Coupled PDE/ODE models of drug delivery in the posterior segment of the eye

The understanding of drug delivery mechanisms in the posterior segment of the eye is a challenging task, with a relevant impact on the health of millions of people worldwide. As a matter of fact, many ophthalmic diseases affecting this compartment of the eye are currently treated via medications administered either topically or systemically, but their efficacy and degree of penetration to the target is not completely assessed. In this contribution, we propose two PDE/ODE mathematical models to analyze a selection of possible mechanisms through which drugs can affect the haemodynamics of the posterior segment of the eye and in particular in the retina and optic nerve head. After having assessed the well posedness of the two models, we carry out on both a perturbation analysis to quantify the effect of several physiologically relevant phenomena on the main quantities of interest. Then, we use computational tools to investigate several scenarios which, on the one side, confirm the above theoretical results and, on the other, provide new insights into these complex phenomena.

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