The only justification of any treatment in medicine is relieving symptoms or improving prognosis. This thesis aims to guide treatment decisions by applying physiology in interventional procedures in cardiology. In stable coronary artery disease, the presence and extent of inducible myocardial ischemia is a major determinant of the possible benefit of percutaneous coronary intervention (PCI). Fractional Flow Reserve (FFR) is the current standard to assess if a particular stenosis is capable of inducing myocardial ischemia. This thesis proves the ongoing long-term benefits of FFR-guided PCI in patients undergoing cardiac catheterization.

The intra-aortic balloon pump (IABP) supports the circulation during acute myocardial infarction, although its efficacy is subject of heavy debate. The importance of myocardial ischemia and exhausted autoregulation as pathophysiologic prerequisites for effective use of IABP is proposed for the first time in this thesis and investigated in the isolated beating pig heart as well as in humans, solving the controversies surrounding IABP therapy.

In conclusion, this work represents a unique project translating basic science through pre-clinical testing into clinical trials, contributing to improved survival in everyday patients.