



“Design of an experimental device to detect events of horizontal gene transfer in *Escherichia coli*”

Abstract

Horizontal gene transfer is an evolutionary mechanism that contributes to the acquisition of new genetic material among organisms; as such it helps bacteria to acquire antibiotic resistance and other genetic devices. The main goal is to design a device that would detect events of horizontal gene transfer among bacteria. Genetically modified *E. coli* were monitored until a detectable sign appears in the media, indicating an event of horizontal transfer. In order to detect such events, we will use plasmids as the genetic material that could be transferred in a bacterial culture.

Objective

The main goal is to design an experimental model to detect events of horizontal gene transfer among bacteria.

Why is it important?

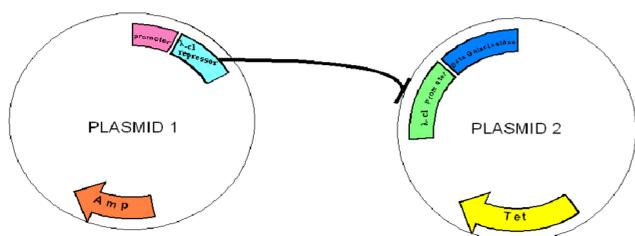
HGT is thought to have played a very important role in the evolution of life, especially in early stages of life where its effect might have blurred the phylogeny of organisms. HGT is very important for synthetic biology as it might allow the genetic devices to spread quickly among natural populations and this has caused great concern to our society.

Why are we interested in HGT?

In the long term that device might help us understand the history of life, control the spread of antibiotic resistance and help us understand better some evolutionary forces that affect the devices that we design and know the risks of unintentional spread of a device.

And the devices that you have designed?

We designed a couple plasmids so that they confer different antibiotic resistance and express a reporter gene when they are in the same cell.



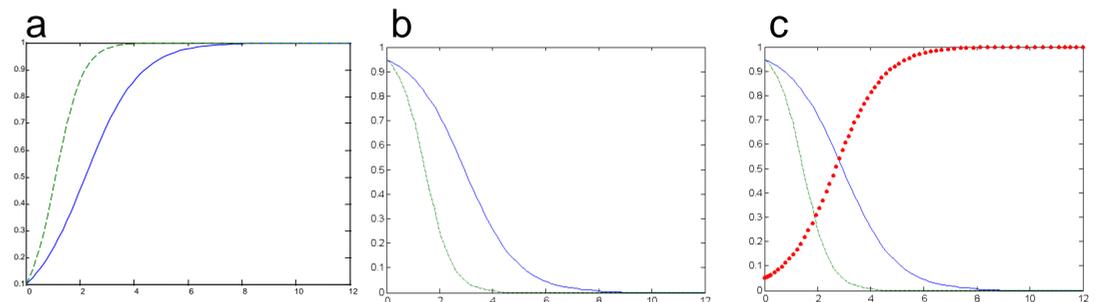
How do we test it?

If we grow a bacteria that has one of our plasmids in a media containing a sublethal dose of an antibiotic whose resistance it lacks and we add to the media the complementary plasmid, we will be able to detect HGT events on basis of the bacterial growth and the expression of the reporter gene.

Mathematical Model

The dynamics of the experiment can be modelled with logistic equations.

$$\begin{aligned} \frac{dA}{dt} &= a_A A \left(1 - \frac{A}{K_A}\right) \\ \frac{dB}{dt} &= a_B B \left(1 - \frac{B}{K_B}\right) \\ \frac{dC}{dt} &= a_C C \left(1 - \frac{C}{K_C}\right) \end{aligned}$$



- a) Bacteria growing exponentially
- b) Bacteria dying in presence of antibiotic
- c) Bacteria which have the plasmid for resistance (RED)

Acknowledgment

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