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Biomolecular transport through hemofiltration Membranes[1] A.T. CONLISK, SUBHRA DATTA, Ohio State University, WILLIAM H. FISSELL, Cleveland Clinic Foundation, SHUVO ROY, UC, San Francisco — A theoretical model for filtration of large solutes through a nanopore in the presence of transmembrane pressures, applied/induced electric fields, and dissimilar interactions at the entrance and exit to the nanopore is developed to characterize the experimental performance of a hemofiltration membrane designed for a proposed implantable Renal Assist Device (RAD). The model reveals that the sieving characteristics of the nanopore membrane can be improved by applying an external electric field, and ensuring a smaller ratio of the pore-feed and pore-permeate equilibrium partitioning coefficients when diffusion is present. The model is then customized to study filtration of both charged and uncharged solutes in the slit-shaped nanopores of the hemofilter for the RAD. Experimental data on the sieving coefficient of serum proteins are reported and compared with the theoretical predictions. Both steric and electrostatic partitioning are considered and the comparison suggests that in general electrostatic effects are present in the filtration of proteins though some data, particularly those recorded in a strongly hypertonic solution (10×PBS), show better agreement with the steric partitioning theory.

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