A very cool *E. coli*
Every year we witness negative effects on agriculture due to frosts.
Species like cocoa and coffee are affected by frost.

Gas exchange in plants.

Agriculture is affected directly by frosts, due to these low temperatures the crops are damaged and it also effects the grass that is eaten by the livestock.

The damage of crops not only implies an economical loss but also causes famine due to the frost. This can affect the population that depends on those crops as a source of food.

In Mexico the crop that is the most affected is coffee.
Life can exist under extreme environmental conditions.

Life has evolved towards cold environments that represents almost 91% percent of the biosphere.
To find a solution for the current problem we went and looked at Nature's solutions.
AFP visualization
Biosynthetic construction that allows *E. coli* to produce an AFP from 15 degrees.
• 4 new biobricks from natural sequences

• Designed for different response to cold shock

Cold Shock response system
Work at Dry Lab
Parts at registry for 2010

BBa_K328000

BBa_K328001
In progress
Future work
Future work
Modeling the cold shock response system

- Cold stress response
- CspA major CS protein in *E. Coli.*
- CspA RNA chaperone

Cold shock dynamics

And many more!
A simplified version
Collaboration UNAM-Genomics

- Application of the light emission-reception system
- Cycle of three nodes
- Positive feedback
Non-linear model

\[
\frac{dy_1(t)}{dt} = k_1 y_1(t) y_3(t) \left(1 - \frac{y_1(t)}{M_1}\right) - \sigma y_1(t)
\]

\[
\frac{dy_2(t)}{dt} = k_2 y_2(t) y_1(t) \left(1 - \frac{y_2(t)}{M_2}\right) - \sigma y_2(t)
\]

\[
\frac{dy_3(t)}{dt} = k_3 y_3(t) y_2(t) \left(1 - \frac{y_3(t)}{M_3}\right) - \sigma y_3(t)
\]
Non-linear simulation
First Mexican Workshop in Synthetic Biology

- Organized by our team and Faculty from Facultad de Ciencias UNAM and CINVESTAV Irapuato.
- More than 90 applications from all the country
- 29 undergraduates and 7 graduate instructors
Main activities

- Brainstorming of short synthetic biology projects.
- Wetlab implementation of projects.
- Mathematical modeling of biological circuits.
- Discussion of human practices, ethical issues, and biotechnology-based business.
- Lectures by invited speakers who are doing research in different fields related to synthetic biology.
- Presentation and discussion of projects at the end of the Summer.
Survey

• Patents
  • Issues found during summer.
  • Legal advise.
  • Knowledge about how to patent.
  • Plans to patent pieces.

• BPA (BioBrick Public Agreement)
  • Knowledge about BPA.
  • Should be included as a integral part of iGEM
Survey

• 132 responses
• 68 teams
• 24 countries
• 110 Students
• 13 Advisors
• 10 Teachers
Patents related

Do you consider patents necessary?

- Yes 58.6%
- No 41.4%
Do you know about BPA?

- Yes 36.4%
- No 63.6%
BioBrick jtools

- Integrated Automated Tool.
- OpenSource.
- Based in biojava library.
- Extendable.
- BioBrick oriented.
- Community available.
Achievements

- 4 Natural ColdShock BioBricks.
- 1 AFP.
- Mathematical Model.
- Simulations of an AFP folding and interaction.
- BioBrick jtools.
• Patents and BPA research.
• First National Workshop in Synthetic Biology.
• Mexican Network in Synthetic Biology.
Future

• Work on improve CSP BioBricks
• Test our AFP
• Fit the model with real parameters
• Develop a biosecurity mechanism
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First Mexican Synthetic Biology Summer Workshop
To the sponsors of the 1st Mexican Workshop of Synthetic Biology