Oral communication (Mathematics and Medicine)

Retinal treatments, electrical assistance and maths - let's play together?

P. M. da Silva[a], J.A. Ferreira[b], P. de Oliveira[c]

[a] IPC/ISEC and CMUC, E-mail: pascals@isec.pt

[b] CMUC, E-mail: ferreira@mat.uc.pt

[c] CMUC, E-mail: poliveir@mat.uc.pt

Abstract

In recent years, numerous ocular treatments have been developed to improve and optimize drug delivery to specific ocular tissues. In clinical research, one primary focus is on retinal diseases. Treatment strategies are complex because numerous physical and biological barriers must be overcome to maintain drug levels within the therapeutic window.

The most common procedure for treating the retina is the use of intravitreal injections. However, recent studies have been exploring new alternative access routes to the retina, particularly the physiological spaces between the layers of the eyeball. In this work, we study a mathematical model that describes drug evolution in the posterior chamber of the eye when the access routes are the subretinal space or the suprachoroidal space. The model includes the action of electric fields used to stimulate drug delivery to the retina.

From a theoretical perspective, we present functional estimates that establish qualitative properties for the total mass of drug released in the different layers. Numerical simulations illustrate the behavior of drug release when intravitreal, subretinal, and suprachoroidal injections are used.

Because the clinical study of alternative access routes is relatively recent, our mathematical and numerical findings can assist the ophthalmology community in better understanding the effectiveness of different retinal treatments.

References

[1] J.A. Ferreira, Paula de Oliveira, P.M. da Silva and R. Silva: *New pathways for drug and gene delivery to the eye: A mathematical model.* Applied Mathematical Modelling **116**, 695–710 (2023)