Heart failure is a fatal condition of a heart, often an outcome of many cardiovascular diseases. It is a major health-care burden, affecting around 40 million people worldwide. The factors underlying heart failure are multiple, complicated and interconnected. A lot of research has been done on the (status) of the big/conduit coronary arteries, which now is a part of a common medial examination for patient at high cardiovascular incident risk. However, little is known on cardiac microvascular system, which is the part of coronary circulation that directly provides blood to myocardium tissue through a system of many small (micrometer size) capillaries. The dysfunction of coronary microcirculation system is not an uncommon problem: as many as 40% of all patients hospitalized due to chest pain may be presented with some form of coronary microcirculation abruption. In order to efficiently diagnose, but also to understand its cause, and hence improve the outcome of patients with this disease, we need to gain insight into pathology of coronary microcirculation, *in vivo* and non-invasively.

Magnetic Resonance Imaging (MRI) is an imaging modality that uses a small interaction between protons in water molecules and very strong magnetic field generated by the scanning machine. MRI can be repeated numerous times on the same subject without any harm, in contrast, for example, to X-ray imaging, including CT scanning. As such, it is a well suited method to study disease progression over long time non-invasively.

In this project we aim to apply new protocols using advanced Magnetic Resonance Imaging methods to directly and indirectly observe changes in microvascular status occurring in coronary microcirculatory system and the corresponding impairment of the cardiac blood flow supply (so-called perfusion) using a murine model of heart failure. For this purpose, we plan to use a special breed of mice that over their life-span develop a cardiac impairment which is very similar to what we observe in human patients with congestive heart failure. We plan to probe the changes in coronary microcirculation during the whole progression of heart failure in animals and later to use the newly acquire knowledge to assess the effect of pharmacotherapy with several medication groups, commonly used to treat heart failure in humans,

We hope, that by combining new methodological advances, we will be able to better understand the link between the microvascular dysfunction and heart failure progression.