

# Combining normothermic machine perfusion with novel therapeutic procedures to improve the function of marginal donor livers

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## Background

Marginal organs are increasingly used to expand the donor pool and to address organ shortage. In this light, normothermic machine perfusion (NMP) has become increasingly important in recent years as it enables extended preservation times which can be used for an objective viability testing. Our aim is to use a modified NMP with extended preservation time to apply therapeutic blood purification methods on discarded organs to make them suitable for transplantation again.

## Methods

In the course of a large animal study with pigs, an NMP lab demonstrator is developed, which is capable of perfusing livers under physiologic conditions with regard to temperature, flow rates, pressures, and oxygenation. Laboratory roller pumps are used for perfusing the hepatic artery and the portal vein. The perfusate (RBC concentrate, albumin solution, further supplements) is oxygenated using a pediatric oxygenator. A rapid control prototyping platform is used for controlling purposes. Livers are damaged by applying cold ischemia times between 6 to 12 hours. The condition of the livers is evaluated using a broad range of assays. Modifications regarding the standard NMP procedure will be implemented, including blood purification approaches and modifications of the perfusate.

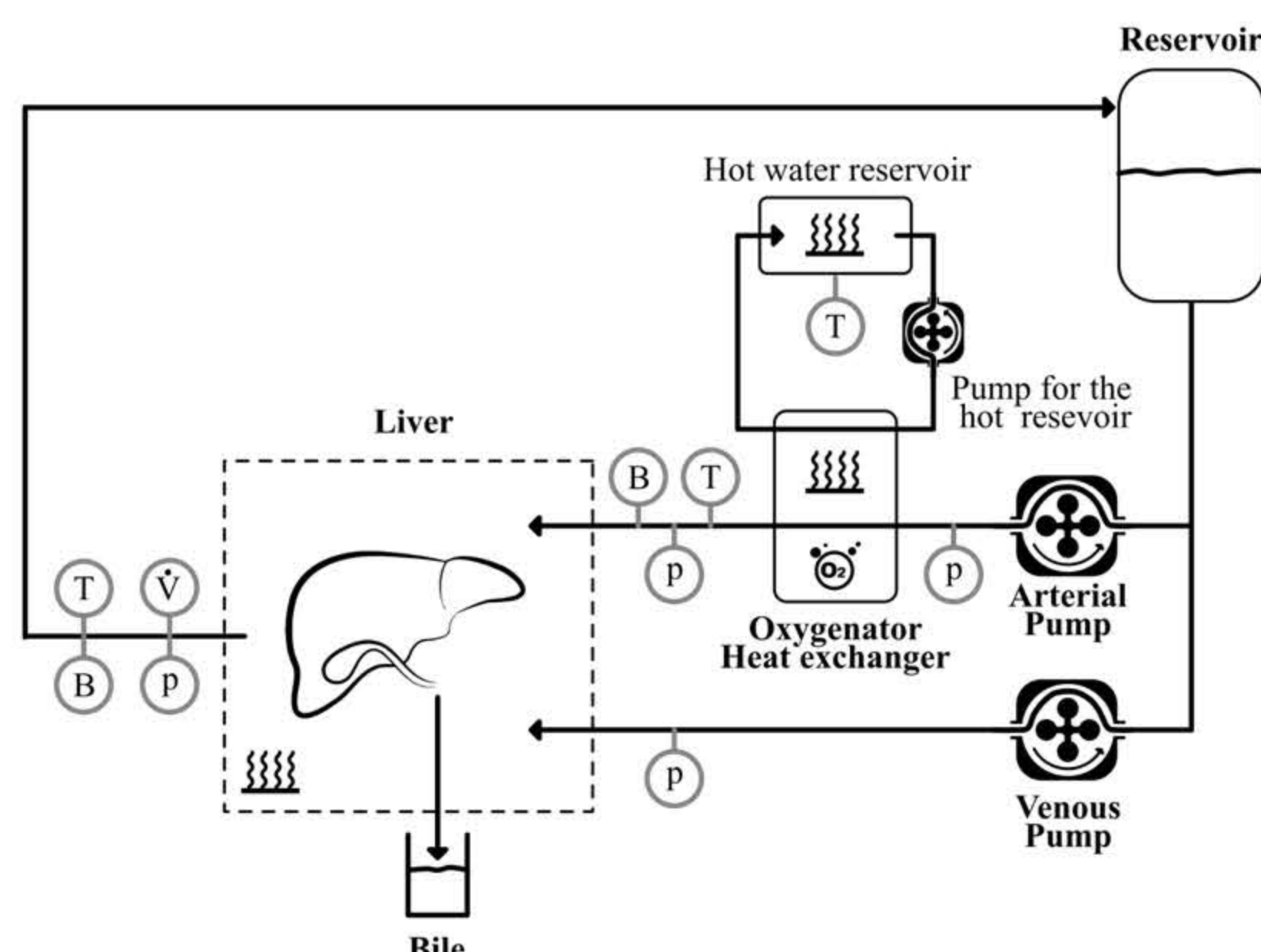


Fig. 1: Schematic setup of the NMP system



Fig. 2: NMP of a pig liver

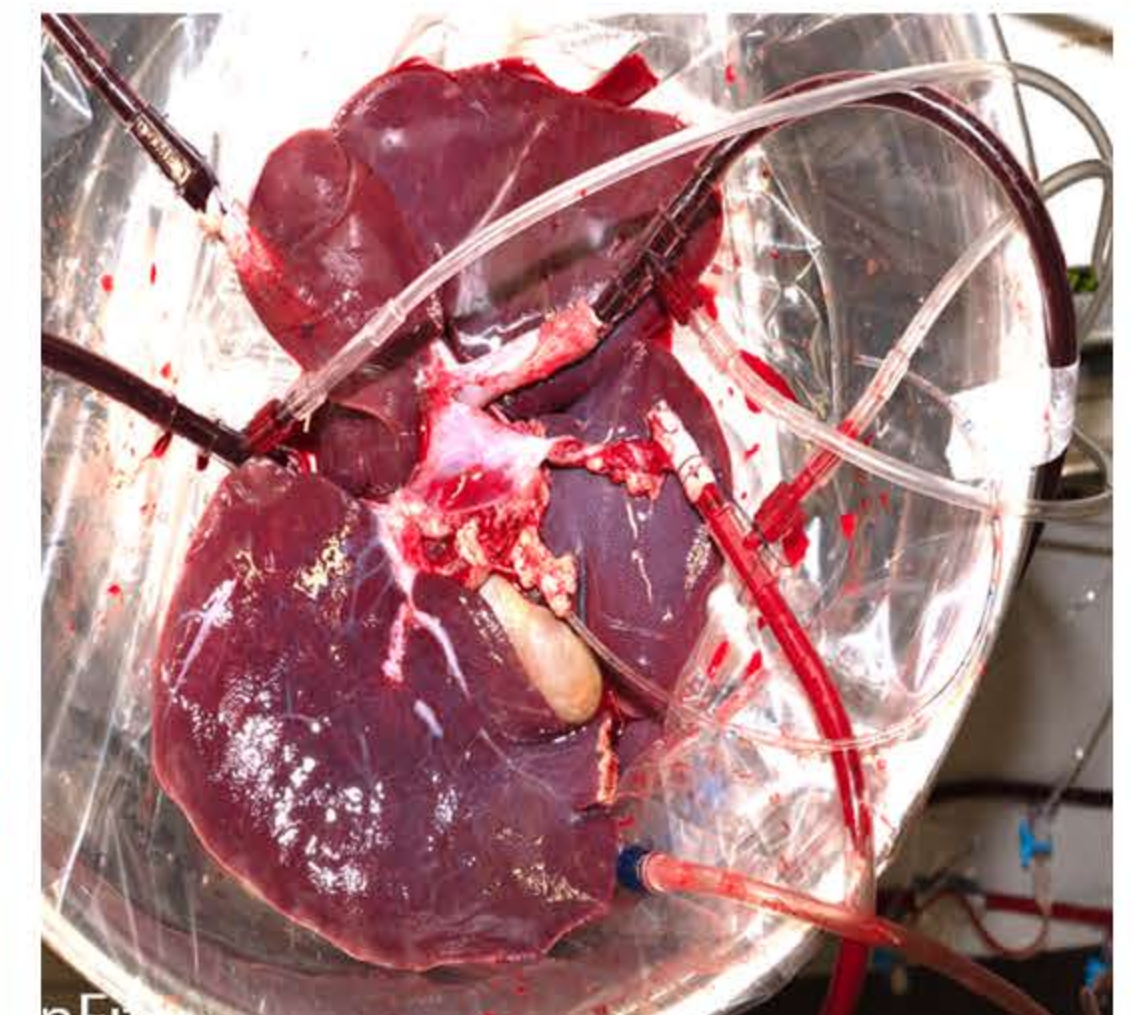


Fig. 3: Cannulated pig liver

## Results

The basic hardware and software framework for the automatic normothermic perfusion of pig livers, perfusion, and surgical protocols were established in order to enable a standardized, comparable perfusion of the damaged organs. Implementation of a control concept for the perfusion at physiologic pressures/flow rates is in progress. NMP modifications are expected to be added at the end of 2022.

## Conclusion

In the future, the organ shortage is expected to worsen as a result of increasing prevalence of metabolic syndrome and the aging society. NMP is a potential key technology that enables the application of therapeutic procedures to organ grafts that were not applicable in this way until now, potentially contributing to a significant increase in the donor pool.