Description for the general public

Energetic performance of animals and humans appears limited by underlying physiological mechanisms. Metabolic ceilings (thresholds for energy expenditure) exist for energetically costly activities over periods of days and weeks. At present we don't understand what limits the energy expenditure of for example a cyclist during the three weeks of the Tour de France and similar limitations apply to all warm-blooded animals. General concepts formulate energetic limitations to exist either on the side of the acquisition of energy from food (central limitation hypothesis) or on the expenditure of energy for example through muscles (peripheral limitation hypothesis). Most investigations so far have been directed towards the energy as currency.

This research focuses on the oxygen supply system and the link of this system to the fat breakdown for energy production through aerobic metabolism. Oxygen supply and fat break down are multilevel process and this research is designed to provide measure on the organ level, on the level of the blood stream, on level of cells and finally on the mitochondira. Hereby, size measurments of organs and cells, measurements on the composition membranes on the cellular and the mitochondria level and enzyme activites are performed to describe the rate of energy production (ATP molecules) required for muscle contraction.

Together with scientists from the US and Germany we will train Starlings (*Sturnus vulgaris*) to fly in a wind-tunnel specifically designed for research on avian flight at the Max-Planck Institute for Ornithology. This allows us to measure energy expenditures for individual birds that migrated over hundreds of kilometres by flying in a laboratory. We will measure the cascade of oxygen supply including blood parameters and the cascade of fat breakdown and analyse the results for relationship to our metabolic rate measurements. In addition we will perform experimental manipulations of dietary fatty acids and exercise training known to affect whole animal energy use. Thus our avian model system will help to understand why cyclists, endurance mountaineers and participants of the early polar expeditions are constrained in their physical performance, just like all other warm-blooded animals.