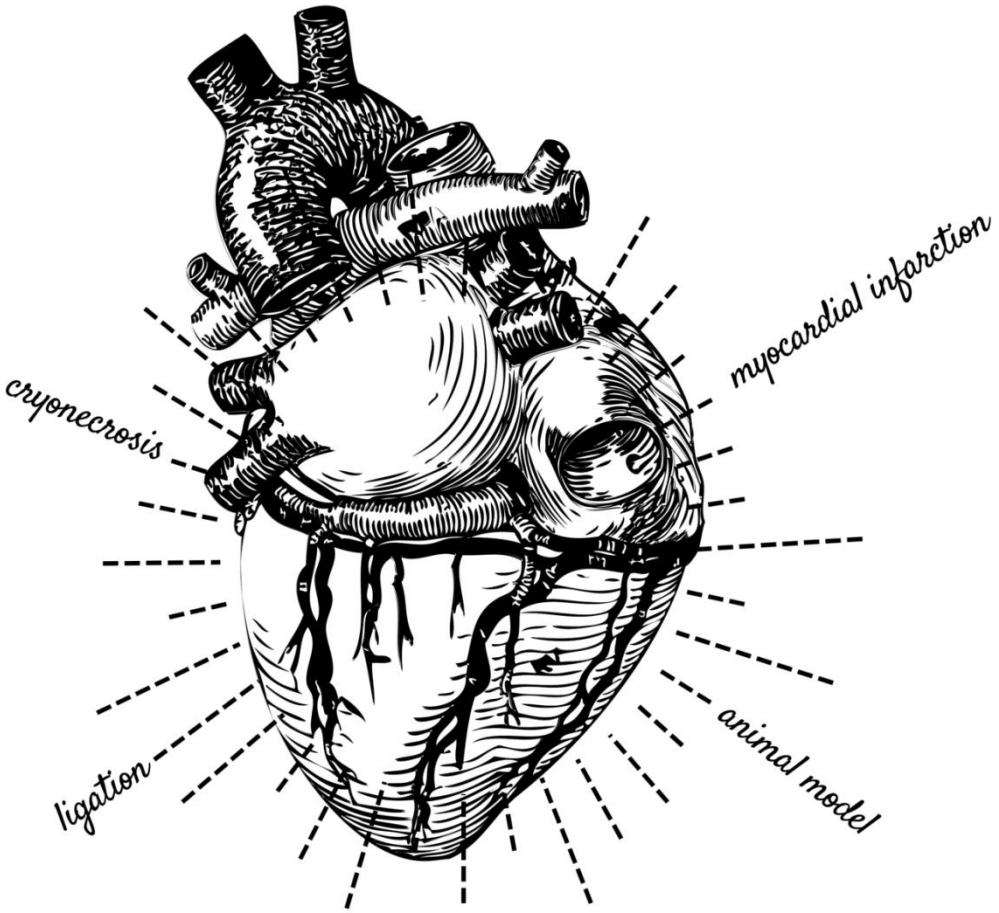
18.12.2015

CONFERENCE ROOM at DOMINANT, RAKVICE



ANIMAL MODELS FOR PRECLINICAL MAGNETIC RESONANCE

seminar

SPEAKERS:

MVDr. Peter Scheer, PhD., Ing. Zenon Starčuk, CSc., Ing. Radovan Jiřík, Ph.D., MVDr. Eva Dražanová, Ing. Lenka Dvořáková

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PROGRAMME

12:00 Lunch

13:30 Animal model of myocardial infarction — MVDr. Peter Scheer, PhD.

14:00 CMR imaging of infarcted rat heart in vivo — Ing. Lenka Dvořáková

14:30 Animal models for MR — MVDr. Eva Dražanová

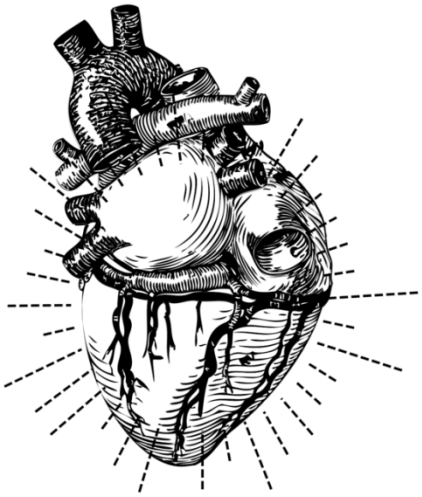
15:00 Coffee break

16:00 Quantitative modelling of tissue perfusion — Ing. Radovan Jiřík, Ph.D.

17:00 As you sow so shall you reap: Mouse's echoes for the right peep. — Ing. Zenon Starčuk, CSc.

18:00 Dinner

19:00 Photo show



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Animal model for myocardial infarction

MVDr. Peter Scheer, PhD.

The coronary artery diseases are the leading cause of the death worldwide. The study of heart failure requires viable animal models that mimic human cardiac diseases, such as myocardial infarction (MI). Two approaches to a MI rat model - cryoinjury and short-term ischemia-reperfusion are described in the talk, of which the cryonecrosis model discussed in greater detail. The cryoinjury is induced by attaching a liquid-nitrogen cooled steel tool on the left ventricle for half a minute. This model is currently used for research focused on cell therapy with endothelial progenitor cells and neovascularization.

CMR imaging of infarcted in vivo rat heart

Ing. Lenka Dvořáková

Cardiac magnetic resonance (CMR) imaging is considered as a standard imaging modality in the research of myocardial infarction (MI). Quantification of MI tissue by delayed contrast-enhancement is highly reproducible and the technique is well-validated and robust. However, in vivo CMR of small animals brings many difficulties stemming mainly from the heart size and the high heart and respiration rate. The talk provides a review of pulse sequences used for MI characterization and quantification. The imaging pulse sequence is critical in determining the image contrast and spatial and time resolution, and affects the formation of artifacts.

Animal models for MR

MVDr. Eva Dražanová

Projects of our NMR group are focused mainly on in vivo imaging, in which usually outbred small rodents in SPF (specific pathogen free) standard are used. In contrast to human MR scanning, we face many specific problems. The first issue is the small size of the organs examined associated with a need for high image resolution. The second complication, in comparison with humans, is the faster metabolism of small rodents, which necessitates different doses of drugs and of anesthetics immobilizing the animal in the MR scanner. Fast breathing and fast heartbeat are the third difficulty experienced during the measurement, mitigated by ECG and respiration gating. Several animal models are described that we use to simulate pathological processes of diseases and to investigate them with the help of MR imaging.

Quantitative modelling of tissue perfusion

Ing. Radovan Jiřík, PhD.

Perfusion imaging is used for estimation of tissue-specific perfusion parameters such as blood flow, blood volume, extravascular-extracellular-space volume, permeability-surface area product or mean capillary transit time. These parameters are valuable in oncology, cardiology and neurology for diagnostics and treatment monitoring. For perfusion imaging using magnetic resonance, there are two general approaches, the first one is based on administration of a bolus of a gadolinium-based contrast agent (dynamic contrast-enhanced and dynamic susceptibility contrast – DCE- and DSC-MRI); the second one uses endogenous water as a freely diffusible contrast agent (arterial spin labeling - ASL). The signal intensity of the acquired images is converted to contrast-agent concentration and modeled using pharmacokinetic models, which describe the distribution of the contrast agent in the tissue in time. Approximation by such models leads to estimates of perfusion parameters for each pixel/voxel of the acquired images and results in sets of perfusion-parameter maps. The talk focuses on compartment pharmacokinetic models.

As you sow you shall reep: Mouse's echoes for the right peep

Ing. Zenon Starčuk, CSc.

As a rule, in-vivo MR signals are produced by multipulse RF irradiation providing defined excitation of selected volumes of interest. Such procedures typically generate numerous echoes, of which usually only one type carries the information desired, while the others are a potential source of artifacts. The talk demonstrates the physical background for echo type classification, and their properties. Based on the Bloch equations the decomposition of signal into coherence transfer pathways is explained, and the assignment of basic echo types (spin echo, double spin echo, stimulated echo) to specific pathways is shown to be the way to exact determination of their excitation profiles. The fact that each pathway is characterized by its own excitation profile and its own k-trajectory is utilized for the explanation of the methods of signal separation. Specific care is devoted to RARE and steady-state free precession signals, such as those used in trueFISP.