

Mathematical Modelling of the Effect of Glucose on Pancreatic Alpha-Cell Activity

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Abstract : Pancreatic alpha-cells participate on glucose regulation together with beta cells. They release glucagon hormone when glucose level is low to stimulate gluconeogenesis from the liver. As other excitable cells, alpha cells generate Ca^{2+} and metabolic oscillations when they are stimulated. It is known that the glucose level can trigger or silence this activity although it is not clear how this occurs in normal and diabetic people. In this work, we propose an electric-metabolic mathematical model implemented in Matlab to study the effect of different glucose levels on the electrical response and Ca^{2+} oscillations of an alpha cell. Our results show that Ca^{2+} oscillations appear in opposite phase with metabolic oscillations in a window of glucose values. The model also predicts a direct relationship between the level of glucose and the intracellular adenine nucleotides showing a self-regulating pathway for the alpha cell.

Keywords : Ca^{2+} oscillations, mathematical model, metabolic oscillations, pancreatic alpha cell

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