

## **Modeling a Glucose Metabolic Pathway and an ATP Synthase Mechanism shows ATP Life Extension in Synthetic Cells**

In synthetic cell protein synthesis, a common limiting factor is the energy supply for transcription and translation. By studying computational and mathematical models of various ATP regeneration mechanisms in synthetic cells, we aim to propose experimental methods for ATP life extension. We use available software tools to study two models. These allow us to develop and study mass action models by implementing simple chemical reaction networks. Our simulations show that a glucose metabolic pathway is able to extend lifetime of ATP up to about 60 hours. Integrating ATP synthase can also independently lengthen the lifetime of ATP to various times depending on the implemented proton gradient mechanism. To ensure prolonged synthetic cell protein synthesis, either the glucose pathway or ATP synthase mechanism can be used. In the future, it will be useful to perform wet-lab experiments in order to compare our model to data.