In the modern day, various liver diseases have become increasingly widespread in the human population, some having important mortality rates. Understanding and efficient treatment of these diseases requires a multidisciplinary approach of systems medicine, combining both experimental and modelling fields, as well as clinical practice. As part of such efforts, there have been several studies in the recent years modelling flow and transport in parts of liver micro-architecture. The work presented in this master thesis aims to formulate a descriptive reduced mathematical model of fluorescent marker transport in both sinusoidal and bile canalicular networks in the liver lobule, along with exchanges with neighboring hepatocytes. Motivated by approaches presented in recently published research, we start from a full 3D model for a Class I mixture, present its reduction into 1D equations along the vessel axis, and show proof-of-concept numerical results, discussing further extensions of the model in view of the multidisciplinary research context outlined above.