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Development of a Comprehensive Model of the Apparent Viscosity of Blood for Simulations of the Microcirculation in Rat Spinotrapezius Muscle Fascia FRANK JACOBITZ, COLIN PORTERFIELD, CHERYN ENGEBRECHT, IAN METZGER, University of San Diego — A more comprehensive model for the apparent viscosity of blood is proposed and applied to simulations of the microcirculation in rat spinotrapezius muscle fascia. At the microcirculatory level, the apparent viscosity of blood depends on the local vessel diameter, hematocrit, and shear rate. Starting with the apparent viscosity model proposed by Pries, Secomb, Gaehtgens, and Gross (Circulation Research, 67, 826-834, 1990), describing the effect of vessel diameter and hematocrit on the apparent viscosity, and using experimental data presented by Lipowsky, Usami, and Chien (Microvascular Research, 19, 297-319, 1980), describing the shear rate dependence of apparent viscosity, a more comprehensive model is developed. This model is applied to simulations of the microcirculation in rat spinotrapezius muscle fascia. The simulations use realistic vessel topology for the microvasculature, reconstructed from microscope images of tissue samples, and consider passive and active vessel properties. The numerical method is based on a Hagen-Poiseuille balance in the microvessels and a sparse matrix solver is used to obtain the solution. It was found, for example, that the distribution of vessel length follows a log-normal law. The distribution of hematocrit, however, was found to be approximately normal.

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