

ANIMAL PHYSIOLOGY

Vector borne pathogens of reptiles.

supervisor: RNDr. Igor Majláth, PhD. (igor.majlath@upjs.sk)

study form: full time

Annotation: The dissertation examines the patterns of formation of parasite-host relationships in the process of evolution between selected pathogens of arthropod-borne and reptile-borne diseases. It concentrates research on the ecology of reptiles, the ecology of ectoparasites and the circulation of pathogens in the natural focus. It focuses on the role of reptiles in the transmission cycle of epidemiologically important pathogens, *Borrelia burgdorferi sensu lato* and *Anaplasma* spp. It comprehensively studies the issue of blood unicellular parasites of reptiles and solves their ambiguous determination. It evaluates the effect of infection on selected physiological parameters in reptile blood. It monitors the occurrence and distribution of studied pathogens. It uses state-of-the-art molecular biological methodologies for the detection of pathogens in host blood in ectoparasites in natural foci in the ecological and climatic conditions of Europe and the world.

Objectives:

1. To determine the species spectrum of ectoparasites and pathogens in free living and imported reptiles
2. To determine the effect of the presence of vector-borne pathogens on selected physiological parameters
3. To characterize the role of reptiles in the transmission of vector-borne pathogens

Characterization the microbiome of ticks of the family Ixodidae with emphasis on the genera *Dermacentor* and *Haemaphysalis*.

supervisor: RNDr. Viktória Majláthová, PhD. (viktoria.majlathova@upjs.sk)

study form: full time

Annotation: The distribution of vectors and pathogens has changed in recent decades for several reasons. In new areas, "new" pathogens emerge or re-emerge and then spread further, either due to climate change but also due to the currently frequently discussed socio-economic changes related to migration. The concept of "neglected diseases" originated in the WHO also in connection with zoonotic diseases and currently is used also in connection with a selected group of vector-borne pathogens. There is also a wide range of vector-borne pathogens in Slovakia, of which little is currently known and causes diseases in humans and animals, and various vertebrates are involved in keeping them in the wild, affecting their genetic variability, abundance and co-occurrence of several pathogens. It is assumed that these pathogens can also significantly affect the senses, responses to stimuli and, consequently, the overall behavioral manifestations of ticks. For this reason, in our dissertation we will comprehensively focus on neglected vector-borne pathogens of bacterial and parasitic origin and their circulation in the natural focus.

Objectives:

1. To determine the bacterial species spectrum in ticks of the genera *Dermacentor* and *Haemaphysalis* by the next generation sequencing method
2. To find out the spectrum of hosts on which ticks were feeding in the previous stage
3. Characterize transmission cycles and the role of individual species of ticks and hosts
4. Define the impact of tick infection on selected behavioral manifestations with a focus on orientation and navigation

Depressive disorders and their potential influencing by biologically active substances.

supervisor: RNDr. Terézia Kisková, PhD. (terezia.kiskova@upjs.sk)

study form: full time

Annotation: Herbal therapy is a potential alternative applied to pharmacological alleviation of depression symptoms and treatment of this disorder, which is predicted by the World Health Organization to be the most serious health problem worldwide over the next several years. It has been well documented that many herbs with psychotropic effects have far fewer side effects than a variety of pharmaceutical agents used by psychiatrists for the treatment of depression.

The aim during PhD. study will be to monitor the influence of selected biologically active compounds (such as secondary metabolites of lichens) on depressive like behavior of laboratory animals. Using molecular methods to study the differences in brain structures associated with behavioral changes. In addition, monitoring of other organ structures that could be affected by biological compounds, such as liver or blood, will be performed. This work requires not only a stay at the home institution, but also partner institutions at home and abroad.

Metabolomics as a tool for searching the possibilities of influencing physiological processes.

supervisor: RNDr. Terézia Kisková, PhD. (terezia.kiskova@upjs.sk)

study form: full time

Annotation: Metabolomics belongs to the latest discovery of „omics“ science disciplines which deal with the mapping of the whole metabolites spectrum in biological fluids or various tissues of living organisms. Metabolomics is described as one of the most exact science disciplines when talking about the current state of the organism. However, the processing and analyzing of such a wide range of identified metabolites is currently a major challenge. Reading this data and assigning it the right meaning is a problem that this science faces in connection with its possible implementation into clinical practice. The aim of the doctoral study is to evaluate and analyze data from metabolomics preclinical studies. Another goal will be to search for affected metabolic pathways and to analyze the relationships between these metabolites in relation to various diseases.

Convergent osteo-physiological patterns in the evolution of the flapping flight: bats vs birds.

supervisor: doc. RNDr. Martin Kundrát, PhD. (martin.kundrat@upjs.sk)

consultant: prof. RNDr. Beňadik Šmajda, CSc.

study form: full time

Annotation: There are two groups of recent vertebrates that successfully colonized aerial environment: bats (Mammalia) and avialan dinosaurs (Aves). Apart from distinct ancestry, bats and birds are the well-known example of functional convergence of forelimb in the evolution of flapping flight. In contrast to birds, the wing airfoil is formed by skin membrane called patagium in bats. Patagial wings consists of the same bone elements, however, their active involvement into flying mechanics was specially modified in each group, respectively. This doctoral project is centered for evaluation of adaptive changes in development of the wing bones of bats and birds. Microstructure of the bone tissue is considered here as a functional interface useful for correlation of osteonal bone patterns with growth dynamics, locomotion performance, metabolism

and thermoregulation. This project aims to shed light on developmental convergence of osteophysiological characteristics in the actively flying vertebrates. We expect the applicant to be fluent in spoken and written English, to show high work engagement, to work along and in a team, in lab as well as in field, to handle correctly fixed biological material and fossils, and being interested in 3D imaging, phylogenetic and statistic methods.

Aims: 1. to collect long bones of the fore- (wing) and hind-limbs representing different developmental stages of the model organisms and to prepare the bone tissue samples for further experimental manipulation;

2. to scan the wing/leg bones and their samples using micro-CT and synchrotron micro-CT;

3. to produce morphologically exact 3D models as based on the CT scans and to collect quantitative parameters of the modelled compact bone;

4. to prepare 2D physical sections from the scanned bone samples;

5. to identify and to measure osteo-chronological microstructures in these 2D sections;

6. to describe osteo-physiological changes in development/functional specialization of the limbs and to compare them with each other using geometric morphometry and biostatistics tools;

7. to formulate an evolutionary scenario about adaptive patterning of the bone tissue during formation of convergent types of the winged limbs utilized for the active flight.



Institute of Animal Physiology Centre of Biosciences SAS

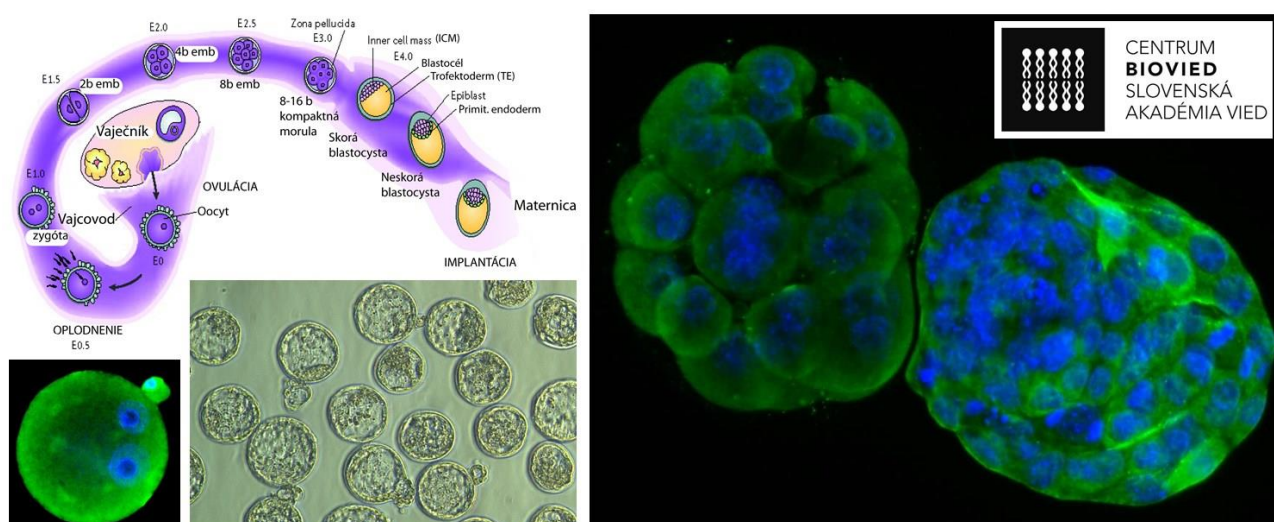
Molecular mechanisms of early embryonic cell communication with the environment.

supervisor: RNDr. Štefan Čikoš, DrSc. (cikos@saske.sk)

consultant: RNDr. Alexandra Špírková, PhD. (spirkova@saske.sk),

study form: full time

Annotation: The mammalian preimplantation embryo (i.e. the embryo in the period from oocyte fertilization to implantation of blastocyst into uterus) can finish its development to the blastocyst stage relatively autonomously and in vitro conditions in relatively simple culture media. On the other hand, recent data indicate that disturbed maternal environment significantly affects developmental potential of oocytes, quality of pre-implantation embryos, success of implantation and can be the cause of unsuccessful pregnancies in both humans and animals. Moreover, in line with the DOHaD (Developmental Origin Health and Diseases) hypothesis, impairment of early embryonic development can also have long term consequences for health in adulthood. The experiments will mostly use a mouse model (in vivo as well as in vitro approaches, including mouse embryonic stem cells). Modern biochemical methods, molecular biology techniques as well as morphological methods will be used to analyze cell receptors, activated signaling pathways and physiological responses of early embryo cells.



The use of alternative zinc sources in nutrition and their effect on selected physiological processes of animals.

supervisor: RNDr. Klaudia Čobanová, PhD. (boldik@saske.sk)

study form: full time

Annotation: The introduction of mineral nanoparticles and organic complexes as a source of trace elements represents the current trend in animal nutrition. These alternative microelement sources are considered to be more bioavailable and absorbed better by the animals in comparison to the traditionally used inorganic sources. Thus it would be possible to reduce the current needs for mineral additives in the diets and minimize their excretion. The dissertation thesis will be focused on the evaluation of zinc bioavailability in farm animals (sheep, poultry) by determining zinc

intestinal absorption and tissue deposition, as well as the activity of specific metalloenzymes and metalloproteins levels in animal tissues will be measured too. The antioxidant response of animals to feed supplementation with various zinc nanoparticles and the quality of foods of animal origin will be studied as well.

Institute of Neurobiology Biomedical Research Center SAS

Activation of endogenous mechanisms leading to neuroprotection after stroke.

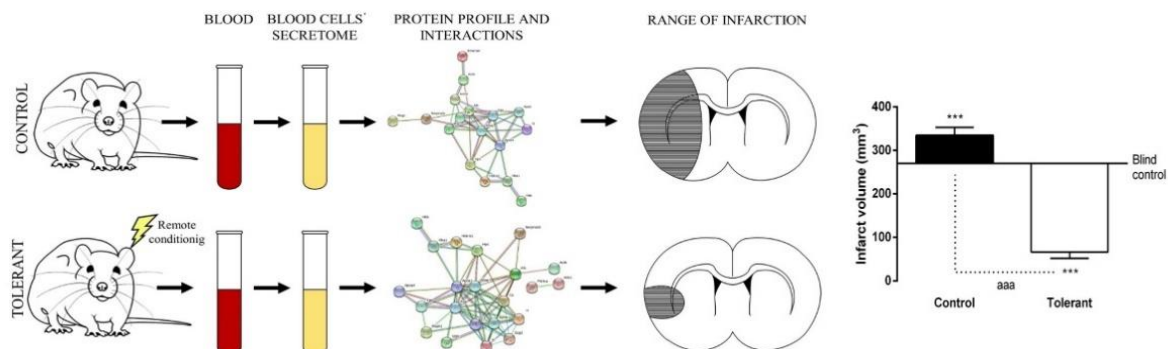
supervisor: RNDr. Petra Bonová, PhD. (bonova@saske.sk)

study form: full time

Annotation: Stroke represents a serious socio-economic problem with limited treatment options. Recently, the phenomenon of ischemic tolerance, i.e. endogenous stimulation of the mechanisms with the ability to induce neuroprotection, has become an attractive solution for the prevention and treatment of such conditions.

Objectives:

1. Study of mechanisms of ischemic tolerance
2. Defining the role of peripheral blood cells in inducing ischemic tolerance
3. Testing of *in vivo* and *ex vivo* conditioning methods
4. Testing of conditioning methods in animal models of ischemic-reperfusion injury of nerve tissue



Regulation of postnatal neurogenesis.

supervisor: RNDr. Marcela Martončíková, PhD. (martoncikova@saske.sk)

study form: full time

Annotation: Generation of new neurons from the stem cells in the brain of adult mammals (postnatal neurogenesis) is a phenomenon that attracts the attention of neurosciences because of perspective of their use in regenerative medicine. The largest neurogenic area in the adult brain is the subventricular zone of the lateral ventricles. Its particularity is that the cells arising here migrate for a long distance by the rostral migratory stream to the olfactory bulb that represents their target structure. Under pathological condition, these cells are able to migrate out of the rostral migratory stream towards the affected brain area. To know the mechanisms regulating neurogenesis is essential for its potential therapeutic use. The aim of the thesis will be to examine the mechanisms regulating the migration of cells in the rostral migratory stream of the rat based on histological methods as well as *in vitro* methods.