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Computer modeling of insulin secretory granules' dynamics in pancreatic betacell

Insulin is the body's glucose lowering hormone which is stored in dense-core secretory granules in pancreatic beta-cells. Glucose-induced insulin secretion follows a two phase time course: one rapid and transient phase and a week but sustained phase. Loss of first phase in insulin secretion results in Type 2 Diabetes, a metabolic disorder which is rapidly increasing worldwide. Therefore it is important to understand the cellular mechanism underlying biphasic insulin secretion. Total number of granules, size distribution and spatial distribution of granules in a typical betacell are important in the proposed models for stimulated insulin secretion from betacells. In this project we develop an in-silico model based on experimental results to find the true size distribution (TSD), 3D density profile and total number of granules (N) in a typical betacell. Then we make an agent-based model for granules dynamics inside the cell and try to find the mechanism and explanation behind the two-phase insulin release.