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MULTISCALE LIVER SIMULATION: A HOLISTIC MODEL FOR HEPATIC FUNCTION AND PERFUSION

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ABSTRACT

The aim of this minisymposium is to highlight the increasing role of computation in multiscale liver simulation. On a macro-structural level, the liver is organized in lobes (with the human liver, for instance, having four lobes). The lobes consist of the smallest repetitive functional sub-elements called lobules. Within the lobules the blood flows through micro-vessels, called sinusoids, along columns of hepatocytes separated by the space of Disse from the endothelial cells lining the sinusoids.

The liver is a multi-function organ which interfaces between the gastro-intestinal system and the blood circulation and, as such, with the environment. The liver has hundreds of different functions, which can be categorized as production, secretion, elimination, detoxification, and immunologic functions. Essential for this functionality is a maximal exchange area between the blood stream and the hepatocytes, implying adequate liver perfusion. A disturbed perfusion and therefor a decreased functionality of the liver is often combined with one or multiple diseases of the liver such as fatty liver or liver cirrhosis but is also a very common problem after surgical treatments such as liver transplantation or segregation.

Since the liver takes such a central function within the human body it is very desirable to improve existing liver models on different scales. Moreover, bridging scales from molecular systems biology to virtual physiological human scale can help to derive a holistic, thermodynamically correct model. Topics of interest in the mini-symposium include:

- experimental approaches for measuring the liver function and perfusion
- 3D reconstruction or representation of micro and macro liver architecture
- function and/or perfusion modeling on different scales:
    - cell metabolism models
    - lymphatic and biliary system
    - lobules/sinusoid and lobular level
    - organ and meso scale
- scale-bridging Methods