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Osmotic and electroosmotic fluid transport across the retinal pigment epithelium: a mathematical model. (English) [Zbl 1406.92133](#)
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Summary: The retinal pigment epithelium (RPE) is the outermost cell layer of the retina. It has several important physiological functions, among which is removal of excess fluid from the sub-retinal space by pumping it isotonicly towards the choroid. Failure of this pumping leads to fluid accumulation, which is closely associated with several pathological conditions, such as age-related macular degeneration, macular oedema and retinal detachment. In the present work we study mechanisms responsible for fluid transport across the RPE with the aim of understanding how fluid accumulation can be prevented. We focus on two possible mechanisms, osmosis and electroosmosis, and develop a spatially resolved mathematical model that couples fluid and ion transport across the epithelium, accounting for the presence of Na^+ , K^+ and Cl^- ions. Our model predicts spatial variability of ion concentrations and the electrical potential along the cleft gap between two adjacent cells, which osmotically drives the flow across the lateral membranes. This flow is directed from the sub-retinal space to the choroid and has a magnitude close to measured values. Electroosmosis is subdominant by three orders of magnitude to osmosis and has an opposite direction, suggesting that local osmosis is the main driving mechanism for water transport across the RPE.

MSC:

[92C35](#) Physiological flow

[92C05](#) Biophysics

[35Q92](#) PDEs in connection with biology, chemistry and other natural sciences

[76W05](#) Magnetohydrodynamics and electrohydrodynamics

Keywords:

[epithelial transport](#); [fluid accumulation in sub-retinal space](#); [electroosmosis](#); [local osmosis](#)

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