

Formation of the cerebrospinal fluid; the non-linear model

R. Maritz* and S. Faley

University of South Africa

faleys@unisa.ac.za, maritr@unisa.ac.za

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We present a mathematical model of the cerebrospinal fluid (CSF) formation based on fluid mechanics concepts. It was assumed that CSF formation begins as plasma, and filtered across permeable boundaries of choroidal capillaries. We use the non-linear Stokes Equation with permeable boundary conditions to model this formation. The cerebral blood capillary is modeled as a micro vessel and blood flow in a micro vessel as a two-phase flow: the deformable blood cells phase and the liquid plasma phase. The principles and methods of “effective area” for studying the penetration of fluid into permeable walls, was used to investigate the filtrate momentum flux from the intracranial capillary wall, through the pia matter and epithelia layer of the choroid plexus, into the subarachnoid space. The existence of a unique weak solution is proved by using the weak formulation, the Riesz-representation Theorem and an application of Ladyzhenskaya’s work on Viscous Incompressible Flows.