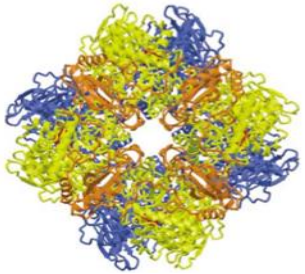

https://collab.its.virginia.edu/access/content/group/f85bed6c-45d2-4b18-b868-6a2353586804/2/Ch21_Schwartz_M_Rubisco_--Spinacia_oleracea--_/Ch21_Schwartz_M_Rubisco_--Spinacia_oleracea_Rubisco.html

Using Directed Evolution to Improve Rubsico Function

Shloke Srivastava and Dr. Jake Stout

Department of Biological Sciences, University of Manitoba, Winnipeg, MB, Canada

University of Manitoba

Background

Global food demands, human populations and CO_2 emissions are rising.

Rubisco is a key enzyme in the process of photosynthesis. Improving it could help improve plant functionality and efficiency, aiding the fight against the growing issues.

Methods

Error-prone PCR (epPCR)

- Inserts mutations randomly into enzyme.

Transformation into *Ralstonia eutropha*

- Optimal strain of bacteria developed for Rubsico.

Screening the library

- Oxygen consumption graphs to screen for improved enzymes for the next round of epPCR.

Objective

To use directed evolution to evolve the Rubisco enzyme to have some level of improvement by random mutagenesis using error-prone PCR

Predictions

If Rubsico were to be improved, it could be for many reasons including:

- Higher enzyme efficiency
- Increased carbon sequestration
- Higher affinity for CO_2
- Decreased O_2 utilization

Expected Results

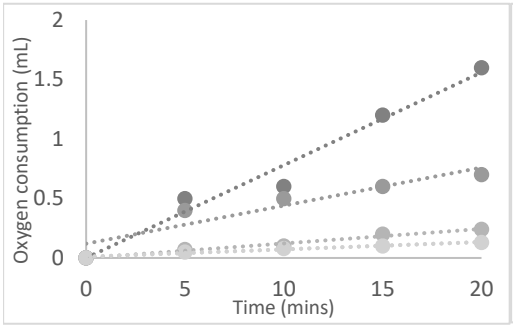

Figure 1. Hypothetical O_2 consumption graph screening mutated Rubisco enzymes to identify template for the next round of epPCR.

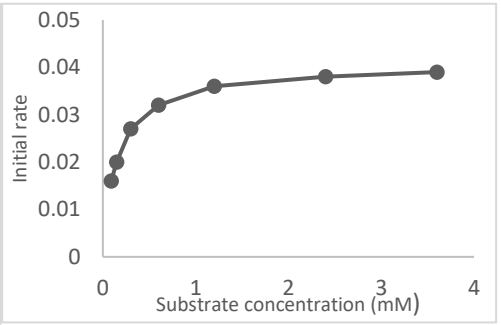

Figure 2. Hypothetical Michaelis-Menten curve to calculate enzyme kinetics values such as K_M and K_{cat} to determine level of improvement.

Conclusions

An improvement in the Rubisco enzyme would improve the process of photosynthesis. This could have many downstream effects including:

- Improving rate of plant growth
- Improving crop yield
- Increase in carbon sequestration

This research could also provide inspiration for continuing to apply directed evolution in plant enzymes, improving biofuel production, secondary plant product extraction and more.

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