IPRO 302 – Synthetic biology

Introduction: All the characteristic of any living organism is determined by its genetic code. Most of which is similar for a given species, and different species vary from each other due to combination of various genes, which make up the entire genetic code. This is the way the organisms are found in the nature, but if a gene or more from another organism is imported to a given organism according to plan, the experimenters can achieve interesting results. This is exactly what we are trying to do by inserting fluorescence genes into the zebra fish. This is the goal for this semester, which can be modified to a more sophisticated plan in the semesters to come.

Goal: The goal of IPRO 302 is to manipulate and modify the genetic material of the organisms according to our desire, which is done by inserting the genes of interest in the experimental organism, which on successful insertion will express the desired character. Up until this semester the basic learning of the genetic manipulation was carried out in bacteria. This is the first time we are working on eukaryotes; our choice for this is the Zebra Fish.

Our team had various fronts to work on and to accomplish we divided ourselves into sub-teams, which along with their goals are described below:

Vector Construction *team* worked on constructing the vector that carries the genetic material to be inserted. This team had to work the most in the lab and involved almost all the members of the team at one point or the other, since the tasks to be achieved long hours of lab work, almost everyday of the semester.

Vector Design *team* was responsible for constructing the oscillator vector to be used in the fish cells, since the old vectors were specific for the bacterial cells, and to achieve required the research of the possible genetic system from various organism and taking the genes of interest from them and give the blue print to construct them together. This will then go through a construction process similar to the construction of the reporter plasmid this semester.

Fish Cell Culture *team* worked on the fish cell line, working on which enhanced our understanding and working with the fish embryos. The fish cells were transfected with the reporter vectors as a test to confirm the vector success in the fish cells.

Fish *team* was a critical part for this semester, since we had to move our fluorescence system to the fish embryos. This required the knowledge to allow us to successfully work with the fish, to be able to breed them, to save the eggs for the injection, establish the injection procedures, and maintain the young fish. The challenges this team faced ranged from determining a proper food and feeding schedule for young and adult fish, to figure out how to provide the fish with a healthy environment. The most important goal doubtlessly was to grow the embryos and injecting the plasmid in the egg successfully so that the cell can survive the injury of injection.

Mathematical modeling *team* took the responsibility to move the oscillating program in MATLAB from last semester to a better operating system capable of dealing with multicellular system where as the old program could only handle a few cells. This is of critical importance since we need to make sure that all the biological work that has been performed on the fish can be maintained in an orderly fashion or else multicolor fluorescence being exhibited by different cells at different times at rates will rob away the beauty of the engineering process. C++ was used to

carry out multicellular calculation but the results had to be displayed through MATLAB due to its diagrammatic superiority over C++.