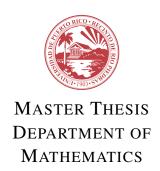# Mathematical model of Ion and Water transport in a Lacrimal Gland Cell

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Abstract

The lacrimal gland apparatus, which is composed of the lacrimal gland, the accessory lacrimal glands, and the lacrimal passages, secretes the tear. Since the lacrimal gland is responsible for the reflex tear, the tear's ion and water secretion can be regulated. A mathematical model of the lacrimal gland acinar cell is developed to regulate the cell volume and ion concentrations (Na^+, Cl^-, and K^+) in the cytosol and lumen for different prescribed values of the interstitial space ion concentrations. By solving a system of differential algebraic equations, the model computes the tear's aqueous layer secretion. For each perturbation of interstitial space ion concentration, the results show how the ion affects the cell volume and both cytosol and lumen ion concentrations in the lacrimal gland acinar cell. In addition, the model is used to investigate Almássy et al.'s hypothesis, that states that the $Na^+-K^+-ATPase$ exchanger is present in the apical membrane to reabsorb K^+ from the secretory fluid.