ISSN 1080-6040. https://doi.org/10.3201/eid2511.190792

[**2**] the molecular ecology of ectoparasites (vectors), pathogens, and their hosts (small mammals) have been common scientific topics at IP SAS and following institutions:

- Institute of Parasitology, Biology Centre, Czech Academy of Sciences, České Budějovice, Czech Republic
- I. I. Schmalhausen Institute of Zoology of National Academy of Sciences of Ukraine, Kyiv, Ukraine
- W. Stefański Institute of Parasitology of Polish Academy of Sciences, Warsaw, Poland
- Wroclaw University of Environmental and Life Sciences, Wroclaw, Poland
- Mitrani Department of Desert Ecology, Swiss Institute of Dryland Environmental, Negev, Israel
- Energy Research, Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Israel
- Faculty of Natural Sciences, Vytautas Magnus University, Kaunas, Lithuania, and others.

43 common publications were published during 2016 – 2021, e.g.:

• SURKOVA, Elena N. - KORALLO-VINARSKAYA, Natalia P. - VINARSKI, Maxim V. - **STANKO, Michal** - WARBURTON, Elizabeth M. - MESCHT, Luther van der - KHOKHLOVA, Irina S. - KRASNOV, B. R.**. Sexual size dimorphism and sex ratio in arthropod ectoparasites: contrasting patterns at different hierarchical scales. In *International Journal for Parasitology*, 2018, vol. 48, no. 12, p. 969-978. (2017: **3.078** - IF, **Q1** - JCR, 1.638 - SJR, **Q1** - SJR). ISSN 0020-7519. https://doi.org/10.1016/j.ijpara.2018.05.006

• MÁCOVÁ, Anna - HOBLÍKOVÁ, Aneta - HYPŠA, Václav - **STANKO, Michal** - MARTINŮ, Jana - KVIČEROVÁ, J.**. Mysteries of host switching: Diversification and host specificity in rodent-coccidia associations. In *Molecular Phylogenetics and Evolution*, 2018, vol. 127, p. 179-189. (2017: **4.412** - IF, **Q1** - JCR, 2.088 - SJR, **Q1** - SJR). ISSN 1055-7903. https://doi.org/10.1016/j.ympev.2018.05.009

[**3**] the molecular taxonomy, diagnostics, treatment, phylogeny, spatial distribution, and biogeography of *Echinococcus multilocularis* and *Echinococcus granulosus* have been studied under an extensive multilateral collaboration between IP SAS and experts from many countries across Europe; 11 common publications were published during 2016 – 2021, e.g.:

• DEPLAZES, P. - RINALDI, Laura - ALVAREZ ROJAS, Cristian A. - TORGERSON, Paul R. - HARANDI, Majid Fasihi - ROMIG, Thomas - **ANTOLOVÁ, Daniela** - SCHURER, Jana M. - LAHMAR, Samia - GRINGOLI, Guiseppe - MAGAMBO, Japhet K. - THOMPSON, Andrew - JENKINS, Emily J. Global distribution of alveolar and cystic echinococcosis. In *Echinococcus and Echinococcosis*. 1st edition, Netherlands, Elsevier L.t.d. Academic Press, 2017, 315-493. ISBN 978-0-12-811471-1. https://doi.org/10.1016/bs.apar.2016.11.001

• KINKAR, Liina - LAURIMÄE, Teivi - BALKAYA, Ibrahim - CASULLI, Adriano - ZAIT, Houria - IRSHADULLAH, Malik - SHARBATKHORI, Mitra - MIRHENDI, Hossein - ROSTAMI-NEJAD, Mohammad - PONCE-GORDO, Francisco - REHBEIN, Steffen - KIA, Eshrat Beigom - SIMSEK, Sami - **ŠNÁBEL, Viliam** - UMHANG, Gérald - VARCASIA, Antonio - SAARMA, Urmas**. Genetic diversity and phylogeography of the elusive, but epidemiologically important *Echinococcus granulosus* sensu stricto genotype G3. In *Parasitology*, 2018, vol. 145, no. 12, p. 1613-1622. (2017: **2.511** - IF, **Q2** - JCR, 1.194 - SJR, **Q1** - SJR). ISSN 0031-1820. https://doi.org/10.1017/S0031182018000549

[**4**] anthelmintic resistance and the treatment of farm animals have been common topics of IP SAS and European partners involved in several COST actions; 23 common publications were published during 2016 – 2021, e.g.:

• RAISOVÁ STUCHLÍKOVÁ, Lucie - MATOUŠKOVÁ, Petra - VOKŘÁL, Ivan - LAMKA, J. - SZOTÁKOVÁ, Barbora - SEČKAŘOVÁ, Anna - DIMUNOVÁ, Diana - NGUYEN, Lin Thuy - **VÁRADY, Marián** - SKÁLOVÁ, Lenka**. Metabolism of albendazole, ricobendazole and flubendazole in *Haemonchus contortus* adults: Sex differences, resistance-related differences and the identification of new metabolites. In *International journal for Parasitology : Drugs and Drug Resistance*, 2018, vol. 8, no. 1, p. 50-58. (2017: **3.030** - IF, **Q1** - JCR, 1.556 - SJR, **Q1** - SJR). ISSN 2211-3207. https://doi.org/10.1016/j.ijpddr.2018.01.005

• BOSCO, Antonio - KIEßLER, Jan - AMADESI, Alessandra - **VÁRADY, Marián** - HINNEY, Barbara - IANNIELLO, Davide - MAURELLI, Maria Paola - CRINGOLLI, Giuseppe - RINALDI, Laura**. The threat of reduced efficacy of anthelmintics against gastrointestinal nematodes in sheep from an area considered anthelmintic resistance-free. In *Parasites & vectors*, 2020, vol. 13, art. no. 457. (2019: **2.824** - IF, **Q1** - JCR, 1.406 - SJR, **Q1** - SJR). ISSN 1756-3305. https://doi.org/10.1186/s13071-020-04329-2

3. Implementation of the recommendations from the previous evaluation period

Recommendations from the previous evaluation periods were:
[**1**] Obtaining relatively stable funding for the Institute is important.
[**2**] Good young PhDs should obtain grants to get postdoctoral positions elsewhere and then be able to return. They should obtain resources to establish their own research groups.
[**3**] An international advisory board should be established.

[**1**] In addition to the national budget, the main source of finances are the VEGA and APVV projects. IP SAS participated in 15 APVV (in 8 projects as the coordinator and in 7 projects as the partner) projects during 2016 – 2021. A total of **1,765,854 €** were alocated to IP SAS from APVV projects during 2016 – 2021, enabling research activities of all 10 laboratories. Twenty-four VEGA projects (in 21 projects as the coordinator and in 3 projects as the partner) were conducted at IP SAS during 2016 – 2021. The total acquired finances from VEGA projects was **568,458 €.**

A total of **28,000** € was obtained for paid services and expertise, mainly diagnostics and proficiency tests during 2016 – 2021. The profit from the services provided by IP SAS is mainly used for purchasing consumables for laboratories involved in the services.

[**2**] **Miroslava Vargová** is a young researcher in the Laboratory of Immunology, whose research is orientated towards various mechanisms of the innate and acquired immune responses of hosts and parasites. The laboratory has recently focused on the study of the immunomodulatory properties of various probiotic strains and their products (bacteriocins) in intestinal parasitic infections.

Miroslava Vargová participated in a one-year working stay (February 2020 to February 2021) for her PhD at the laboratory of Professor Sung Ouk Kim at the Department of Microbiology and Immunology, The Schulich School of Medicine – Dentistry, University of Western Ontario, London, Ontario, **Canada**. The stay was financially supported by the National Scholarship Programme of the Slovak Republic. The laboratory in Canada is focused on the immunological and signalling mechanisms of macrophages in response to various microorganisms, tissue damage, and cancer. Prof. Kim is a leading scientist in the study of the immunomodulatory properties of probiotic organisms and their effects on intestinal immunity. His team elucidated the signalling and molecular mechanisms that induce the production of immunoregulatory factors in intestinal macrophages and affect inflammation in the gut.

The research by Miroslava Vargová in Canada focused on (i) the principles of signalling mechanisms of innate immunity cells activated by bacterial strains and their products (bacteriocins), and (ii) the effect of the excretory-secretory antigens of the roundworm *Trichinella spiralis* on immune cells and signalling pathways. She gained experience with new progressive methodologies and immunological techniques such as cell immunophenotyping, immunohistological cell labelling, co-stimulatory expression markers, detection of signalling mechanisms, and epigenetic methodologies and modifications such as DNA methylation and post-translational histone processing. She studied the role of epigenetic modification (enterocins, *T. spiralis* antigen) in regulating macrophage phenotype during the probiotic treatment of trichinelosis with enterococci.

Miroslava Vargová returned to IP SAS in February 2021 and successfully defended her PhD thesis at the University of Veterinary Medicine and Pharmacy in Košice in January 2022. She was accepted as a postdoctoral fellow by IP SAS on February 2022 to implement her skills and knowledge gained in Canada in the Laboratory of Immunology, mainly in the field of epigenetic modifications in the regulation of the dendritic cell phenotype in *T. spiralis* infection. She is a prospective candidate for the Štefan Schwarz fellowship.

Young researchers are encouraged to conduct working stays abroad. Holders of the Štefan Schwarz fellowship (for details see 2.8.2.2.) have participated in several working stays abroad (Europe, North America, and Asia), and only those who spent some time in laboratories abroad were accepted to IP SAS as researchers.

[**3**] The advisory board of IP SAS was established and includes experts in various fields of parasitology (for details see 1.4.1.). The following recommendations were proposed by the advisory board:

• ***Research of zoonotic parasites should be exploited by including protozoa such as*** **Giardia** ***and*** **Cryptosporidium**

Implementation of the recommendation:

The Laboratory of Environmental Parasitology implemented the detection of *Giardia* and *Cryptosporidium* in humans, domestic animals (dogs and cats), and wildlife (European beaver) using a combined coprological (microscopy) and molecular (PCR identification and sequence analysis) approach. The first data on the topics were already published. Júlia Bystrianska Šmigová, a postdoctoral fellow in the laboratory, participated in a 3-month working stay at the Department of Parasitology, Faculty of Medicine, University of Rome, Rome, Italy. She was trained in molecular and bioinformatical methods applicable to more extensive genetic analyses of *Gardia* and *Cryptosporidium,* which are planned to be implemented at IP SAS.

• ***Sufficient resources should be available for the continuous development of diagnostic methodology***

Implementation of the recommendation:

The Laboratory of Human Parasitology, Laboratory of Veterinary Parasitology, and Laboratory of Molecular Ecology of Vectors have been constantly developing and validating new and more-specific methods for the diagnosis of the causative agents of parasitic diseases of humans and other animals. The *de novo* design and validation of new methods is mainly financed by scientific grants. The expenses of laboratories dealing with diagnostics are covered by the financial profits of IP SAS from commercial services, as well. IP SAS has a clear strategy to support this type of research and its further implementation into practice.

• ***Studies of novel developments in the non-chemical prophylaxis and control of parasitic diseases should be increased***

Implementation of the recommendation:

Traditional pharmacological therapy combined with the application of natural plant additives are promising as effective future antiparasitic treatments, and IP SAS aims to continue with this type of study. Natural compounds and their anthelmintic effects have been studied in the Laboratory of Experimental Pharmacology, in which parallel *in vitro* and *in vivo* experiments determined the effect of a combination of various plant mixtures as feed additives. Animal performance, parasitological status, haematological parameters, and antioxidant status in lambs experimentally infected with the gastrointestinal parasite *Haemonchus contortus* were monitored. Herbal nutrition therapy has contributed to increasing the resistance of lambs and the subsequent elimination of worms in experimentally infected lambs.

The Laboratory of Experimental Pharmacology also focuses on screening the antiparasitic activity of natural compounds that represent secondary metabolites from higher plants and lower organisms (e.g. lichens and algae) using in vitro parasitic models. Promising data were obtained for the flavonoid silymarin (flavonolignans silybin, silychristin, and dehydrosilybin), carotenoid astaxantin, atranorin isolated from lichens, and leukocytes extracted from human blood donors (immodin), which interfere specifically with protein membrane receptors on worms, mitochondrial enzymes involved in respiration and the generation of ATP, and enzymes involved in the metabolism of xenobiotics and drugs. The combined therapy was more effective than traditional pharmacologic treatments.

• ***Expanding investigations of parasite communities to other host species (amphibians) would be interesting***

Implementation of the recommendation:

The Laboratory of Population Genetics has focused on studies of the origin and migratory routes of medically and veterinarily important parasites of humans, ruminants, and fish. The laboratory began to extend its study by implementing a novel group of hosts, anurans, i.e. frogs and toads. These animals are amongst the most globally threatened taxonomic groups, so they must be studied with special permission from the corresponding governmental organisations. Anurans have a rich fauna of parasites, but their diversity in Slovakia is not known. Anurans are also intermediate hosts of medically important diphyllobothriid tapeworms of the order *Spirometra*, which are causative agents of the serious parasitic diseases sparganosis and spirometrosis in humans. The Laboratory of Population Genetics has broad

experience with diphyllobothriid tapeworms (*Dibothriocephalus latus* and *D. dendriticus*), which can be directly applied in studies of *Spirometra*.

• ***Expanding the scope of studies of the transmission of various groups of parasites between domestic and wild animals would be interesting***

Implementation of the recommendation:

The Laboratory of Veterinary Parasitology has focused on newly emerged parasites potentially transmitted from wildlife to companion and domestic animals. The current scientific orientation of the laboratory has focused on rodents, which represent a high risk of transmission of parasitic and bacterial diseases from wildlife to domestic animals and humans and are amongst the most successful urbanised species. Two model localities with various types of landscapes (urban and rural) were chosen in Tatra National Park, the main recreational Slovak area with high densities of people, domestic animals, and wildlife.

4. Research strategy and future development of the institute for next five years

(Recommended 3, max. 5 pages) **Research strategy of the institute in the national and international contexts, objectives, and methods (including the information on when the strategy was adopted)**

The strategy of IP SAS is to adopt new approaches and directions for developing the research branches which have a long tradition in the Institute and in which the IP SAS maintains its leading position in Slovakia or in Europe: systematics and population genetics of multicellular parasites; diagnostics, epidemiology and ecology of parasites of humans, animals, and plants; immunology, pharmacology and treatment of parasitic diseases; vectors and vector-borne diseases; and environmental parasitology. The interdisciplinary "one health concept" of the Institute will continue by studying a broad range of parasites of humans, animals, plants, and environment. The particular novel methods or parasitic models, which are planned to be implemented in the coming years, are indicated below.

Proportional basic and applied research was proved to be a good strategy covering the international importance and the national impact. IP SAS has an ambition to publish in a high quality journals and to maintain the publication activity of researchers. In the same time, we will keep our long-term and start new cooperations and agreements with educational institutions, public-health institutions, governmental institutions, and private companies documenting an important position of IP SAS in Slovakia.

The international cooperation with our partners in Europe but also in North America and Asia is well developed. However, we have to encourage young researcher to apply for more fellowships enabling working stays abroad. In the same time, long-term stays of foreign PhD students or young researchers would be welcome.

The ***Laboratory of Human Parasitology*** will continue the study of zoonotic parasites, especially *Echinococcus* spp., *Hymenolepis* spp., *Taenia* spp., *Toxocara* spp., *Trichinella* spp., and the protozoan parasite *Toxoplasma gondii*. Both *Echinococcus* species have been in Slovakia for a long time, but little is known about the species composition and genetic polymorphism of *E. granulosus* sensu lato in the country. Novel data on the genetic polymorphism of *E. granulosus* will be obtained to compare and correlate genetic and epidemiological data for *Echinococcus* spp. with different levels of infectivity. Molecular methods will be applied for the determination of a reliable taxonomy, host specificity, and the causative agents of hymenolepiasis in humans and other animals. A case of the malignant transformation of *Hymenolepis nana* in an immunocompromised HIV-positive patient was published in 2015. The genetic analyses identified six mutations, five of which were associated with protein-coding changes linked with a higher infectivity and lethal outcome of the disease. Future genetic analyses of *H. nana* from humans and other animals will enable us to identify the specific genotype of *H. nana* associated with infectivity and pathology of the parasitosis.

Beekeeping has a long tradition in Slovakia and is very important for agriculture and for the complex balance of conservation in nature. Bee colonies have suffered large losses worldwide in recent decades. Various factors, including parasitic pathogens, can be responsible for the collapse of bee colonies. Some parasites (e.g. *Varroa destructor*, *Nosema apis*, *Nosema ceranae*, *Lotmaria passim*, and *Crithidia mellificae*) are considered possible causes of winter losses of colonies. Some laboratory members have long-term experience with beekeeping, so the laboratory will also focus on the occurrence, epidemiology, and genetic variability of various parasites of bees in Slovakia, aiming to identify a correlation between the presence of pathogens and the status of colony health.

The ***Laboratory of Veterinary Parasitology*** The irreversible changes in habitats linked with the higher risk of transmission of parasites from wildlife to domestic animals and humans are direct consequences of the escalating trend of urbanisation. Rodents are amongst the most successful urbanised species, and rural and urban human communities regularly struggle with rodent overpopulation. The helminth fauna of rodents therefore needs to be studied in detail in order to control the possible spread of parasitic and bacterial diseases from rodents to humans. The epidemiological study of canine and feline vector-borne infectious diseases will continue, with special emphasis on central and eastern Europe and on newly spreading parasitic species such as *Leishmania* spp. and *Hepatozoon* spp. The societal impact of the research will be to ensure, with the cooperation of veterinary surgeons, the development of new therapeutic approaches against vector-borne parasites.

The ***Laboratory of Ichthyoparasitology*** will integrate standard approaches (alpha taxonomy, light microscopy, and scanning electron microscopy) with advanced microscopic tools (laser scanning microscopy) and molecular methods (environmental DNA) in the detection of parasites. Large-scale surveys will focus on water-borne parasitic diseases and invasive parasites, especially in commercially important fish species. Monitoring the distribution of fish pathogens in commercial fisheries will have a practical application for aquaculture. The possible impact of the polluted environment in eastern Slovakia will be correlated with the macro- and microstructures of chromosomes of fish parasites. The distribution and amount of repetitive DNA in parasite genomes will be studied using RepeatExplorer and Tandem Repeat Finder software. The functional morphology of fish parasites will be studied using the immunofluorescent detection of neuroactive substances in the nervous system, frontal glands, and excretory system, whose secretory/excretory products play key roles in host-parasite relationships. The bioaccumulation of pollutants by fish parasites will be studied using various models to understand the biological mechanisms responsible for the uptake and storage of toxins in parasite tissues. The possible link between unfavourable environmental conditions and the occurrence of B chromosomes and morphological abnormalities in fish parasites will be investigated.

The ***Laboratory of Plant Nematology*** has priorities for the future sustainability of agriculture, forestry, and the biosphere. Modern agriculture faces major challenges as the world's demands for food increase calls for more strict measures to protect and preserve our environment and natural resources. The effects of ecological intensification on functional diversity, plant protection, and food quality/quantity will be evaluated together with strategies of agricultural production, pest invasion, and climatic extremes across Europe. The study of soil microbiota and soil nematodes in natural forest ecosystems will provide important recommendations for soil protection and biodiversity. New molecular data on nematode communities in deciduous and temperate coniferous forest ecosystems will provide information on the occurrence of plant parasitic species and potential hazards to forests in Europe. The basic issues of soil and plant ecology will be studied with emphases on the species diversity and structure of soil nematode communities, the functional diversity of microorganisms, the structure of vegetation, and their interactions in natural ecosystems. Soil nematodes and microorganisms will be used as indicators of the soil environment in uninvaded and invaded ecosystems.

The ***Laboratory of Environmental Parasitology*** will focus on applying multiple criteria of spatial phenomena to evaluate the occurrence and spread of parasitic diseases. Innovative molecular tools will be applied for the species-specific identification and genotyping of intestinal parasites with zoonotic potential. Special attention will be paid to unicellular protists, the causative agents of cryptosporidiosis, giardiasis, and blastocystosis. The genetic variability of parasites will be evaluated by the bioinformatics methods. Research on the impact of environmental and socioeconomic factors on the spread of important sanitary microorganisms and on the quality of soil and water resources in areas at risk will be continued. Preventive environmental, health, and medical measures reducing the risk of the spread of microbial and parasitic organisms in the environment will be studied in cooperation with local governments and the private sector.

The ***Laboratory of Immunology*** will focus on more-detailed research of macrophages, an important factor regulating the immune system, having a central role in turning innate immune responses into adaptive responses and playing a key role in resistance to infections with helminths, including *Trichinella spiralis*. The interactions between beneficial microbiota, macrophages, and parasites in the host represent a very active system where all components play a relevant role in modulating each other and in the maintenance of homeostasis important for the health of the host. The future research of the laboratory will focus on the signalling pathways in macrophages affected by the parasite and beneficial bacteriocin-producing strains. The study of the immunomodulatory activity of probiotic bacteria/bacteriocins on macrophage function can identify their potential role in the control of trichinellosis.

The ***Laboratory of Population Genetics*** will proceed with studies of the origin and migratory routes of diphyllobothriid tapeworms using mtDNA and microsatellites. The novelty of the research will be the application of double-digest RAD sequencing (ddRAD-Seq), a strategy for sequencing fractional genomes designed to efficiently identify and score genetic variants across any genome. Except for new methodologies, the laboratory plans to enlarge the spectrum of model parasites and will focus on flies from the family Hippoboscidae (Diptera), obligate haematophagous ectoparasites distributed worldwide. The goal of the research team is to define the genetic structure and variability of hippoboscids from Slovakia.

Vector-transmissible pathogens and vector competency for infectious agents will be determined in louse flies, which are vectors for some important pathogens. Anurans (frogs and toads) are amongst the most globally threatened taxonomic groups having a rich parasite fauna. Several studies have provided information about the diversity of parasites of amphibians in diverse ecological settings in Europe, but information for Slovakia is limited. The parasite fauna of the common toad *Bufo bufo* (Amphibia: Bufonidae) from various localities in Slovakia will be estimated. The potential role of amphibians as transmitters of zoonotic parasites (e.g. *Spirometra*, causative agents of sparganosis and spirometrosis in humans) will be assessed.

The ***Laboratory of Experimental Pharmacology*** will focus on miRNAs as regulators of gene expression that have been linked with the pathogenesis of several human diseases, including cancer. An in vitro system for cultivating *Echinococcus multilocularis* protoscolexes will be established in an axenic cultivation system and used to study direct concentration-dependent effects of the anthelmintic albendazole (ABZ) and its active metabolite ABZ sulphoxide on the profile of secreted parasite-specific miRNAs and the expression of genes linked to asexual proliferation in parasites. The laboratory will focus on the expression of four parasite-specific circulating miRNAs that were detected in experimental murine alveolar echinococcosis. Denaturing SDS-PAGE and Western Blotting for analysing the production of selected protein markers have already been introduced in the laboratory. Chemiluminescent detection and densitometry will be introduced to quantify protein production after normalisation to beta-actin. Described methodical procedures will be selected to identify effective miRNAs and their functions to better understand parasite physiology and to investigate the potential role of parasite-derived regulatory RNAs in the promotion of myeloid suppressor cells during infection.

The ***Laboratory of Therapy of Parasitic Infections*** will take two directions of research. The first focus will be on diseases of small ruminants caused by parasitic nematodes and the associated emergence, detection, and spread of resistance to macrocyclic lactones and the main representative - ivermectin. The spread of resistance to macrocyclic lactones in parasites will be determined on sheep and goat farms throughout Slovakia using the most sensitive *in vivo* and *in vitro* methods. The amounts of ivermectin residues in foods that are preferentially used for human consumption will be examined. The control of gastrointestinal parasites is usually limited to the repeated use of anthelmintics, which has led to the development of anthelmintic resistance. Bioactive compounds of plant origin, known as plant secondary metabolites (PSMs), are alternatives to anthelmintics. In addition to their anthelmintic activity, PSMs can modulate ruminal fermentation and affect methanogenesis. Special importance will be attributed to the effect of feed additives on the microbiome and parasites of the rumen to reduce methanogenesis in infected animals. The effect of chicory and nanoparticles of zinc oxide on methane production by lambs infected with *Haemonchus contortus* will be investigated. PSMs of chicory and nanoparticles of zinc oxide are assumed to mitigate methane production by affecting the population of ruminal methanogens. Two long-term *in vivo* experiments will be conducted, one with chicory and one with nanoparticles of zinc oxide as the sources of PSMs, to evaluate the effect of PSMs and trace elements on experimentally infected animals.

The ***Laboratory of Molecular Ecology of Vectors*** will continue studies of the tick-borne encephalitis virus and newly emerged species of vectors, vector-transmitted pathogens, and reservoir hosts. The role of parasitoid wasps as a potential biological control against the survival of ticks and the spread of the wasps in the environment will be studied. The research will focus on the possible negative or positive effects of the wasps on other species of pathogens in tick vectors. In vitro cultures of local strains of *Babesia canis* and *Babesia gibsoni* (agents of canine babesiosis) will be established for detailed genetic studies of these unicellular parasites. These genetically diverse strains have distinct pathogenicities that complicate the treatment of infection and that strongly influence therapeutic responses. The *in vitro* cultivation of local canine piroplasms and the further isolation of antigens or attenuated strains could help us to improve the effective immunoprophylaxis of babesiosis and to establish a basis for the development of an effective vaccine.

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