iGEM-MÉXICO
PROJECT

iGEM-MÉXICO PROJECT

PARTICIPANT INSTITUTIONS

IPN – INSTITUTO POLITÉCNICO NACIONAL
(National Polytechnic Institute)

UPIBI - Unidad Profesional Interdisciplinaria de Biotecnología (Biotechnology Unit)

ESCOM - Escuela Superior de Cómputo
(School of Computational Sciences)

iGEM-MÉXICO PROJECT

PARTICIPANT INSTITUTIONS

UNAM – UNIVERSIDAD NACIONAL AUTONOMA DE MÉXICO (National University of Mexico)

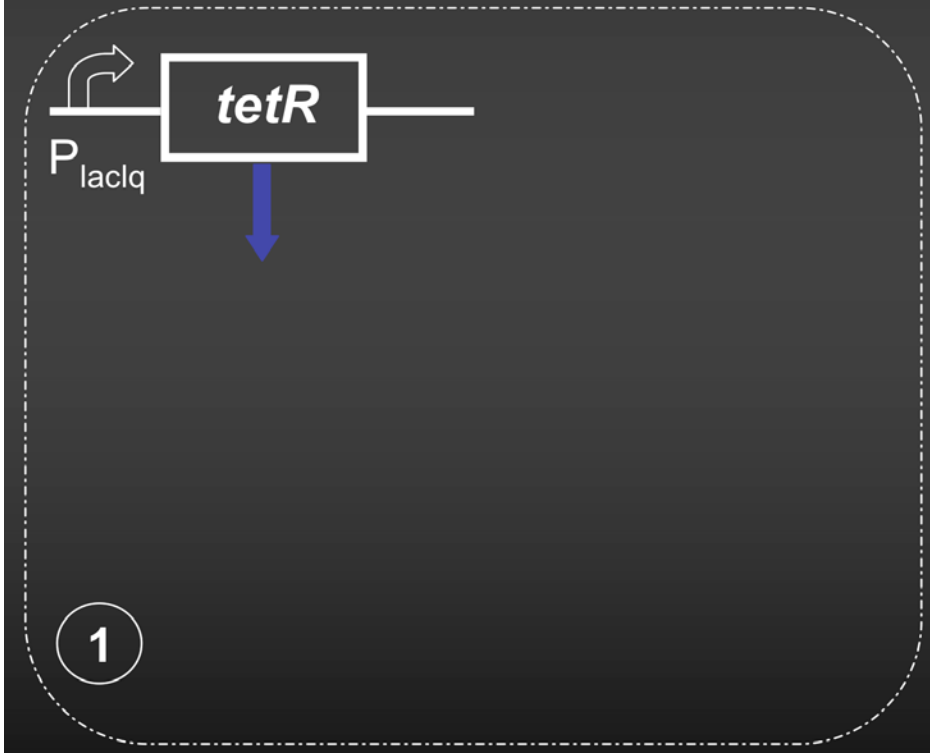
FC - Facultad de Ciencias (School of Sciences)

IIMAS - Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas (Institute for Applied Mathematics)

iGEM-MÉXICO PROJECT – UPIBI's contribution

EXPERIMENT PROPOSAL:

Engineering a genetic signaling cascade to produce a green flourescence protein expression/repression system in Escherichia coli [1,2]



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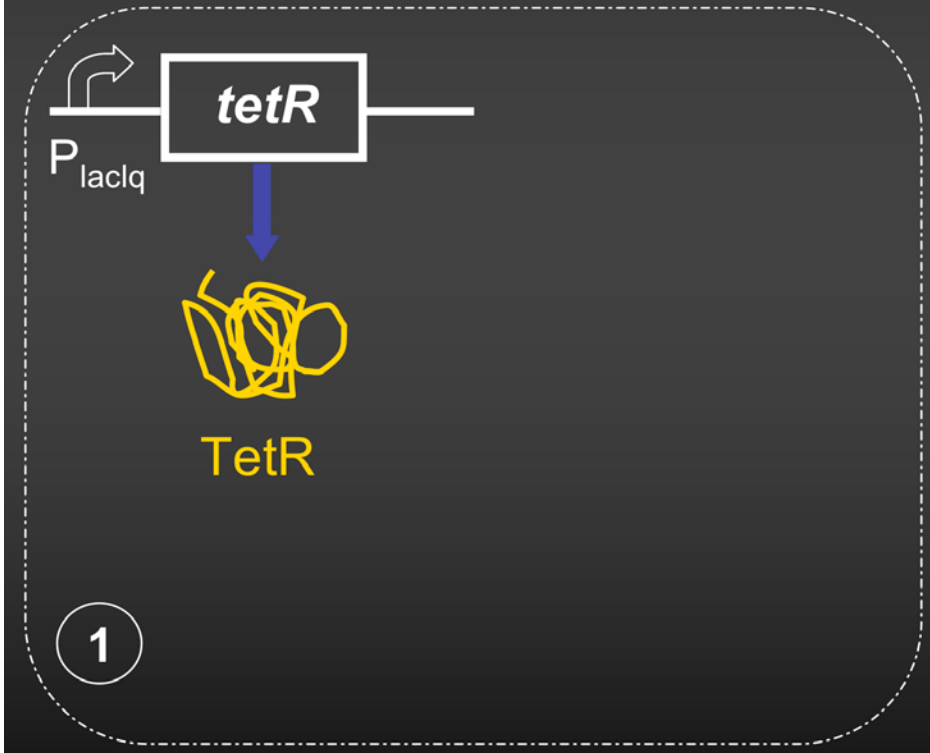

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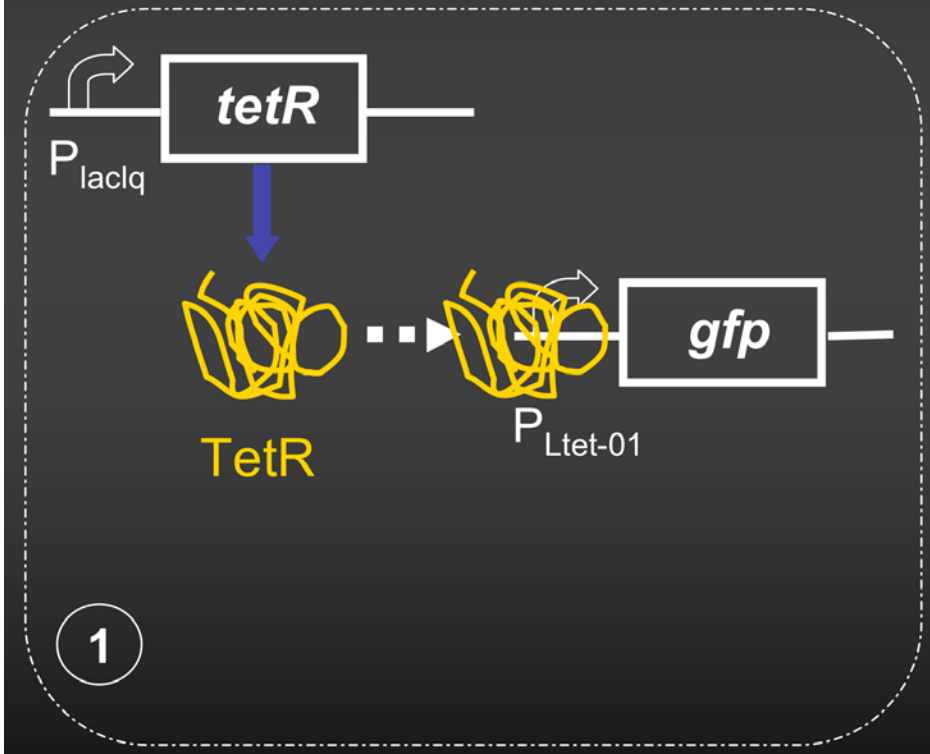

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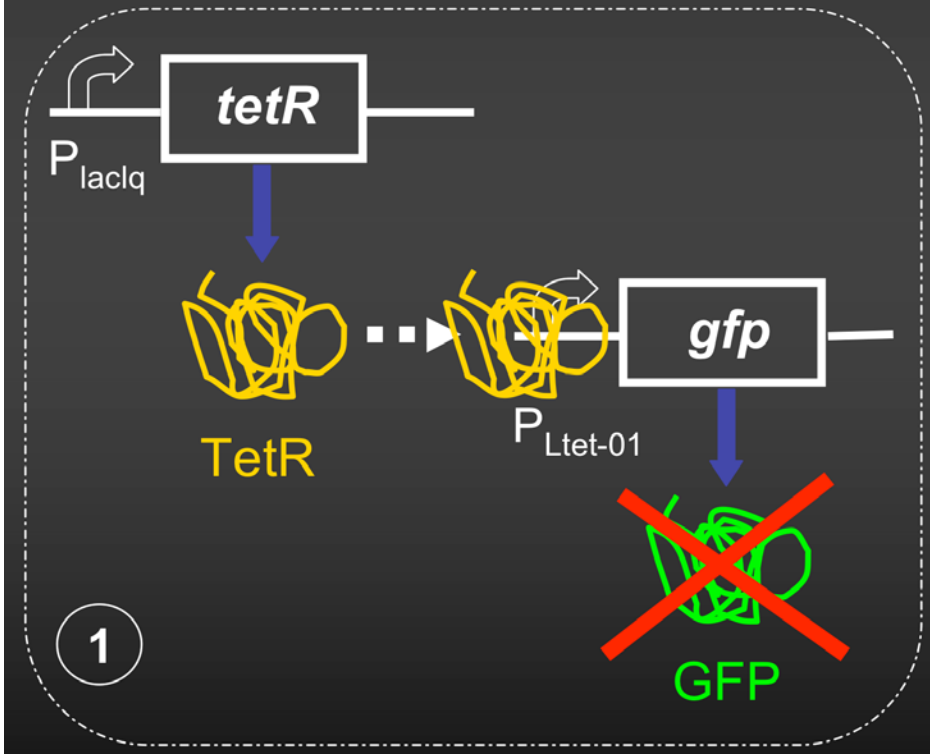

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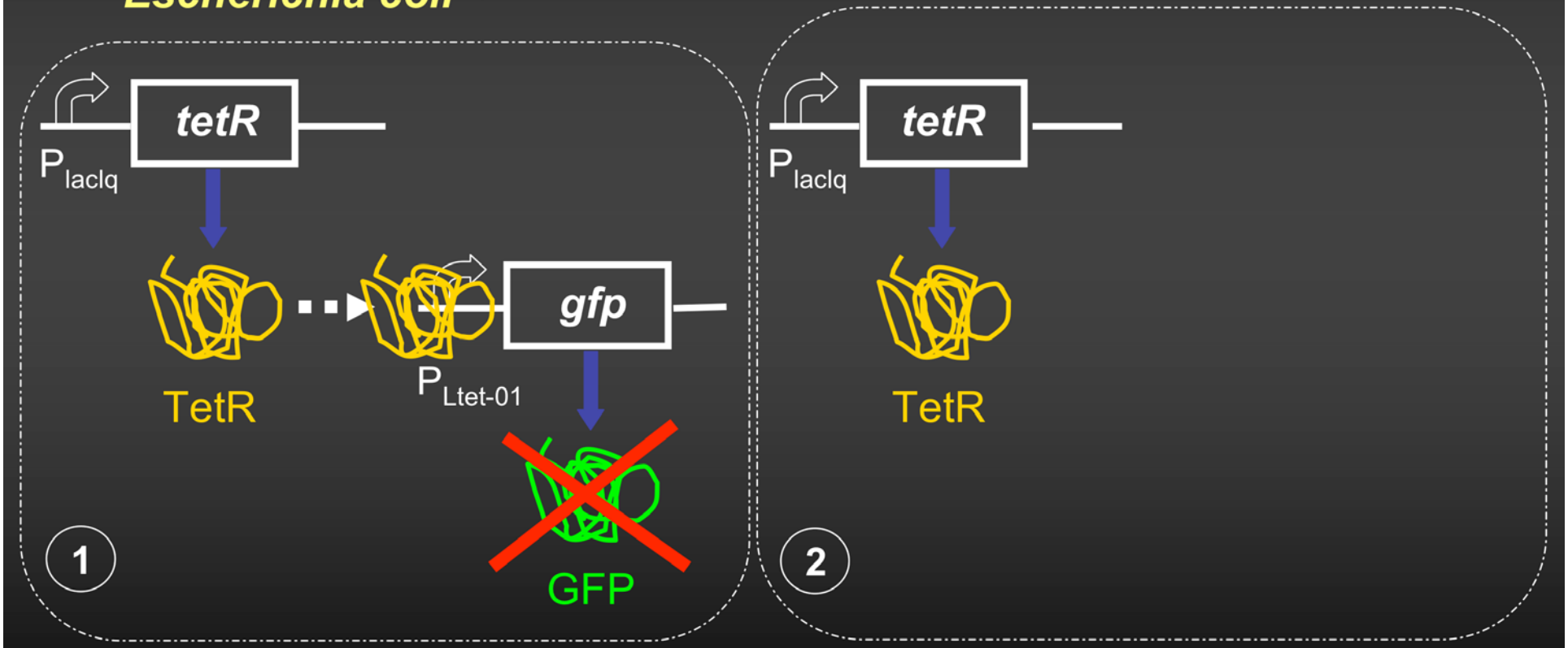

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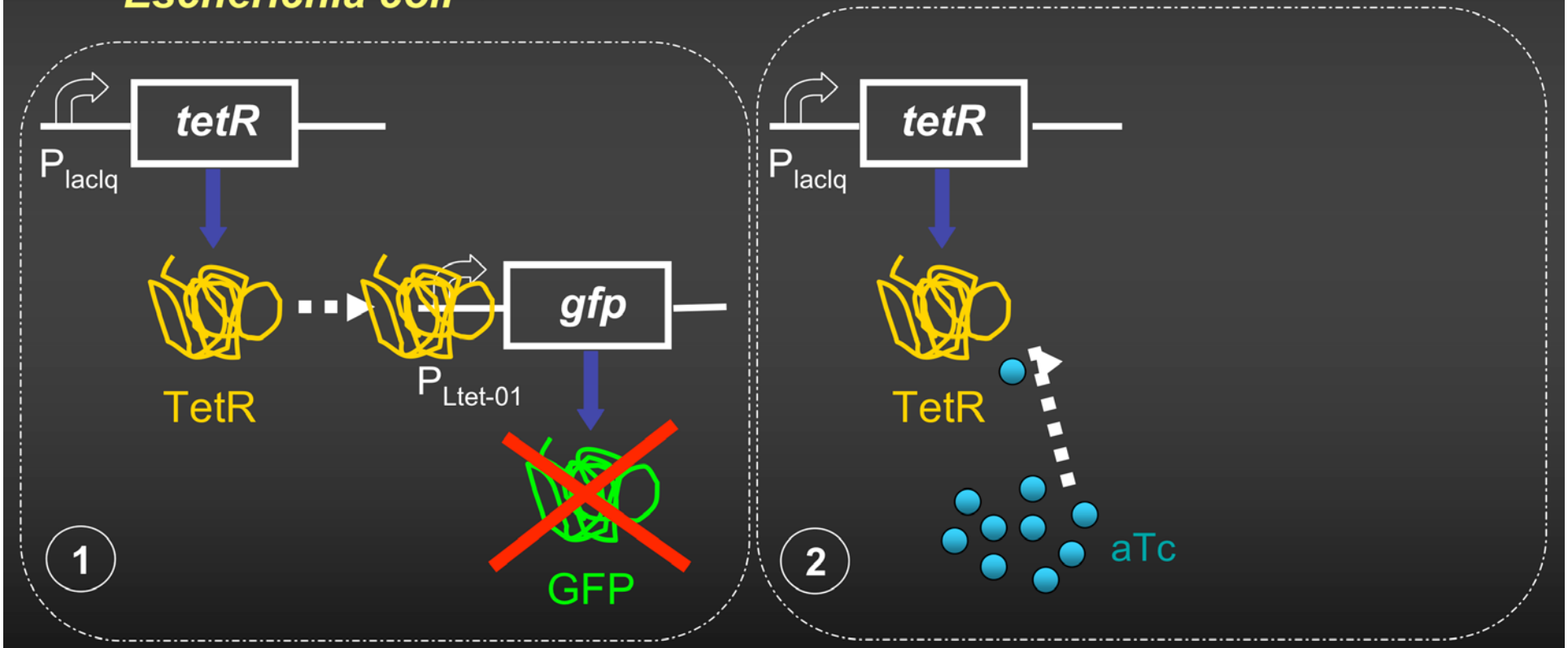

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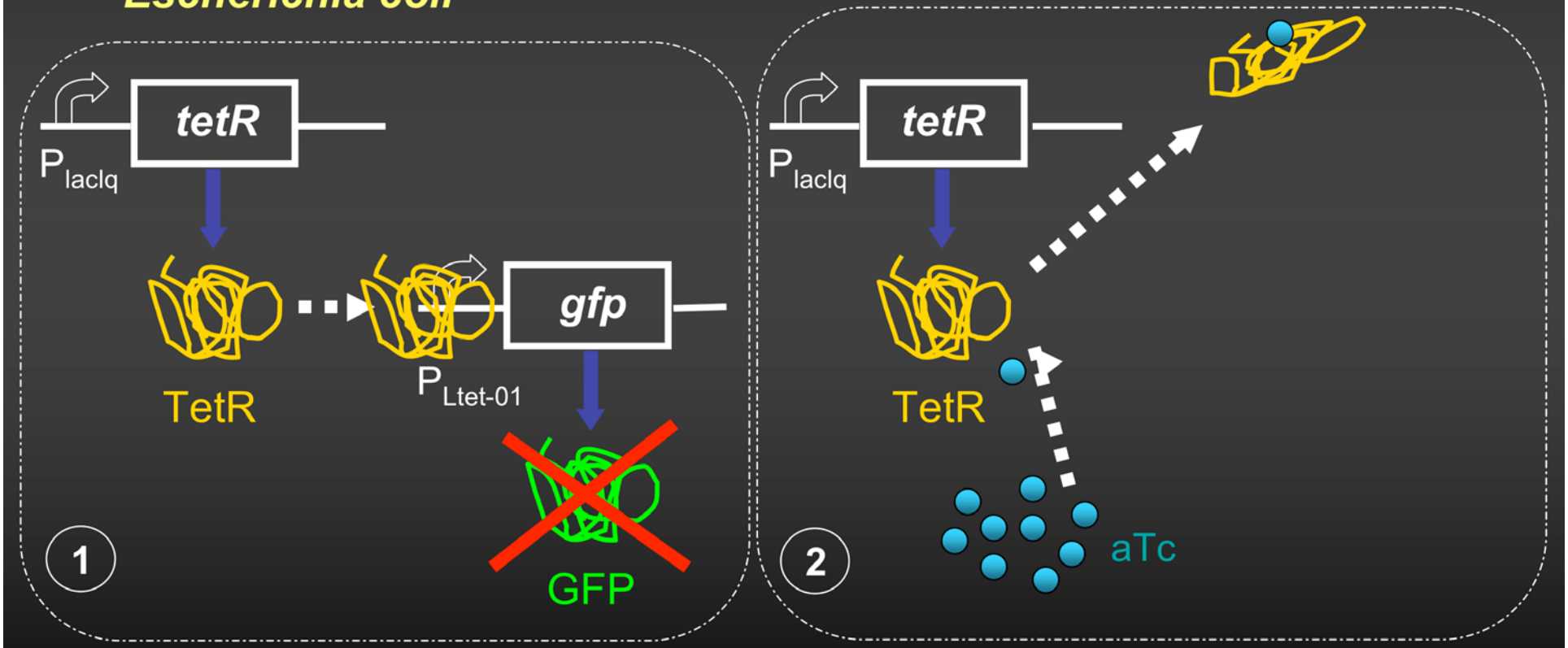

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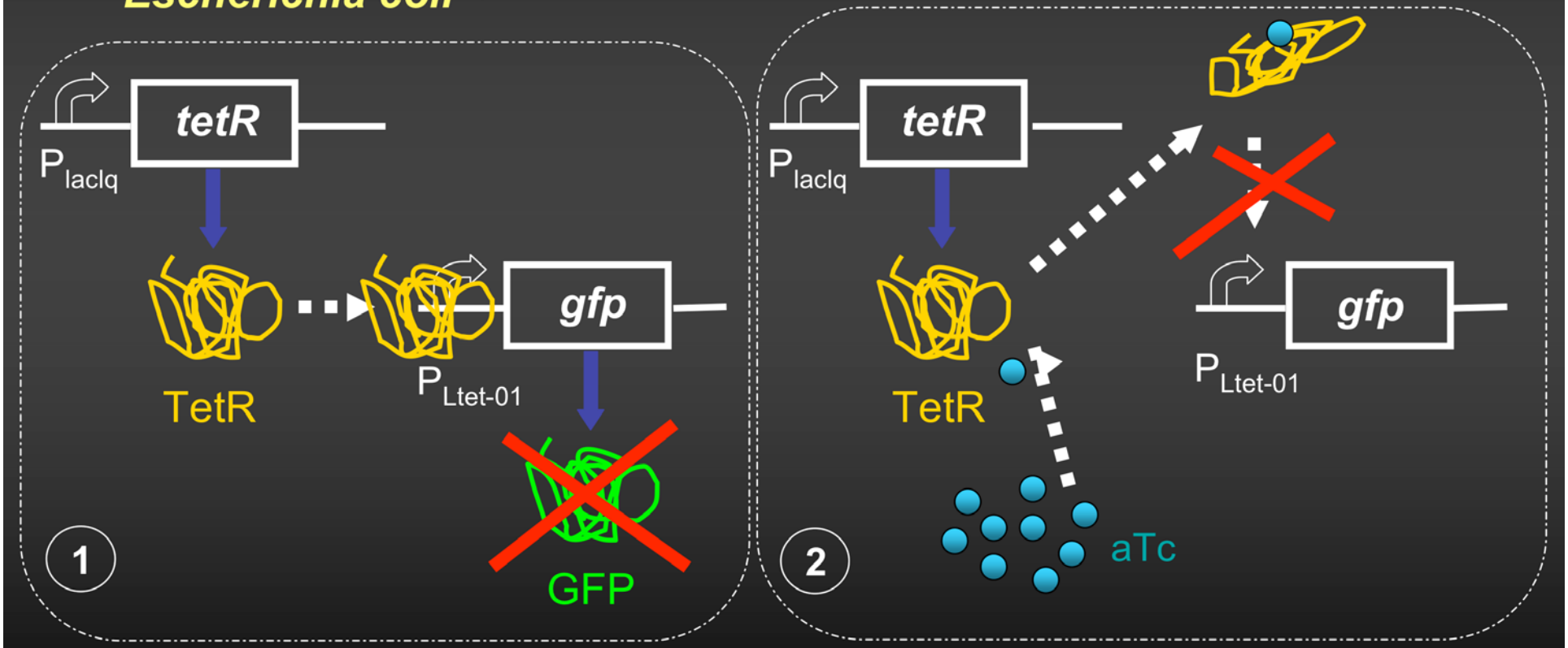

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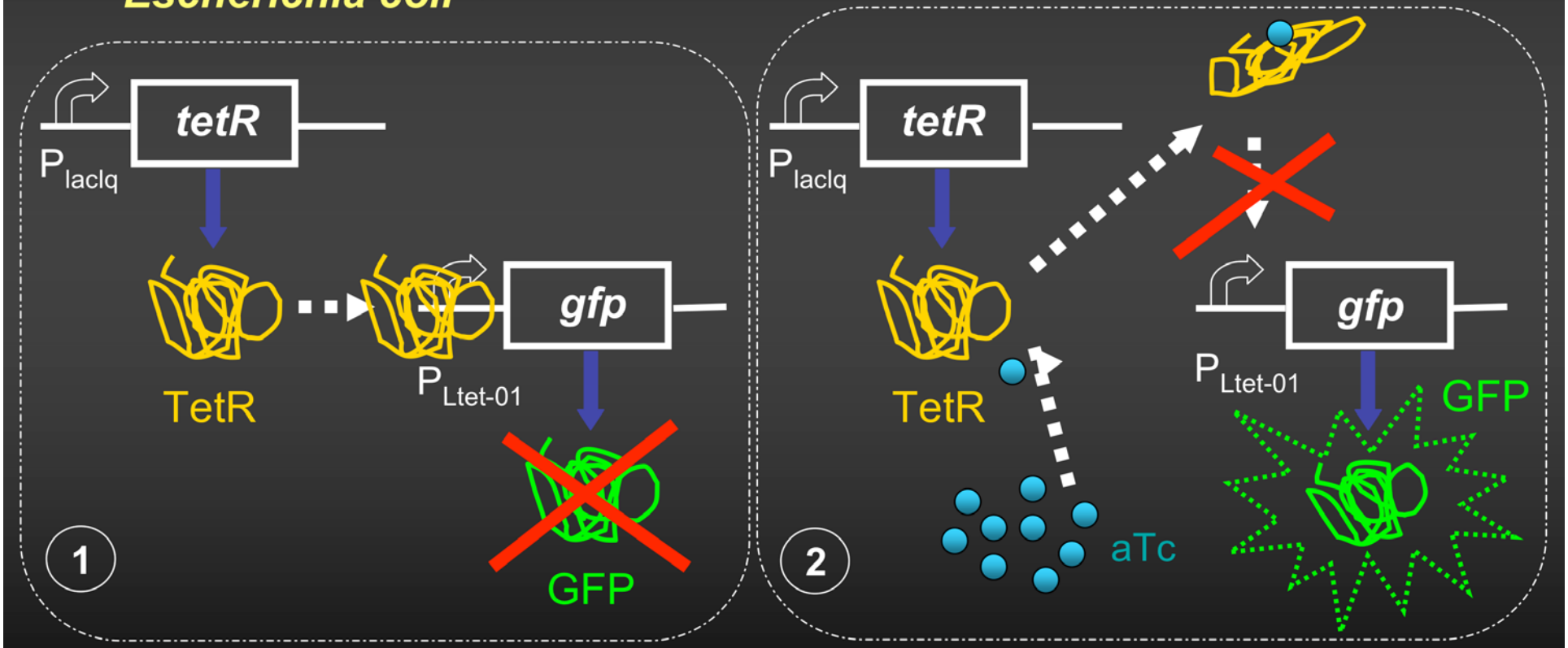

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iGEM-MÉXICO PROJECT – UPIBI's contribution

Biological parts

Select biobricks

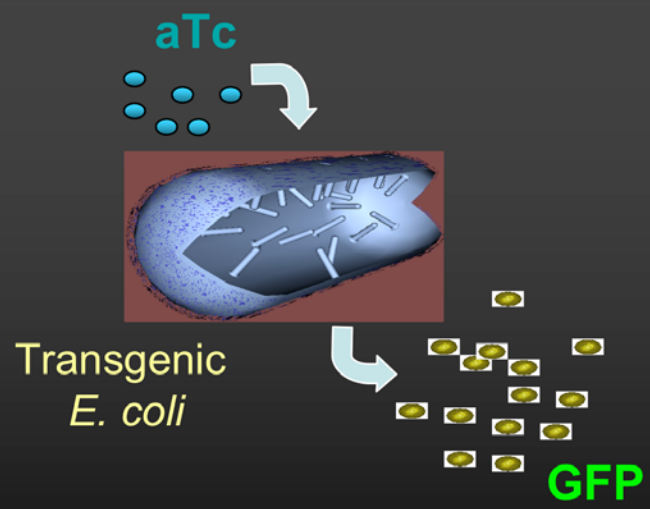
Build parts with the correct endings (recognition site for the restriction enzyme) by PCR

Build separetely the *tetR* regulator and the reporter *gfp* plasmid

Introduce the plasmids in the cellular system *E. coli*

Test the genetic cascade by adding aTc to the media

Toggle switch



iGEM-MÉXICO PROJECT – FC and IIMAS's contribution

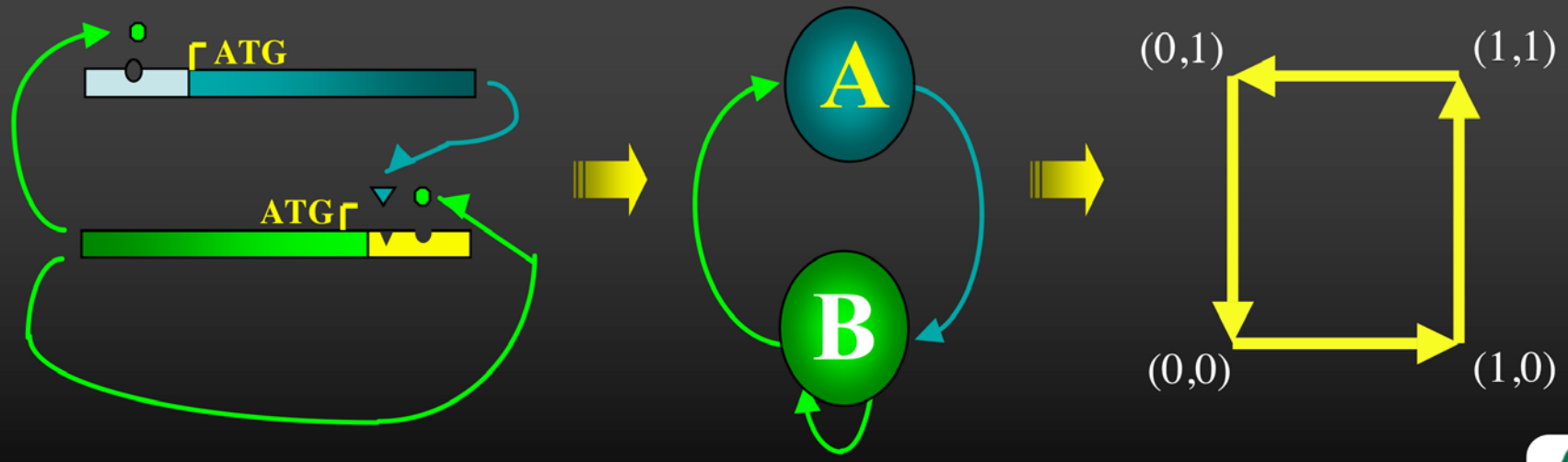
IN THIS PART OF THE PROJECT:

We intend to emulate some genetic networks already identified in Arabidopsis responsible for the formation of hair in root and leaves. These networks lead to simple genetic circuits of the repression/expression type. We would like to show that these systems support Turing patterns.

TRANSCRIPTIONAL REGULATORY NETWORK

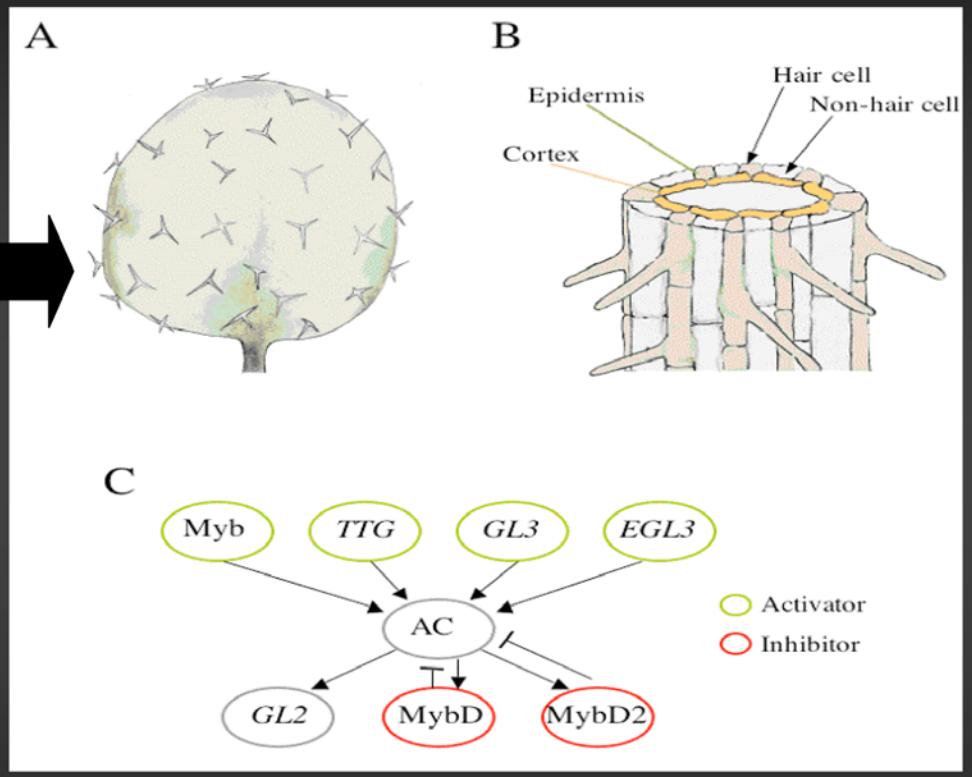
PROTEIC ACTUATORS (TeTR – GFP)

ASSOCIATED DYNAMICAL SYSTEM



iGEM-MÉXICO PROJECT – FC and IIMAS's contribution

(A) Sparsely dotted trichome pattern in a wild type *Arabidopsis* leaf.



(B) Striped trichoblast pattern in *Arabidopsis* roots. Root hairs develop on epidermal cells that contact two cortical cells

(C) Genes that are not shared between these two networks belong to the same gene families

iGEM-MÉXICO PROJECT – ESCOM's contribution

MODELLING PROPOSAL:

Developing models to describe inside-the-cell metabolic events through a cellular automata process.

Cellular automata are discrete or continues dynamical systems able of support cellular process in a way massively parallel.

Cellular automata are often simulated on a finite grid rather than
infinite one. In two dimensions, the universe would be a rectangle instead of an infinite plane.

iGEM-MÉXICO PROJECT – ESCOM's contribution

Diffusion Rule: is a complex cellular automaton able of support particles.

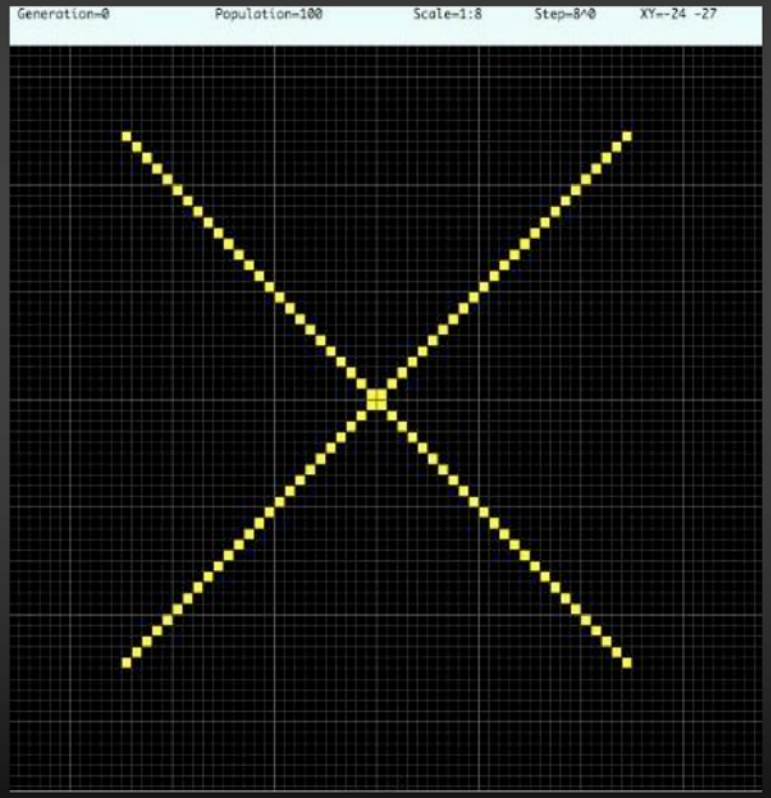
The dynamic at the local function is working into the next way:

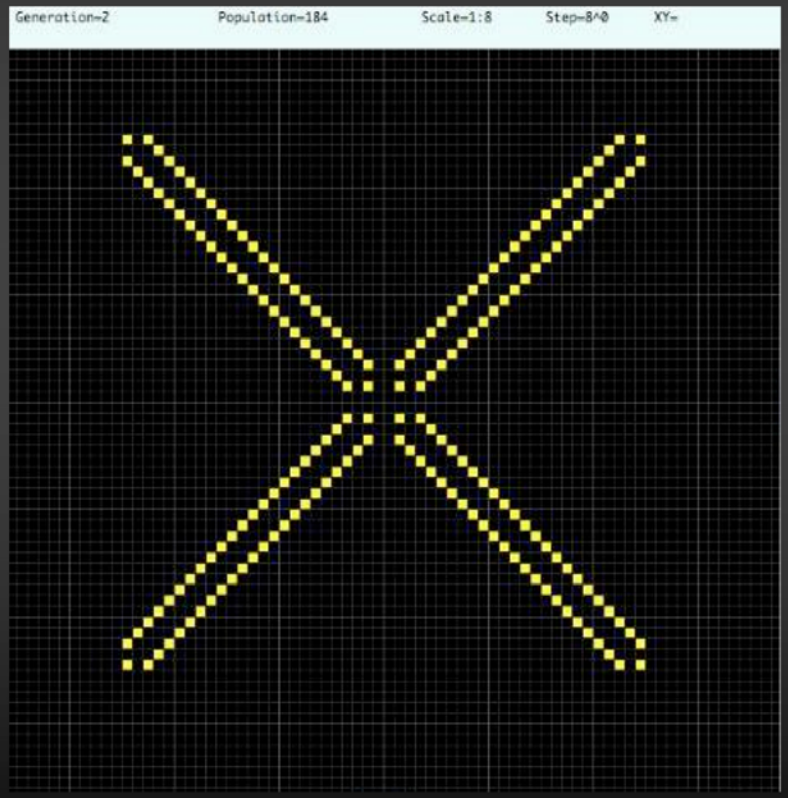
1. *Cell in state 0 takes state 1 if there are exactly two neighbors in state 1, otherwise the cell remains in state 0.*

2. *Cell in state 1 remains in state 1 if there are exactly seven neighbors in state 1, otherwise the cell switches to state 0.*

iGEM-MÉXICO PROJECT – ESCOM's contribution

http://uncomp.uwe.ac.uk/genaro/diffusionLife/diffusionLife.html
http://uncomp.uwe.ac.uk/genaro/papers.html





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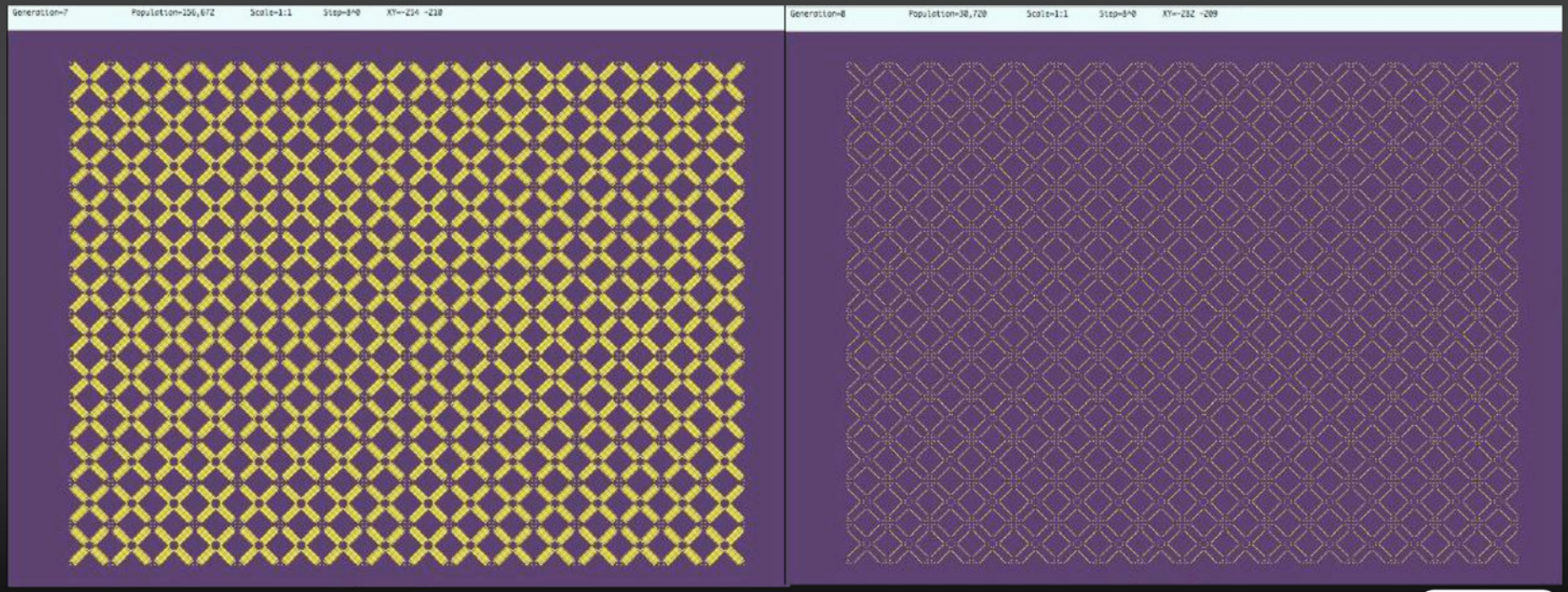
Luminescence: Using the diffusion rule we can generate a dynamical pattern over a system, like turn on/off ligth with alive o dead cells that show a luminescence, examples include fluorescence, bioluminescence and phosphorescence.



iGEM-MÉXICO PROJECT – GENERAL PERSPECTIVES

iGEM-México long term research

- Creation of new biobricks.
- Virtual reality in biological systems.
- Simulation of biological events throug cellular automata.
- Turing patterns generated by simple genetic circuits.
- Non-conventional computing applications.

http://parts2.mit.edu/wiki/index.php/Main_Page

iGEM-MÉXICO

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1) Unidad Profesional Interdisciplinaria de Biotecnología (UPIBI)

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2) Escuela Superior de Computo (ESCOM)

Ph. D. Genaro Juárez, M. Sc. Rosaura Palma, M. Sc. Carlos Silva, M. Sc. Jaime López, Bach. Eng. Tania Bermúdez, Bach. Eng. Paulina León.

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