EVERYTHING IN NATURE IS ABOUT CONTEXT
Motivation
Sustainability
MOTIVATION CYCLES
LUXILLA BIOLAMP
BACKGROUND
Space Invader
made by 2010
Cambridge iGEM team
Synechocystis PCC 6803

LUXILLA BIOLAMP
EXPERIMENTAL DESIGN
LuxBrick

**Substrate production enzymes**

**Luciferase**

**Substrate production enzymes**
Substrate recovery

LuxBrick

Substrate production

byproducts

Substrate consumption

substrate

Light
**Strategy**

- **Circadian promoter 1**: Recovery enzymes
- **Circadian promoter 2**: Luciferase

Graph showing substrate levels over time:
- Day
- Dusk
- Night
Programmable Expression

Microarray data

- Expression profiles: Sinusoidal fix
  
  \[ k \cdot \sin \left( \frac{\pi \cdot (x - \theta)}{12} \right) + y \]

- Concentration profiles

Desired peaking time

- 08:00
- Protein: Half-life

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**PROGRAMMABLE EXPRESSION**

\[ \frac{\partial S}{\partial t} = K_1 K_3 S^* \text{[recovery enzymes]} - K_2 K_4 S \text{[luciferase]} \]

**K_1; K_3 = promoter strength**

**K_2; K_4 = catalytic activity**
pSB1C3_IntS (Susceptibility construct)

CONSTRUCTS DESIGN

pSB1C3_IntK
(neutral construct)

*Synechocystis* genome

CONSTRUCTS DESIGN

**PSB1C3_IntK**

![Diagram of PSB1C3_IntK](image)

**PSB1C3_IntS**

![Diagram of PSB1C3_IntS](image)
EXPERIMENTAL SECTION 1
CHARACTERIZATION LUXBRICK
Light output maximization

Critical parameters: Glucose and temperature
CHARACTERIZATION LUXBRICK: RESULTS

GLUCOSE EFFECT

Temperature effect: Relative luminescence units vs. mM glucose concentration.

TEMPERATURE EFFECT

Relative luminescence units for different temperatures:
- 28°C
- 30°C
- 37°C
- Uninduced (30°C)
EXPERIMENTAL SECTION 2

ASSEMBLY AND TRANSFORMATION
pSB1C3_IntK (luciferase generator)

pSB1C3_IntS (substrate generator)

Verified by:
- ✔ Amplification
- ✔ Digestion
- ✔ Sequencing
Presence of transformant colonies after 2 weeks from transformation with pSB1C3_IntK (Pta_LuxAB) construct.
No significative difference in bioluminescence readings between either LuxAB transformants and wild-type Synechocystis.
Bioluminescence Assay N°2

**Synechocystis PCC6803**

- **Pta::LuxAB replicate1**
- **Pta::LuxAB replicate2**
- **wt**

- **BG11 medium**
- **Decanal 3% v/v**
**EXPERIMENTAL HIGHLIGHTS**

- Characterization of Luxbrick
- Standardized protocols and methodologies for *Synechocystis*
- Modelling strategy
- Two new plasmid backbones
- Bioluminescence in cyanobacteria

What is next:
- Oscillatory behaviour
- Substrate unit
Biolamp: Inspired by Nature

Euprymna scolopes

- Reflectins layer
- Bacterial cavity
- Protective dermis
- Amplifying lens
HUMAN PRACTICES

CONSTITUTIVE EXPRESSION OF SYNTHETIC BIOLOGY IN CHILE

Early phase

Exponential growth

Maturity phase
HUMAN PRACTICES

SYNTHEtic SOCIOLOGY

- Early phase
- Exponential growth

CONEIB congress

- Exponential growth
- Maturity phase

Photo by Fernán Federici

TEAM UC CHILE
SYNBIO WORKSHOP

17 – 21 December 2012 in Santiago, Chile.

Free admission!

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