Molecular biology of parasites and diagnosis of parasitic diseases

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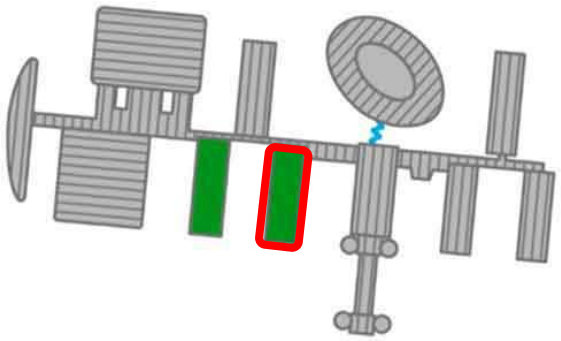

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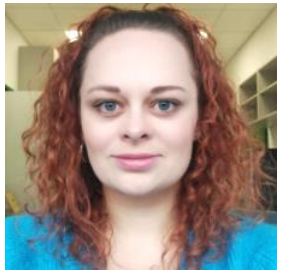
TEAM

Mgr. Nikol Reslová, Ph.D.
Diagnostics of helminths.

Mgr. Lucie Škorpíková, Ph.D.
Molecular diagnostics of food borne parasites.

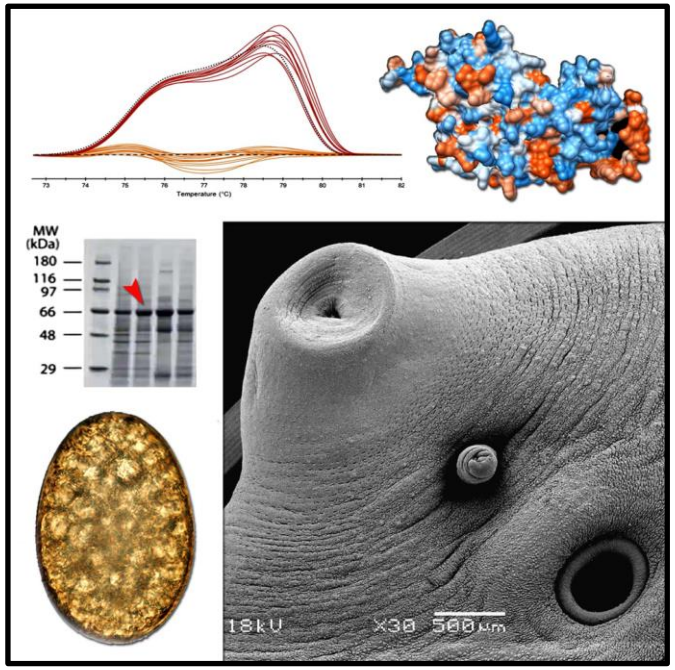


Mgr. et Mgr. Jana Ilgová, Ph.D.
Characterization of protein molecules of helminths.

Mgr. Jiří Vorel, Ph.D.
The bioinformatic analyses.

Molecular biology of parasites and diagnosis of parasitic diseases

The scientific activities of our group encompass long-term research in the field of molecular biology of parasites. Our focus is primarily on the identification and **molecular/biochemical/immunological characterization of functional molecules** and their role in essential biological processes of the parasite or their involvement in host interactions. By elucidating the molecular basis of the studied organisms, we strive to contribute to the **improvement of diagnostic methods**, which are currently inadequate.



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Experimental organisms:

The organisms included in our experiments are **representatives of parasitic worms** such as **monogeneans** (e.g., Diplozoon paradoxum, Eudiplozoon nipponicum), **flukes** (e.g., *Schistosoma mansoni*, *Fasciola hepatica*, *Fascioloides magna*), **tapeworms** (e.g., *Hymenolepis diminuta*), and **nematodes** (e.g., *Trichinella genus*, gastrointestinal trichostrongylid nematodes, **entomopathogenic nematodes** of the *Heterorhabditis* and *Steinernema* genus).

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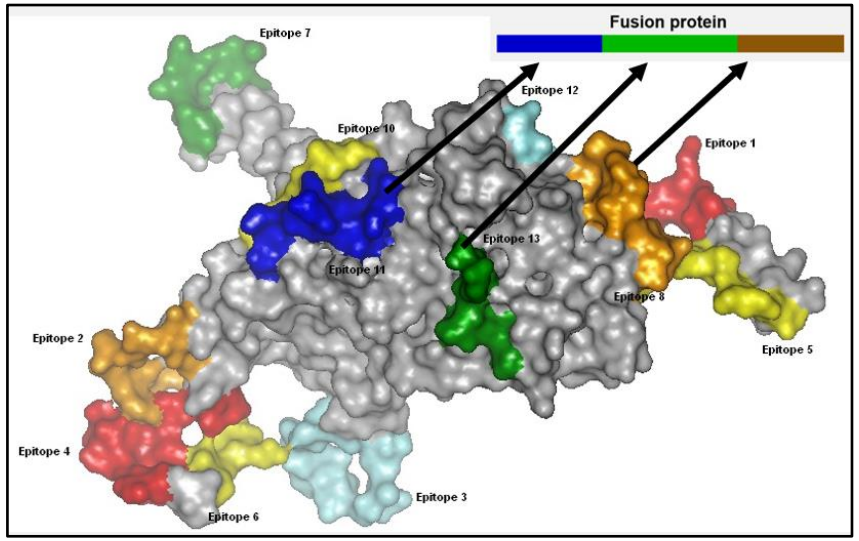
Methods:

We approach our objects of interest primarily through **molecular methods** (PCR, qPCR, gene cloning, NGS - genomics, etc.), **proteomic methods** (mass spectrometric methods MALDI TOF-TOF, LC-MS/MS), **bioinformatics** (evaluation of "omics" data), **biochemical techniques** (electrophoresis, chromatography, spectrometry, fluorometry, protein expression etc.), **immunological methods** (ELISA, blot), and **microscopic techniques** (brightfield, fluorescence, laser, scanning, and transmission microscopy).



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Molecular biology of parasites and diagnosis of parasitic diseases

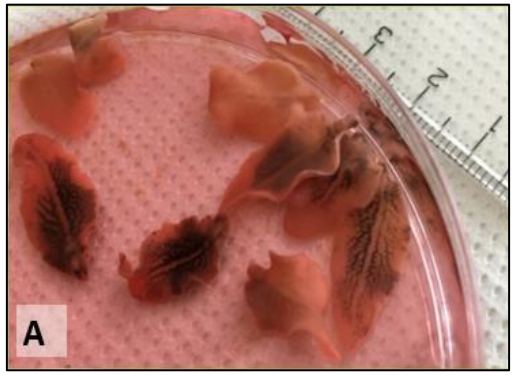
Research topic 1: Molecular diagnosis of parasitoses

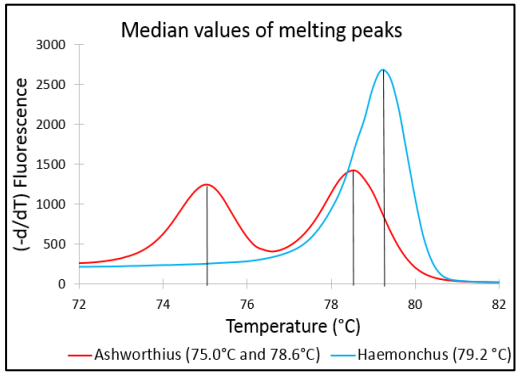
Research topic 2: "Omics" approaches in the study of molecular interactions between parasite and host

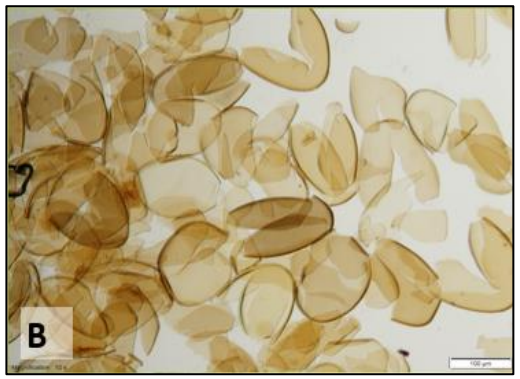
Research topic 1: Molecular diagnosis of parasitoses

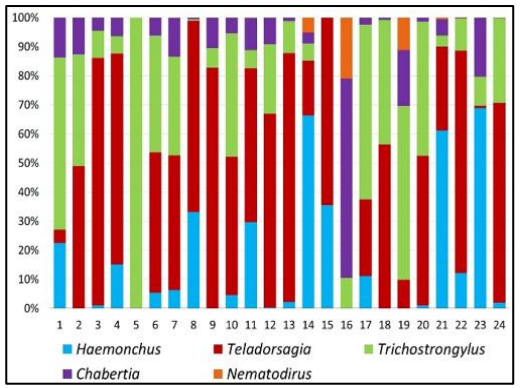
- Development and optimization of molecular diagnostic methods for the detection of parasitic agents, ideally in a multiplex format

- Monitoring of parasites in ruminant livestock and wild-living species using molecular diagnostic methods.









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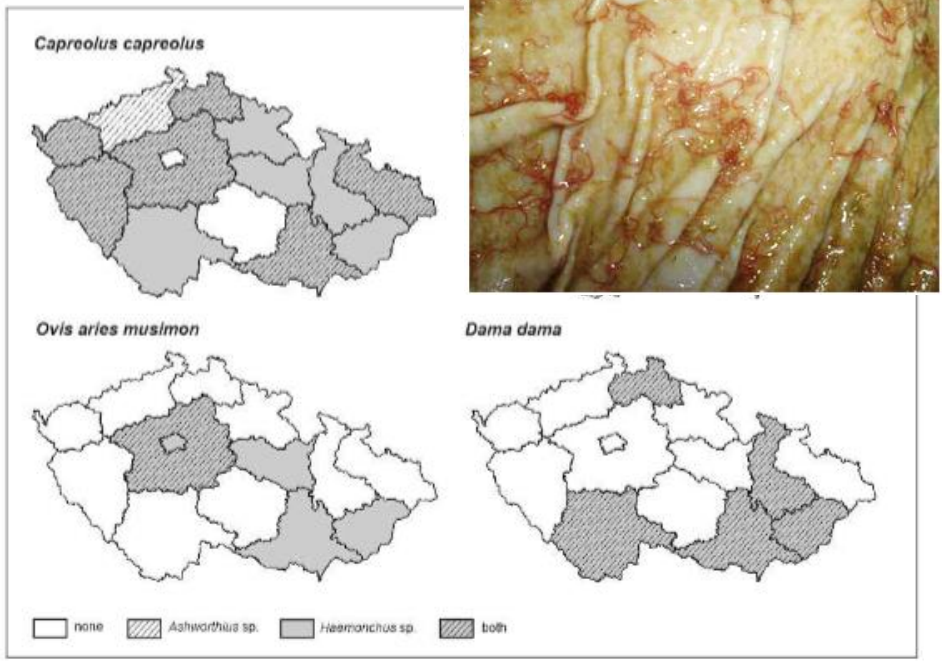
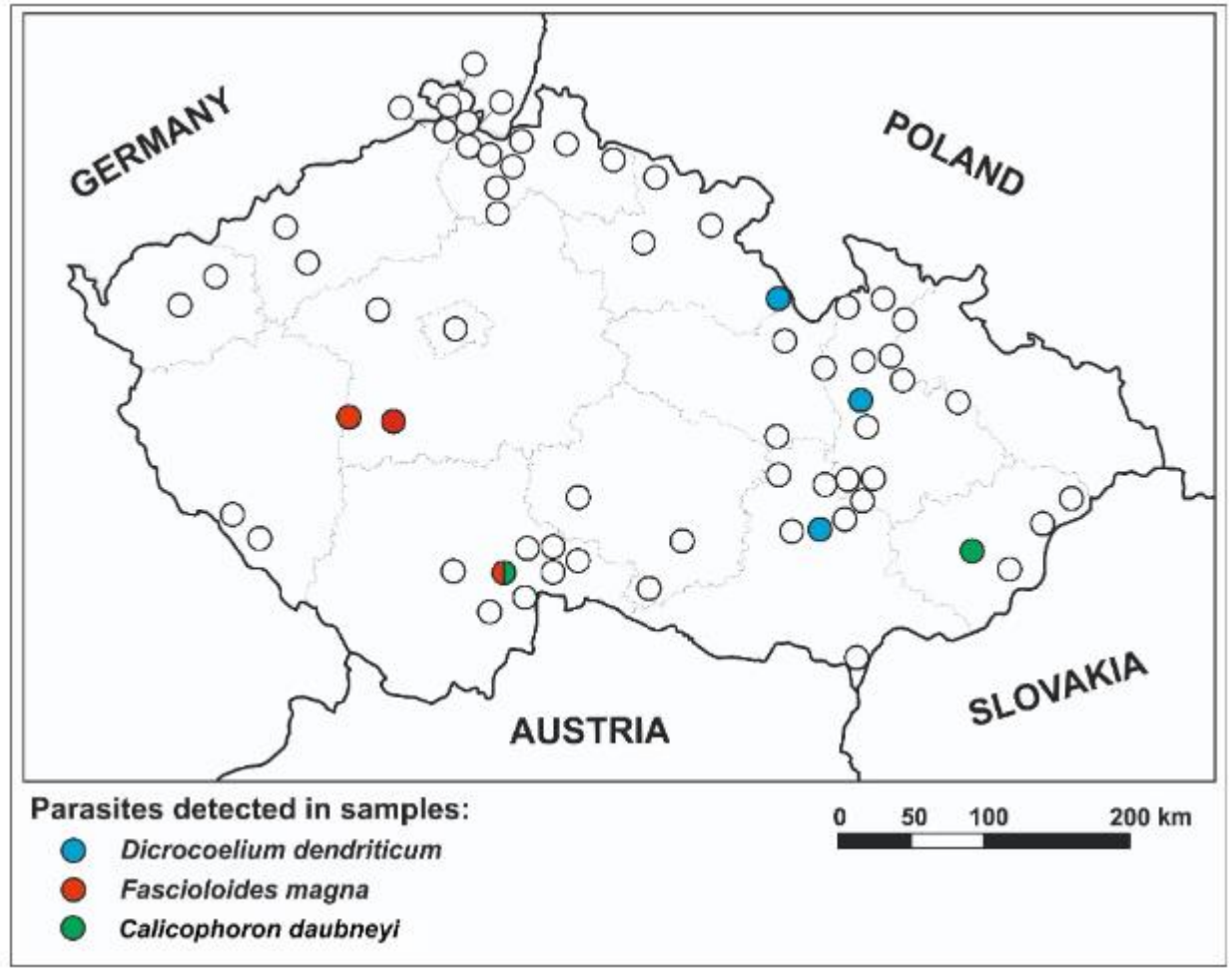
		Helminth Species					
		Ashworthius sidemi	*Haemonchus* spp.	*Fascioloides magna*	*Fasciola hepatica*	*Dicrocoelium dendriticum*	*Paramphistomidae* spp.
Ruminant species	Red deer (*C. elaphus*)	30.7% (124/404)	6.9% (28/404)	3.0% (12/404)	0.0% (0/404)	0.0% (0/404)	0.0% (0/404)
	Roe deer (*C. capreolus*)	5.4% (20/371)	23.2% (86/371)	0.5% (2/371)	0.0% (0/371)	0.8% (3/371)	0.0% (0/371)
	Fallow deer (*D. dama*)	7.7% (10/130)	16.9% (22/130)	0.8% (1/130)	0.0% (0/1		
	Mouflon (*O. a. musimon*)	1.3% (1/78)	12.8% (10/78)	0.0% (0/78)	0.0% (0/7		
TOTAL PREVALENCE		**15.8% (155/983)**	**14.9% (146/983)**	**1.5% (15/983)**	**0.0% (0/9**		



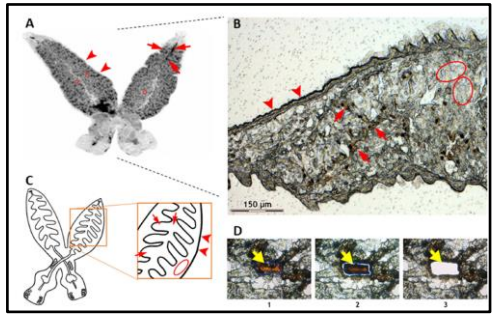


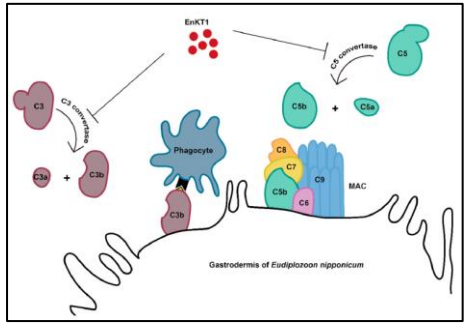
Research topic 2: "Omics" approaches

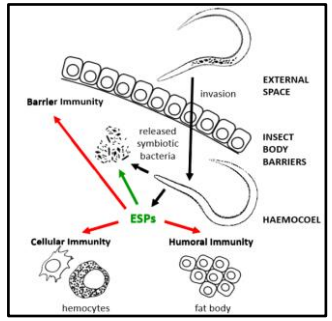
"Omics" approaches in the study of molecular interactions between parasite and host

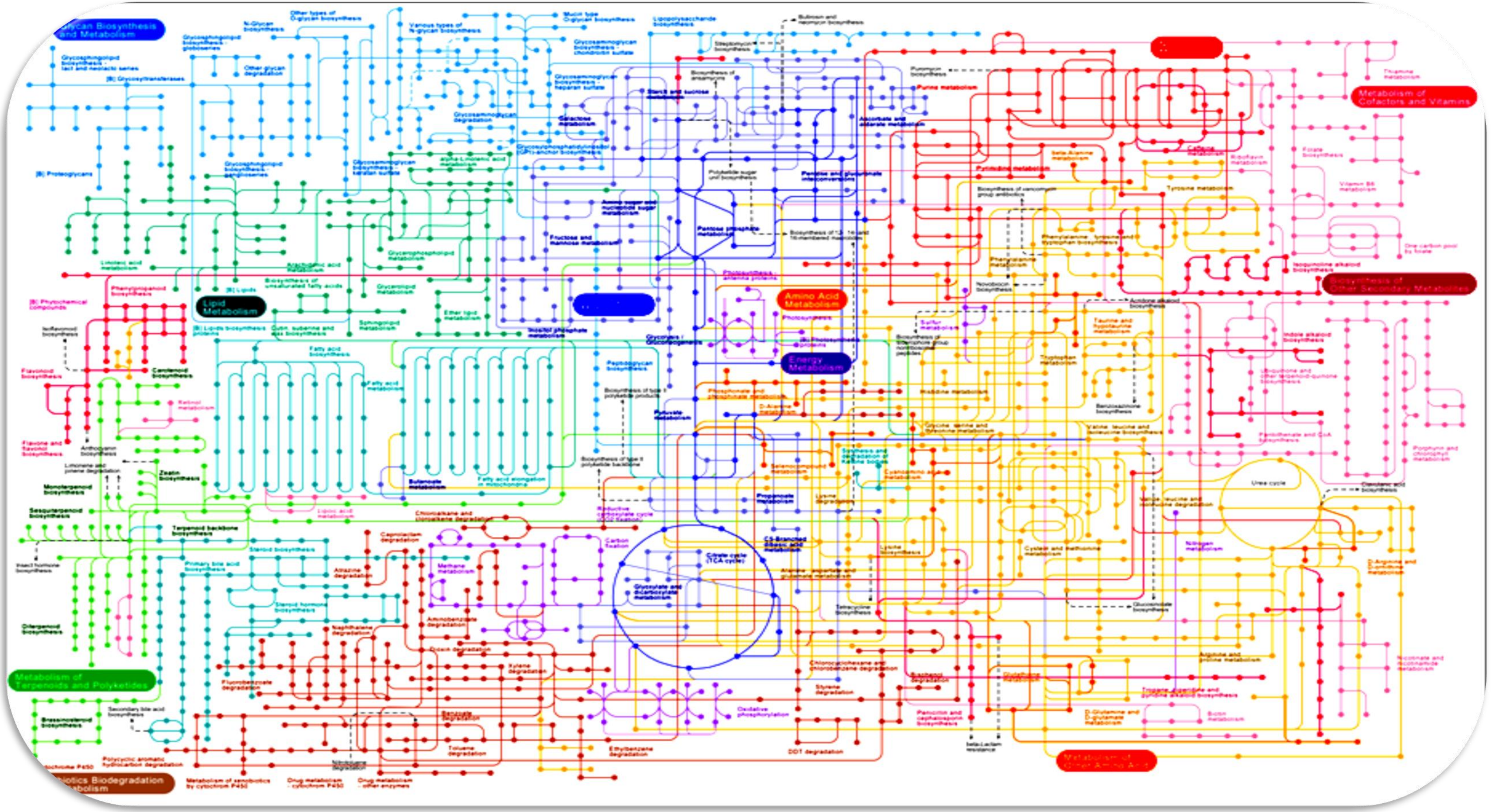
- Analysis of genomes, transcriptomes, proteomes, and secretomes of parasitic organisms to define protein molecules essential for parasite survival or playing a crucial role in parasite-host interactions

- Defining the principles of anthelmintic resistance development using data generated by high-throughput sequencing








Glycan Biosynthesis and Metabolism
Metabolism of Cofactors and Vitamins
Lipid Metabolism
Amino Acid Metabolism
Energy Metabolism
Metabolism of Terpenoids and Polyketides
Metabolism of Other Amino Acid
Purine metabolism
Pyrimidine metabolism
Starch and sucrose metabolism
Galactose metabolism
Ascorbate and aldarate metabolism
Pentose and glucuronate interconversions
Pentose phosphate pathway
Fructose and mannose metabolism
Amino sugar and nucleotide sugar metabolism
Glycolysis / Gluconeogenesis
Pyruvate metabolism
Propanoate metabolism
Butanoate metabolism
Citrate cycle (TCA cycle)
Glyoxylate and dicarboxylate metabolism
Oxidative phosphorylation
Methane metabolism
Carbon fixation
Nitrogen metabolism
Sulfur metabolism
Urea cycle
Fatty acid biosynthesis
Fatty acid elongation in mitochondria
Linoleic acid metabolism
Arachidonic acid metabolism
Glycerophospholipid metabolism
Glycerolipid metabolism
Ether lipid metabolism
Sphingolipid metabolism
Steroid biosynthesis
Steroid hormone biosynthesis
Primary bile acid biosynthesis
Terpenoid backbone biosynthesis
Zeatin biosynthesis
Carotenoid biosynthesis
Flavonoid biosynthesis
Retinol metabolism
Tyrosine metabolism
Tryptophan metabolism
Histidine metabolism
Lysine biosynthesis
Lysine degradation
Arginine and proline metabolism
Thiamine metabolism
Riboflavin metabolism
Vitamin B6 metabolism
Folate biosynthesis
Biotin metabolism
Toluene degradation
Xylene degradation
Styrene degradation
DDT degradation
Drug metabolism - cytochrome P450

Projects

TAČR SS05010070: Spread of invasive parasite species and their devastating effects on the biodiversity of native ruminant species (2022–2024)

https://starfos.tacr.cz/cs/projekty/SS05010070

Faculty of Agrobiology, Food and Natural Resources

GAČR GA23-06457S: Identification and functional characterization of bioactive molecules produced by entomopathogenic nematodes (2023–2025)

https://is.muni.cz/osoba/hyrsl#projekty

NAZV QL24010306: Sustainable parasite control in small ruminants corresponding to the One Health concept (2024–2028)
https://immunopharm.cz/projekty/nazv_gosheepar/

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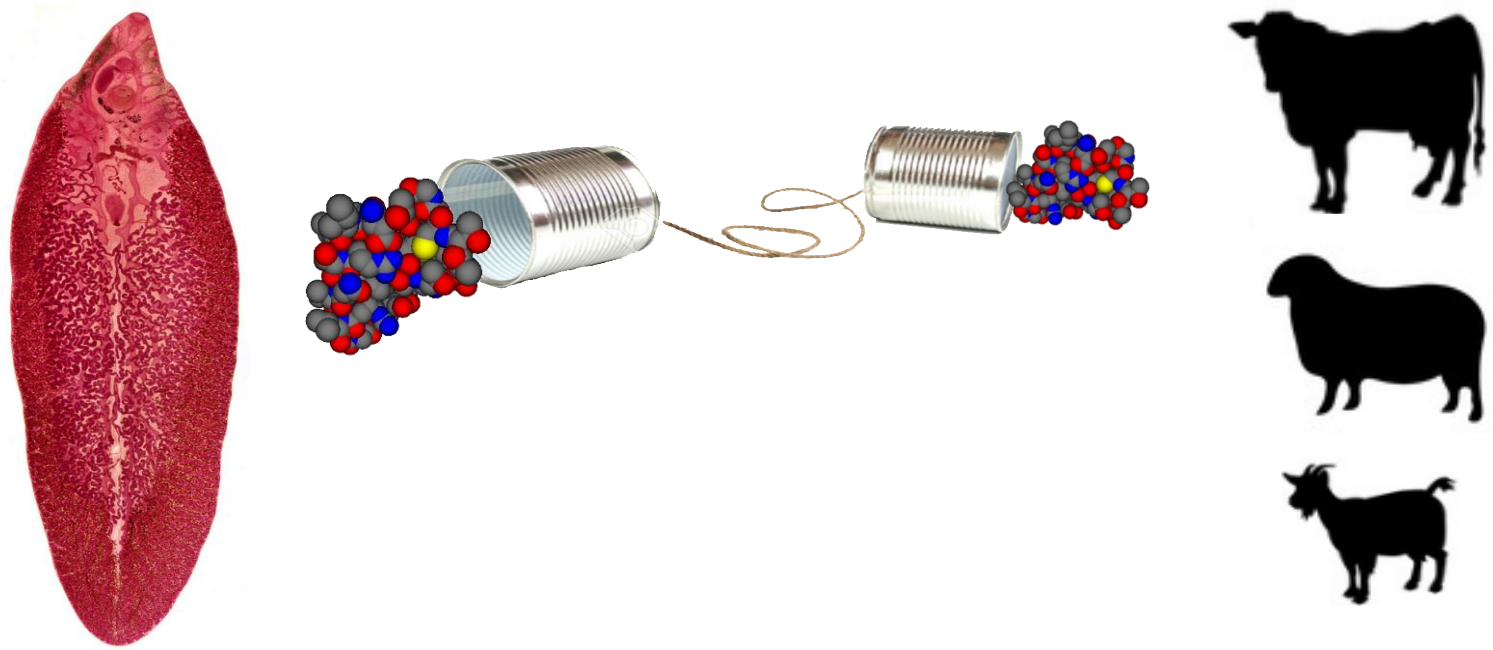
Thank you for attention



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