**Modeling ATP Life Extension in Synthetic Cells by an ATP Rheostat and ATP Synthase Mechanism**

In cell free protein synthesis, a common limiting factor is energy. By modeling various ATP regeneration mechanisms in synthetic cells, we aim to propose experimental methods by which ATP life extension can occur. We use available software tools to study particular models. These include bioscrape, BioCRNPyler, and autoReduce. These allow us to develop and study mass action models by implementing simple chemical reaction networks. We find that the rheostat pathway is able to extend lifetime of ATP up to about 60 hours. The ATP synthase model can also lengthen the lifetime of ATP to various times depending on the implemented proton gradient mechanism. To ensure prolonged cell free protein synthesis, either the ATP rheostat or ATP synthase mechanism can be developed. In the future, it will be useful to understand the experimental pros and cons for the different models.