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Development of a modified Hess-Murray law for non-Newtonian fluids in bifurcating micro-channels[1] DAVID EMERSON, ROBERT BARBER, STFC Daresbury Laboratory — Microfluidic manifolds frequently require the use of bifurcating channels and these can be used to create precise concentration gradients for chemical applications. More recently, novel devices have been attempting to replicate vasculatures or bronchial structures occurring in nature with the goal of creating artificial bifurcations that mimic the basic principles of designs found in nature. In previous work, we have used the biological principles behind the Hess-Murray Law, where bifurcating structures exhibit a constant stress profile and follow a third-power rule, to enable rectangular or trapezoidal micro-channels to be fabricated using conventional lithographic or wet-etching techniques. Using biological principles to design man made devices is generally referred to as biomimetics and this approach has found success in a range of new and emerging topics. However, our previous work was limited to Newtonian flows. More recently, we have used the Rabinovitsch-Mooney equation to be able to extend our analysis to non-Newtonian fluids. This has allowed us to develop a new rule that can provide a design criterion to predict channel dimensions for non-Newtonian flows obeying a constant stress biological principle.

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