Final SURF 2020 Report

Write for people who are in other disciplines.

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

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**Abstract**: In synthetic cell protein synthesis, a potential limiting factor is the energy supply for transcription and translation. By computationally studying 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 can extend lifetime of ATP up to about 60 hours. Integrating ATP synthase can also lengthen the lifetime of ATP to various times depending on the implemented proton gradient mechanism. These simulations will help us understand if ATP is truly the limiting factor. 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.

**Text:**

1. **Begin with background**
   1. **Present nature and scope of problem being investigated**
   2. **Give rationale for work**
   3. **State main conclusions briefly**

**Make sure accessible to readers in any discipline (including non-science)**

1. **Describe findings concisely with brief description of methodology when necessary**
2. **Discussion of results**
   1. **Implications of research, relation to other work in the author’s lab, and future research directions**

**Section should be technical but not obtuse**

1. **Methods**
   1. **Subdivided by short headings referring to technique being used or the experiment being explained**
   2. **Directed toward scientist’s own field**
2. **Figures**
   1. **Include figures whenever possible to illustrate points**
   2. **Explanatory diagrams may help explain background information (txtbk pictures are fine(**
   3. **Carefully choose image, font size, line widths, labels to ensure figures are clear**
   4. **Plot theory and experiment on the same graph and redraw screen photos.**
   5. **All should have captions**
3. **References**
   1. **Numbered, sequentially as they appear in the text. At the end of the paper. In superscript in text**
4. **Acknowledgements**
   1. **Acknowledge your mentor and all other individuals who provided technical assistance, and the individuals, organizations, grants, or contracts from whom you received financial support. Students should be sure to include the names of their financial sponsors.**
5. **Appendices**
   1. **Large data files, catalogs, tables, diagrams, and archival information can be included her**
6. **Can send to Caltech Undergraduate Research Journal**