OR Imunologie

Vypsané doktorské práce pro akademický rok 2022/2023

Inhibition of ALDH enzymes as a novel treatment in acute leukemia

Meritxell Alberich Jorda, M.Sc., Ph.D.

ID 246692

ncreased ALDH activity has been reported in several types of cancer, including leukemias. In this project we will investigate whether ALDH inhibition can eradicate leukemic cells, and the mechanisms of action.

Role of the transcription factor C/EBPdelta in emergency granulopoiesis

Meritxell Alberich Jorda, M.Sc., Ph.D.

ID 246690

Our preliminary data indicates that the transcription factor C/EBPdelta is a key player in the activation of emergency granulopoiesis at the hematopoietic stem cell level.

This project will focus on investigating the role of this protein in the process of emergency granulopoiesis, and how it controls hematopoietic development.

Molecular mechanisms of immunopathogenicity during SARS-CoV-2 infection and reinfection

Mgr. Jana Balounová, Ph.D.

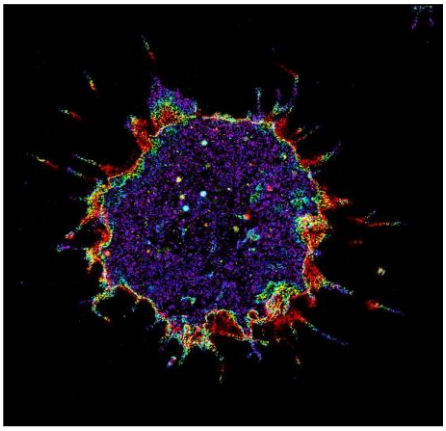
ID 246632

The topic of the proposed PhD study will focus on immunopathological manifestation of SARS-CoV-2 infection and reinfection on cellular and molecular level. Experimental humanized mouse models will be used to study pathogenicity and immune system response depending on SARS-CoV-2 variant infection targeted to selected organs. The work will run in conventional laboratories and in our own BSL3 laboratory at CCP, where the infected mouse models will be housed. The methods used will include molecular biology tools, cloning and vector preparations, western blotting, immuno assays, flow cytometry, microscopy. The critical findings of the study will rely on precise phenotyping of mouse models in a variety of SARS-CoV-2 infection conditions.

The impact of actin cytoskeleton and surface morphology on T-cell activation

Mgr. Marek Cebecauer, Ph.D.

ID 223862



Interaction of lymphocytes with target cells is one of key mechanisms regulating immune response in higher organisms. The role of diverse receptors and signalling molecules in this process was described in numerous works in the past. However, the role of cell surface morphology has not been studied in detail yet. This could be a reason why we still lack a detailed understanding of the very early events leading to the T-cell activation.

T cells are densely covered by membrane protrusions, including specialised microvilli. We and others demonstrated the accumulation of critical signalling molecules, such as TCR, CD4, LAT, at the tip of microvilli in unstimulated T cells (refs.). It was also shown that, at least in vitro, T cells interact with dendritic cells via microvilli on both sides. In this project, we aim to study the interaction of the two surfaces at nanoscale using superresolution microscopy. Our preliminary data indicate that CD2, an abundant adhesive receptor, is randomly distributed on the T-cell surface with a significant presence at the tip and shaft of microvilli. On the contrary, LFA-1, a specialised high affinity integrin forming tight connection with a target cell by binding to its ligand, ICAM-1, accumulates at the base of these protrusions. We hypothesise that CD2 forms a primary contact between T cells and target cells, which is followed by LFA-1/ICAM-1 binding in activated T cells. In collaboration with the laboratory of Dominik Filipp (Institute of Molecular Genetics, Prague), we will further investigate how alpha-actinin, an adaptor connecting LFA-1 to actin cytoskeleton regulates early signalling events.

The work will include imaging of adhesion receptors and ligands in the contact site between T cells and target cells. The imaging approaches will include a panel of advanced fluorescence and super-resolution microscopy techniques, which will be complemented by flow cytometry and some basic biochemistry methods to monitor signalling events in cells with altered gene expression (LFA-1 and alpha-actinin knock-outs).

Franke C; Chum T; Kvicalova Z; GlatzovaD; Gentsch GJ; Rodriguez A; Helmerich DA.; Herdly L; Mavila H; Frank O; Brdicka T; van de Linde S and Cebecauer M. Approach to map nanotopography of cell surface receptors. Comms Biol. 5: 218 (2022); DOI: 10.1038/s42003-022-03152-y

Regulation of adaptive immune response by intestinal epithelial cells

Mgr. Jan Dobeš, Ph.D.

ID 246680

Antigen presentation molecule MHCII, essential for activation of CD4+ T-cells, was detected on intestinal epithelial cells (IECs) decades ago. Recent studies established the importance of IECs-mediated MHCII-based antigen presentation in colitis or graft-versus-host disease. Nevertheless, the function of MHCII on IECs remains elusive in homeostatic conditions and the nature of antigens presented by MHCII on IECs remains cryptic. This research project aims to delineate mechanistically the function on MHCII on IECs. Our preliminary data indicate that MHCII on

IECs serves for presentation of antigens derived from microbes with partially intracellular, but largely extracellular life strategy. The presence of MHCII is essential for keeping these microbes under surveillance by immune system. We hypothesize that MHCII+ IECs

instruct T-cells to precisely position their help to affected IECs and even mark them for clearance if these are strongly stressed by microbes' presence.

The research project will use the genetically modified animal models to determine the role of MHCII on intestinal epithelium and its importance for immune surveillance.

The function of NK and NKT cells in thymic negative selection

Mgr. Jan Dobeš, Ph.D.

ID 246678

Thymic negative selection is essential for proper development of T-cells, preventing effectively their self-reactivity and onset of autoimmune diseases. Medullary thymic epithelial cells (mTECs) are utilizing transcription factor Aire in order to produce the large array of tissue specific self-antigens. These are presented to developing T-cells on mTECs MHC class I and II molecules. Given the relatively low number of mTECs, the chance to eliminate the self-reactive T-cell clones is enhanced by coordinated transfer of antigens from mTECs to dendritic cells. Although this process was intensively studied during last decade, process regulating the antigen transfer remains largely elusive. our preliminary data points to the essential regulatory role of NK and NKT cells in activation and position of DCs. Moreover, these cells also regulate the generation of substrate for antigen transfer. The proposed research project will utilize genetically modified animals in order to uncover the role of NK and NKT cells in coordinated antigen transfer regulation and T-cell negative selection.

Effect of gluten-free diet (GFD) on immune parameters, microbiome and metabolome in inflammatory bowel disease and primary sclerosing cholangitis

MUDr. David Funda, Ph.D.

ID 246642

Idiopatické střevní záněty (IBD] je chronické, relapsující, imunitně mediované zánětlivé onemocneni gasteointestinalniho traktu. Primární sklerozující cholangitida (PSC) je progresivní onemocnění žlučovodů, které v pokročilém stádiu choroby představuje jednu z nejčastějších indikací k ortotopické transplantaci jater v rozvinutých zemích. Ačkoliv genetické faktory přispívají ke vzniku těchto onemocnění, faktory vnějšího prostředí (diety) a následné změny mikrobiomu mají pravděpodobně významný vliv v etiopatogenezi těchto onemocnění. PSC je přibližně u 70% nemocných asociováno s IBD. V poslední době se objevily nezávislé důkazy o úloze chronického střevního zánětu u celé řady imunitně mediovaných onemocnění. Lepek a jeho komponenty mají prozánětlivý efekt podobný lipopolysacharidu. U řady autoimunitních onemocnění (diabetes 1 typu, některé neurologické poruchy) byl již prokázán příznivý vliv bezlepkové diety (GFD).

Cílem tohoto projektu je objasnění mechanismů interakce bezlepkové diety, mikrobiomu a metabolomu, a studium vlivu GFD na slizniční a přirozenou imunitu u IBD a PSC. Projekt je založen jak na lidské randomizované klinicke studii (vliv bezlepkové diety na klinické symptomy PSC a IBD), tak na myších indukovaných modelech IBD (model DSS-indukované kolitidy u BALB/c myší) a PSC (DSS-indukovaná PSC na modelu Mdr2-/- KO myší).

Mechanistické studie zahrnují analýzu imunitních parametrů, změn metabolomů a změn bakteriomů ve vztahu k bezlepkové dietě. Použité metodiky zahrnují izolaci leukocytů periferní krve od pacientů a izolaci buněk z lymfatických tkání u myší, flowcytometrii, tkáňové kultury, ELISA, charakterizaci metabolomů (ve spolupráci s Lab. charakterizace molekulární struktury), přípravu vzorků pro sekvenaci bakteriomů, analýzu dat apod. Projekt zahrnuje mezinárodní spolupráci.

Mechanobiology of lymphocyte motility

Mgr. Miroslav Hons, Ph.D.

ID 246688

An efficient immune response requires cells of the immune system to be at the right place at the right time and depends on their migration and correct positioning in tissues. We work at the interface between cell biology and immunology and study how leukocytes establish motility, distinguish various environmental cues and interpret them in their behavior. Our primary focus are mechanical aspects – we want to understand how leukocytes recognize physical stress, adapt to obstacles and integrate mechanical and chemical signals from the environment. We concentrate on the role of cytoskeleton and signaling pathways that trigger cytoskeletal rearrangement. To this end, we use combination of artificial environments, pharmacologic/genetic interventions and various types of imaging.

To expose cells to mechanical stress or defined obstacles in their migratory paths we use silicon devices with custom-made imprinted patterns. This way we apply on cells defined deformations or force them to migrate through channels with a given diameter. The role of individual genes is assed mainly by genome editing as we take advantage of the CRISPR/Cas9 system. Moreover, the basis of our work lies in broad spectrum of imaging methods. We benefit from exceptional core resources and equipment in BIOCEV and we use many modalities of live cell imaging (FLIM, FRET, TIRF) and electron microscopy.

For more insight please see:

· Cellular locomotion using environmental topography. Nature. 2020 Jun;582(7813):582-585.

· Chemokines and integrins independently tune actin flow and substrate friction during intranodal migration of T cells. Nat Immunol. 2018 Jun;19(6):606-616.

About the lab:

https://www.biocev.eu/en/research-program/cellular-biology-and-virology.4/leukocyte-motility.66

About the PI:

https://orcid.org/0000-0002-6625-3348

We are looking for dedicated candidates interested in cell biology, cell migration, cytoskeleton, immunology and microscopy. We offer part-time employment and an opportunity to work in a newly established research group within the BIOCEV with its exceptional equipment.

Applicants are encouraged to provide a brief CV with summary of recent work to Miroslav Hons, PhD (miroslav.hons@lf1.cuni.cz)

The role of dysbiosis on proportional and functional characteristics of particular neutrophil subsets

doc. RNDr. Jiří Hrdý, Ph.D.

1. LF

The work will be focused on the understanding of mutual interaction between the microbiota and host immune system with special focus on neutrophils. Neutrophils were considered as a homogeneous population of terminally differentiated cells. Recently, it has been shown that neutrophils consist of very heterogeneous subpopulations of cells with distinct functions including immunoregulatory capacity. During dysbiosis (changes in microbiota composition and its functions), homeostatic interactions between microbiota and host immune system are altered. Dysbiosis will be induced by antibiotics administration and we will try to correct for dysbiosis and restoration of mutual homeostatic interactions between microbiota and host immune system by probiotic supplementation using experimental mouse model. To reach the proposed goals of thesis, different methods including flow cytometry, real-time PCR, cell separation, bacteria cultivation will be employed.

Role of neutrophils in health and disease

doc. RNDr. Jiří Hrdý, Ph.D.

1. LF

The topic of dissertation thesis will be focused on characterisation of proportional and functional parameters of neutrophils in health and disease. Neutrophils were considered as relatively homogeneous terminally differentiated population of leukocytes with relatively short survival time in periphery. Recent studies highlight the neutrophil heterogeneity with distinct functions including immunoregulatory one. The role of neutrophils in initiation and progression of tumour will be studied using experimental mouse models. Further, we will focus on the impact dysbiosis on changes of homeostatic interaction between host immune system and microbiota in the context of tumour. For successful solvent of dissertation thesis, it will be important to get familiar with following methods: flow cytometry, real-time PCR, particular cell subsets isolation and separation, handling with experimental animal models (mouse).

Effect of early postnatal probiotic supplementation on maturation of neonatal immune system

doc. RNDr. Jiří Hrdý, Ph.D.

ID 246593

The work will be focused on the understanding of the effect of early postnatal supplemention with single strain or complex probiotic mixtures on maturation of neonatal immune system. Special focus will be paid to characterisation of gut mucosal immunity and gut barrier function. The experimental mouse model will be used to study the impact of early postnatal probiotic supplementation on immune system maturation. Probiotic supplementation will start second day after the birth and impact of probiotic supplementation on changes in microbiota composition and dynamics of mutual interactions between microbiota and host immune system. To reach the proposed goals of thesis, different methods including flow cytometry, real-time PCR, cell separation, bacteria cultivation and experimental animal models will be employed.

Complexes of IL-2 and anti-IL-2 mAb with selective stimulatory activity for CD25 + T cells in cancer immunotherapy: changing the paradigm

RNDr. Marek Kovář, Ph.D.

ID 246249

Complexes of IL-2 and anti-IL-2 mAbs possess extremely high biological activity in vivo. Moreover, such IL-2 complexes have selective stimulatory activity for different IL-2 responsive cells depending on the clone of anti-IL-2 mAb. Complexes based on S4B6 mAb (IL-2/S4B6) stimulate predominantly CD122 high populations, i.e. memory CD8 + T and NK cells, while those based on JES6-1A12 mAb (IL-2/JES6) stimulate selectively CD25 + cells, i.e. mostly T reg cells. Thus, the current paradigm in the field is that IL-2/S4B6 are suitable for cancer immunotherapy and IL-2/JES6 are predetermined for autoimmunities and transplantology. However, we found in preliminary experiments that IL-2/JES6 exert antitumor activity both per se and in combination with chemotherapy. Most promising antitumor effect of IL-2/JES6 was observed when injected after CTLA-4 plus PD-1 blockage using even highly suboptimal dosage of respective blocking mAbs. We thereby presume that IL-2/JES6 or their analogs like recombinantly produced immunocytokines may represent novel class of perspective cancer immunotherapeutics. The aim of the project is to change the current paradigm in the field and show that complexes of IL-2 and anti-IL-2 mAb with selective stimulatory activity for CD25 + T cells possess antitumor activity and are promising tool for cancer immunotherapy particularly in combination with immune checkpoint inhibitors. Our group has established long-term collaboration with the laboratory of Jamie B. Spangler (John Hopkins University, Baltimore, USA) participating particularly in this project.

In case you are interested in this project, please do not hesitate to contact me and to discuss your potential participation.

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Imunopatologický podklad patogeneze fibrotického hojení plicní tkáně po poěškození

zevními a vnitřními noxami

prof. MUDr. Martina Koziar Vašáková, Ph.D.

ID 246736

Plicní tkáň má uniformní vzorce reakce na poškození, která může vést k restituci ad integrum, k přetrvávajícímu zánětu, fibrosním změnám stacionárního charakteru, ale i k progredující fibróze. Mezi známé faktory ovlivňující sklon k patologickému hojení plíce, jejímž důsledkem jsou progredující intersticiální plicní procesy patří stárnutí, kouření, expozice organickým a anorganickým prachům a infekčním agens a některé genetické faktory (polymorfismy genů pro mucin a Tollip, mutace surfaktantových genů, telomeropatie), nicméně řada faktorů je neznámých. Patologický typ hojení vedoucí k devastujícímu poškození plicní tkáně je i hlavním faktorem morbidity a mortality na covid-19. Zaměřením studijního programu bude tedy snaha o identifikaci genetických faktorů, imunologických faktorů, vyšetření bronchoalveolární laváže (FACS) v korelaci s klinickým a radiologickým obrazem pacientů s fibrotizujícími procesy různé etiologie, se snahou určit rizikový genotyp a fenotyp a tak snáze predikovat možné progredující plicní postižení jako odpověď na noxu různé etiologie

Hypersensitivity Pneumonitis: Current Concepts of Pathogenesis and Potential Targets for Treatment. Vasakova M, Selman M, Morell F, Sterclova M, Molina-Molina M, Raghu G. Am J Respir Crit Care Med. 2019 Aug 1;200(3):301-308. doi: 10.1164/rccm.201903-0541PP.

Effect of genotype on the disease course in idiopathic pulmonary fibrosis despite antifibrotic treatment. Sterclova M, Kishore A, Sikorova K, Skibova J, Petrek M, Vasakova M.. Biomed Rep. 2021 Nov;15(5):87. doi: 10.3892/br.2021.1463. Epub 2021 Aug 23.

DSP rs2076295 variants influence nintedanib and pirfenidone outcomes in idiopathic pulmonary fibrosis: a pilot study. Doubkova M, Kriegova E, Littnerova S, Schneiderova P, Sterclova M, Bartos V, Plackova M, Zurkova M, Bittenglova R, Lostaková V, Siskova L, Lisa P, Suldova H, Doubek M, Psikalova J, Snizek T, Musilova P, Vasakova M.

Interstitial Score and Concentrations of IL-4Rα, PAR-2, and MMP-7 in Bronchoalveolar Lavage Fluid Could Be Useful Markers for Distinguishing Idiopathic Interstitial Pneumonias. Bruzova M, Pavlova M, Matej R, Sterclova M, Vasakova M. Diagnostics (Basel). 2021 Apr 13;11(4):693. doi: 10.3390/diagnostics11040693.

Biomarkers of fibroproliferative healing in fibrosing idiopathic interstitial pneumonias. Vasakova M, Sterclova M, Stranska E, Mandakova P, Skibova J, Matej R. Open Respir Med J. 2012;6:160-4. doi: 10.2174/1874306401206010160. Epub 2012 Dec 28.

IL-4 polymorphisms, HRCT score and lung tissue markers in idiopathic pulmonary fibrosis. Vasakova M, Sterclova M, Matej R, Olejar T, Kolesar L, Skibova J, Striz I. Hum Immunol. 2013 Oct;74(10):1346-51. doi: 10.1016/j.humimm.2013.07.011. Epub 2013 Jul 31.

Pathological effect of Sars-Cov2 infection in non-canonical sites and its chronic effects.

Mgr. Jan Procházka, Ph.D.

ID 246644

PhD work will be focused on pathology development after Sars-Cov2 infection not only in respiratory tract, but also in secondary organs such as heart, liver, kidney, brain intestine or pancreas. The work will investigate also severity of pathology development after reinfection. The study will discriminate between viral based tissue injuries and secondary immune cells mediated tissues damage. The pathology development will be modelled in our mouse models with humanized Ace2 receptor for viral entry, with systemic or organ specific expression. Work will be based on histological methods, spatial proteomics, metabolomics, and transcriptomics.

Influence of the gut microbiome on the development of neuropsychiatric disorders

RNDr. Radka Roubalová, Ph.D.

ID 246681

The objective of this project is the study of the gut microbiome and microbial metabolites and their effect on human behavior. The project will focus on microbiota-gut-brain communication with an emphasis on the role of the immune system in the development of neuropsychiatric diseases, specifically sleep and eating disorders. Methodically, the gut microbiome composition and microbial metabolites analysis will be performed and put into context with immunopathogenic mechanisms involved in the disease development. The project will be based both on clinical samples from patients and on mouse models.

The student should have basic experience with methods of molecular biology and immunology. The student should be able to work independently and should have good knowledge of English.

Vaccination with engineered antigens and antibody delivery therapy for Sars-Cov2

doc. RNDr. Radislav Sedláček, Ph.D.

246652

PhD work will be focused on in-vivo preclinical testing of novel therapeutic delivery systems for RNA and proteins to mouse model sensitized for Sars-Cov2 infection and development of the immune responces. The work will rely on assembly of viral and non-viral particles, analysis of monitoring of RNA delivery efficacy and safety. The effect of delivered components for vaccination will be evaluated by detail characterization of immune system response. The efficacy of vaccination will be tested on multiple Sars2 variants of concern. The engineered antibodies prepared in collaboration with Luca Varani (Institute for Research in Biomedicine (Bellinzona, CH)) will be tested on multiple Sars2 mouse models and they protective efficiency will be evaluated. The methods used in PhD study will encompass broad variety of molecular biology methods (molecular cloning, PCR, WB, qPCR). Single cell proteomic and transcriptomic approaches will be implemented to reveal the immune system reaction to infection and reinfection in context of vaccination or antibody treatment.

Ex vivo modulation of dendritic cells and T cells for enhancement of cancer immunotherapy efficacy

RNDr. Daniel Smrž, Ph.D.

2.LF

Cancer is one of the leading causes of death in developed countries. Traditional cancer treatments – surgery, chemotherapy, or radiation therapy – have shown considerable efficacy at the early stages of the disease. These treatments usually fail or have minimal effectiveness at very late stages of the disease. New treatment modalities that would allow an effective therapy even at very late stages of cancer are needed.

Immunotherapy is modern cancer therapy. The breakthrough in cancer immunotherapy is considered immune checkpoint inhibitors and adoptive cellular immunotherapy. However, immunotherapy is still failing in many cancers. These failures are attributed to multiple mechanisms cancer uses against the immune system. The proposed Ph.D. project will investigate the mechanisms that affect current immunotherapy's antitumor performance. The work will focus on dendritic cells, T cells, and selected molecules regulating their effector functions. The project aims to improve the therapeutic performance of dendritic cells and T cells produced ex vivo for adoptive cellular immunotherapy.

The first part of the project will consist of ex vivo-production of both cell types from peripheral blood of healthy donors. The second part will consist of functional analyses of these cells, including their phenotype, cytotoxic activity, and maturation. The methods used will be cell isolation and culturing, flow cytometry, immunoblotting, and microscopy.

The influence of microbiota on the pathogenesis of cutaneous and intestinal diseases

Mgr. Zuzana Stehlíková, Ph.D.

ID 246761

Current epidemiology studies clearly show a relationship between changes in microbiota composition and skin and intestinal diseases. Our laboratory focuses on the influence of microbiota on diverse inflammatory diseases such as inflammatory bowel disease, psoriasis or atopic dermatitis for many years. Apart from identification of microbiota we currently aim to investigate its effect on the gut-skin axis. Dysbalanced composition of intestinal microbiota is a risk factor for the impairment of the intestinal barrier. Therefore, we hypothesize that the alteration in the composition of intestinal microbiota could affect the gut-skin axis communication and lead to skin manifestation of various diseases (psoriasis, atopic dermatitis, vitiligo, inflammatory bowel disease). During the Ph.D. study, Martin Mihula MSc. will focus on how the composition of the skin and gut microbiota changes in patients with skin manifestations of disease. Moreover, he will look into how microbiota of a diseased/healthy person may influence the barrier function of the gut and skin. Using biological material obtained directly from patients and healthy humans, the influence of the microbiota will be investigated under in vitro conditions. Among other things, Martin Mihula MSc. will also address changes in the microbiota and the integrity of the gut/skin barrier in psoriasis patients following administration of anti-IL-17 biologic therapy, which can lead to the development of non-specific intestinal inflammation in some psoriatic patients. In his work, he is going to use state-of-the-art techniques such as next-generation sequencing (MiSeq, 3'mRNA Seq), co-culture of gut microbiota with human organoids, liquid chromatography with mass spectrometry (LC-qTOF-MS), ELISA, flow cytometry and immunofluorescence methods.

A role of clostridia in colonization resistance against enteric infections

doc. Ing. Igor Šplíchal, CSc.

ID 246727

Toll-like (TLR) receptors are cellular receptors recognizing various molecular structures typical for microorganisms and tissue damage.

During the doctoral study, the student will deal with the importance of clostridia for colonization resistance against enteric infections with Salmonella Typhimurium and enteropathogenic E. coli. The intestinal barrier state (damage/protection) will be characterized by histopathological changes in the intestine and the expression of villin, claudin-1, and occludin proteins in an experimental gnotobiotic piglet model. Activation of the inflammatory response will be assessed by the expression of TLR2 and TLR4, MD-2 and CD14 co-receptors, and MyD88 and TRIF adapter molecules. The inflammatory response will also be characterized by local and systemic levels of the inflammatory cytokines IL-1β, IL-6, IL-8, IL-10, IL12, IL-18, IFN-γ, and TNF-α.

The student will mainly use RT-qPCR (RNA isolation, cDNA synthesis, PCR), Western blot, histology, immunohistochemistry, hemocytometry, and xMAP technology (Luminex).

The doctoral thesis will be prepared at the Institute of Microbiology of the Czech Acad Sci in Nový Hrádek and the doctoral student will collaborate on a grant from the Czech Science Foundation.

The supervisor and the address of the training workplace:

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Phenotypes of extrinsic allergic alveolitis

MUDr. Martina Šterclová, Ph.D.

1.LF

Preliminary scope of work: Extrinsic allergic alveolitis (EAA) belong among more common interstitial lung diseases. Their manifestation and course are very heterogeneous and obviously exposure to inhalation antigen is not sufficient for disease development. In addition, a significant proportion of patients fail to identify the source of potential exposure, which complicates the recommended adherence to regimen measures. Student's work on the project includes prospective and retrospective data collection of patients with EAA with a focus on both the specification of the most likely source of inhalation antigen and a description of the development of the disease over time (functional impairment, radiological findings). Student will ensure the collection of biological material (blood, fluid obtained by bronchoalveolar lavage) and in patients with a clear source of exposure, a sample of the potential causative agent. The sample is lyophilized from the patient's environment for further storage. After obtaining enough data, patients will be divided into clusters according to the manifestation of the disease and according to the source of exposure. The aim of the work will be to verify whether a group of patients with a similar phenotype of the disease shares similar biochemical parameters (concentrations of selected proteins in the blood and fluid obtained by bronchoalveolar lavage), or genetic background.

During the study, the candidate will get acquainted with the management of patients with interstitial lung diseases, including the assessment of radiological findings, ensure the collection and storage of samples and will focus on proteomic analysis of the material obtained.