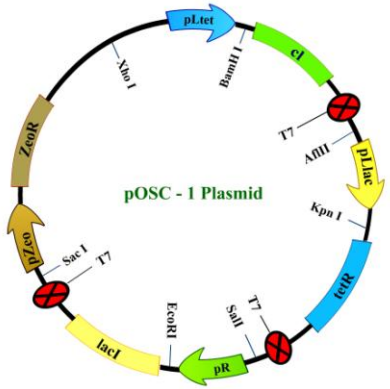
INTRODUCTION

Since the discovery of DNA and the Human Genome Project there have been leaps and bounds in the understanding of the metabolic pathways and functioning of living systems. It is easy to view a cell like a machine with genes, promoters, terminators, and proteins as some of its parts working together for some common function.

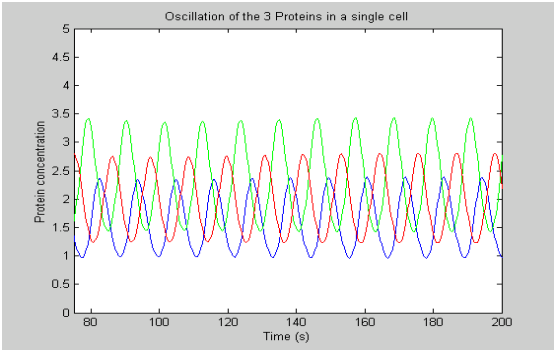
Oscillatory Plasmid



Scientists have been practicing Genetic engineering since the 1970s when single genes were inserted into existing biological systems for expression. However, engineering one gene is far from the engineering of the simplest living organism, the virus, which requires at least 50 genes. Scientists still have not been able to accomplish this feat. Our project has come close though, with the synthesis of a *novel* organism containing more than 20 genes!

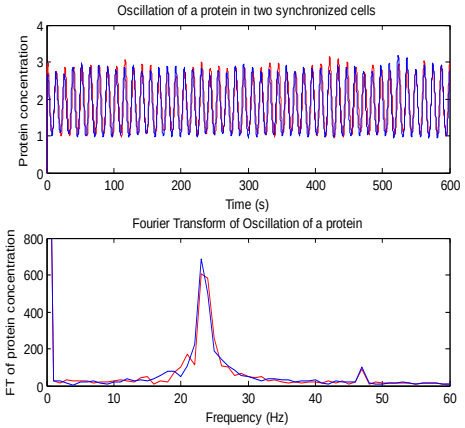
HOW?

To create an oscillating color scheme, we are engineering plasmids (circular DNA) with a series of promoters, which turn on three different genes that code for fluorescent proteins. Fluorescent proteins are ideal for this experiment because we can see which cells are in what stage in the cycle. The plasmids were created using inexpensive lab techniques to fuse genes from many different sources (jellyfish, viruses, phages, and some synthesized in our own lab). Once created, the plasmids were then inserted into *E. coli*.

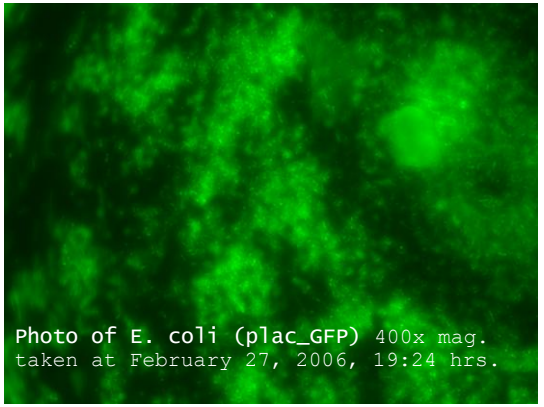


WHAT WE ARE DOING?

Prior to this semester, the mathematical models for the oscillator had been roughly outlined to select the best pieces (machinery) for the plasmid. In the lab, techniques for combining the genes had been studied and many of the genes were put together.



This semester, IPRO 302 has made great progress towards polishing the math modeling. Stochastic and deterministic models were examined using “noise” which emulates real cellular conditions. Modeling for the implantation of synchronization has also been completed.



Connecting each gene in the lab is a time intensive task which is not always successful. However, this project is near completion of the 20 gene system necessary for the flashing bacteria.

OBJECT

IPRO 302 is on the forefront of this research by creating a system of about 20 genes that causes its host to oscillate three fluorescent colors. The purpose of this project was to study how genes and their protein products inter-react within a living organism. Thus, the superficial objective of this project was to create an oscillating metabolic pathway. To create this oscillatory system we first had to model it mathematically and then create it biologically.

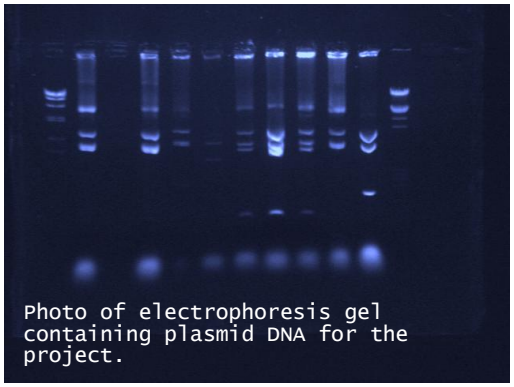


Photo of electrophoresis gel containing plasmid DNA for the project.

Once the system is created, it can be expanded upon to create even more advanced system with more genes. Synchronization would be the logical next step. This would allow for multiple cells to oscillate together, expressing the same fluorescent protein at the same time. From there, the possibility of moving into multi-cellular organisms could be considered.

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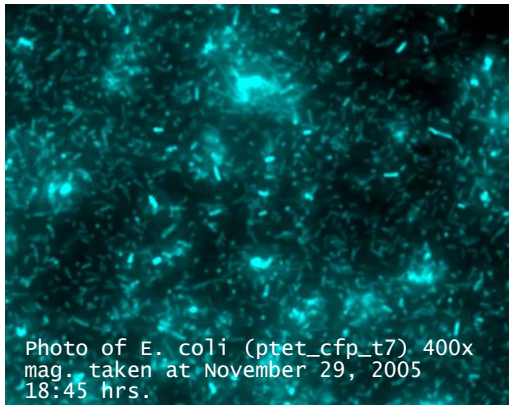

Photo of E. coli (ptet_cfp_t7) 400x mag. taken at November 29, 2005 18:45 hrs.

Interested in Learning More?

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IPRO 302

Synthetic Biology:

Engineering Novel Organisms

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