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Charge effect on solute transport across a periodic fiber array MASAKO SUGIHARA-SEKI, TAKESHI AKINAGA, HIDEYUKI O-TANI, Kansai University — The luminal surface of vascular endothelial cells is covered by a fiber matrix layer referred to as the glycocalyx layer, and charge carried by the glycocalyx layer has been shown to significantly modulate the permeability of the microvessel wall to charged solutes. The present study is aimed to develop a fluid mechanical and electrostatic model for the transport of charged solutes across the glycocalyx layer and to examine the charge effect on the rate of diffusional and convectional transport of the solute. The glycocalyx layer was assumed to consist of identical circular cylinders with fixed surface charge, aligned parallel to each other in a hexagonal arrangement. For a spherical solute with fixed surface charge suspended in an electrolyte solution between circular cylinders, fluid mechanical and electrostatic analyses were carried out to calculate the flow field as well as the electric field around the solute to estimate the rate of solute transport across the layer. It was found that even at rather large ion concentrations, the repulsive electrostatic interaction between the solute and cylinder of like charge could significantly reduce the transport rate of the solute.

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