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Modelling of high salt intake effect on renal interstitial fibrosis

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1 Introduction

Renal fibrosis is the deposition of extracellular matrix (ECM) in the kidney, during tissue repair or as a response to inflammation. Nowadays, renal failure and specially renal fibrosis diagnosis are increasing in Paraguay and the cause is not clear yet. However, there are strong evidences that high dietary intake of salt promotes the fibrogenic process by unclear mechanisms [3]. This work is part of a more a ambitious one to develop a mathematical model to simulate the progression of renal interstitial fibrosis under different salt concentrations. To this end, a previous model for renal fibrosis from the literature [4] is modified to consider salt concentration. A flow chart is shown in Figure 1.

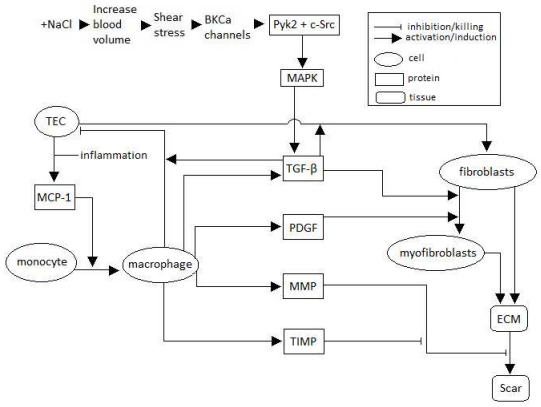


Figure 1: Sat-induced renal fibrosis network, modified from [4]

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2 Model

The mechanism for fibrosis due to salt is not well understood. We explore a possible relationship between the salt and the production of TGF-β, since according to [1,5] higher salt concentration increases blood volume and shear stress on endothelial cells [3]. This yields to activation of calcium-activated potassium channels (BK_{Ca}) and the starting of a signalling cascade that includes complex formation of proline rich tyrosine kinase-2 (Pyk2) and proto-oncogene tyrosine-protein kinase (c-Src) which participates in MAPK activation pathways [1]. Within the MAPK family, p38 and p42/44 MAPK stimulate the production of TGF-β [5] which is a key factor in fibrosis. The modelling begins with a damage tissue and results in a system of two-dimensional reaction-diffusion equations, which are solved in a squared section of the renal cortex with an initial damaged area.

3 Conclusion

In the simulation, some parameters are obtained from the literature and others extracted from experimental values. The analysis of the simulation identifies situations when the pathology can be accentuated due to salt consumption and orientates the experimental validation, which is now necessary for corroborating the hypothetical salt dependence relation.

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