## Seminar Znanstvene sekcije Hrvatskog fizikalnog društva

# Biophysical understanding of sugar metabolism based on a combined empirical-theoretical approach

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Modeling sugar, or glucose, metabolism is of particular importance nowadays given the increasing incidence of diabetes in the world, as well as the increased sensitivity of diabetes patients to others, including infectious, diseases. Pancreatic beta-cells are one of the cell types that make up about a thousand to million separate microorgans called islets, with the function to help keep a delicate metabolic balance known as glucose homeostasis. Evidence suggests that beta-cells perform their function via heavy cell-to-cell communication within the physical limits of an islet, implying that both nutrient sensing and controlled insulin release emerge as collective processes rather than being encoded directly into individual beta-cells. We constructed a dynamical-network model that simulates cell activity, and does so in a manner that faithfully mimics empirical signals. Using the model, we show that network nodes, as the theoretical equivalent of cells, preserve their statistical properties during normal operation, which again closely corresponds to empirical signals. Finally, we illustrate that model-generated and empirically-estimated correlation networks are in excellent agreement. From a mechanistic standpoint, the results endorse the idea that living cell systems, just as modeled dynamical networks, ensure sensitivity to threshold glucose stimulation through coordinated action. During the seminar, we will show how empirical and theortical approaches complement each other on the path to the ultimate goal of developing new diagnostic methods to combat diabetes.