Melbourne Uni

2008

What is iGEM?

- International Genetically Engineered Machine competition
- Started in 2003 within MIT

What is iGEM?

- Now a global competition
- 54 teams, 750 students, 19 countries

What is iGEM

- Teams of students use principles of synthetic biology to create biological systems

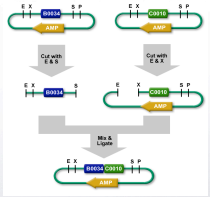
What is Synthetic Biology?

- Builds on genetic engineering technologies
- Adds a set of guiding principles to aid coordination of activities
  - Standardisation
  - Abstraction

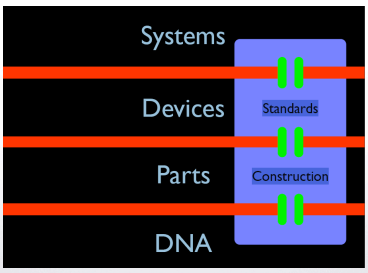
Standardisation

Lego Brick

BioBrick

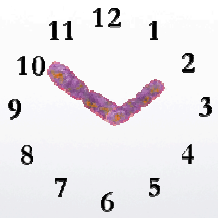


Abstraction



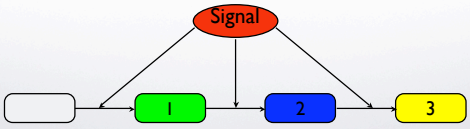
2008 Team Project

BioClock

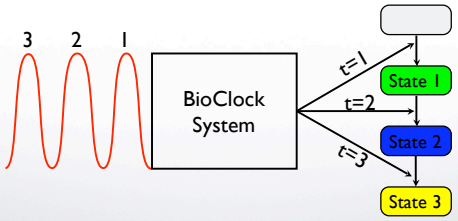


BioClock

- A customisable regulatory system
- One signal switches between multiple states



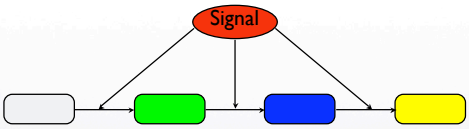
Input Logic Output



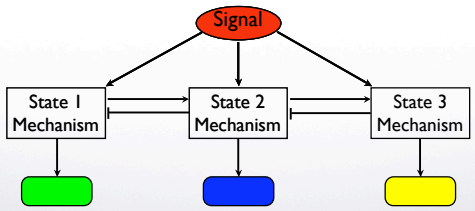
How will it work?

- Two methods currently being looked at
- Ideal implementation through a binary counting system
- Contingency plan using a linear system
- Both will have the similar components, with different interactions

Linear Model



Linear Model



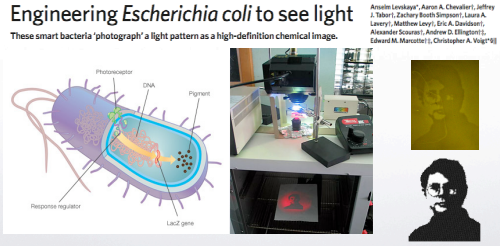
Design

- Small teams researching different parts of system
  - Signaling
  - Riboswitch
  - Positive feedback
  - Modeling

Signal Sensor

Engineering *Escherichia coli* to see light

These smart bacteria 'photograph' a light pattern as a high-definition chemical image.



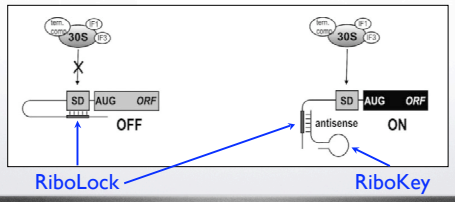
Riboswitch

Review

Engineered riboswitches as novel tools in molecular biology

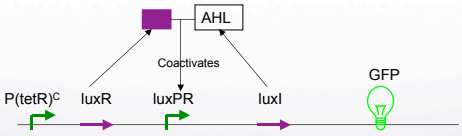
Gesine Bauer, Beatrix Suess *

Journal of Biotechnology 124 (2006) 4–11

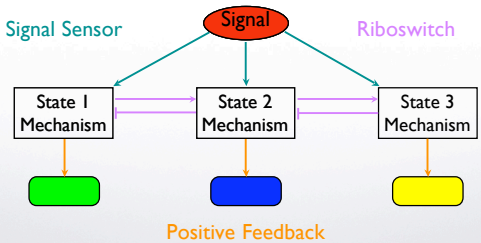


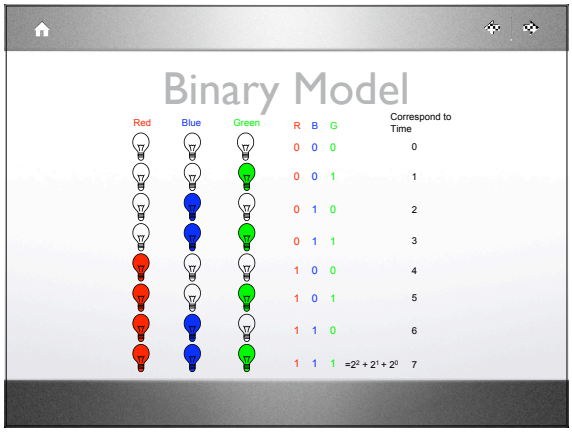
Positive Feedback

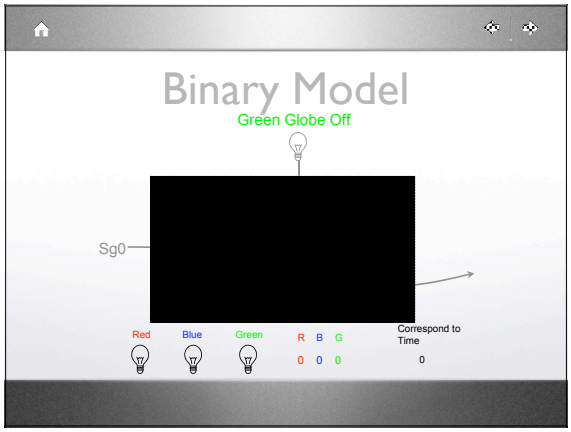
- Feedback loop that upregulates itself

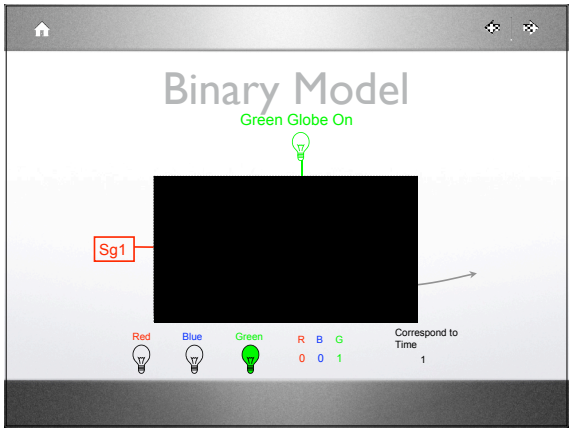


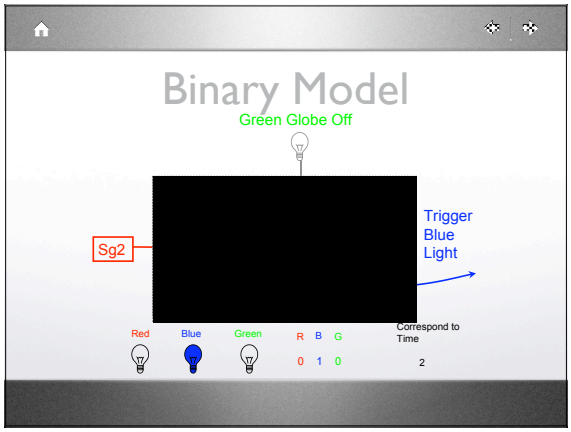
Where they fit in

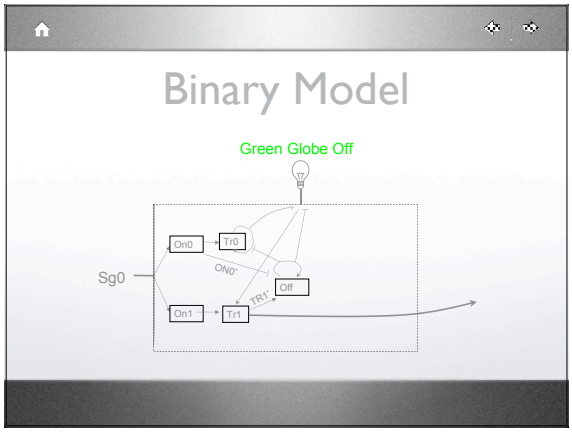


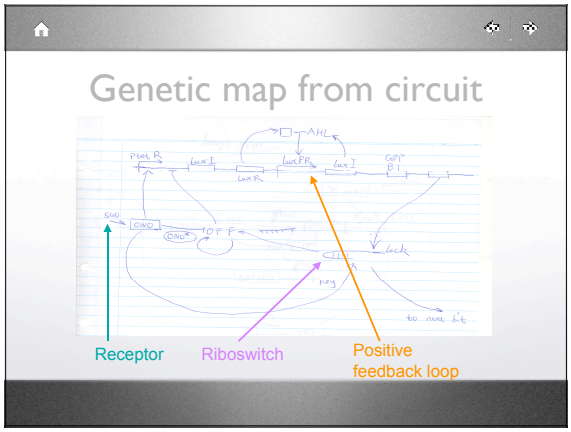

Binary Model
Red
Blue
Green
R B G
Correspond to Time
0 0 0 0
0 0 1 1
0 1 0 2
0 1 1 3
1 0 0 4
1 0 1 5
1 1 0 6
1 1 1 =2² + 2¹ + 2⁰ 7


Binary Model
Green Globe Off
Sg0
Red
Blue
Green
R B G
Correspond to Time
0 0 0 0


Binary Model
Green Globe On
Sg1
Red
Blue
Green
R B G
Correspond to Time
0 0 1 1


Binary Model
Green Globe Off
Sg2
Trigger Blue Light
Red
Blue
Green
R B G
Correspond to Time
0 1 0 2

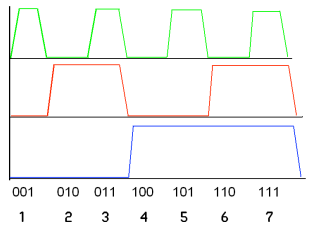

Binary Model
Green Globe Off
Sg0
On0
Tr0
ON0
Off
TR1
On1
Tr1


Genetic map from circuit
Receptor
Riboswitch
Positive feedback loop

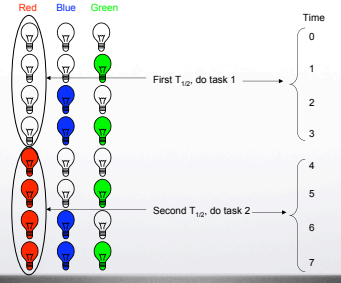
Binary Model

Goal

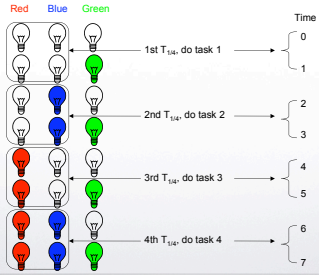
Ex: Counting to seven with three-color system



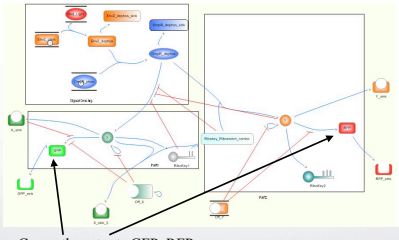
Time Division Tasking



Time Division Tasking

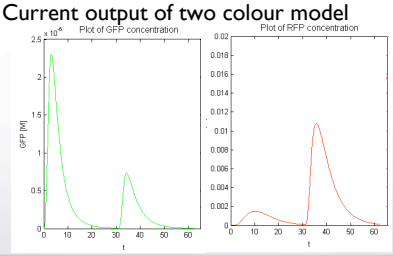


Modeling with two colours



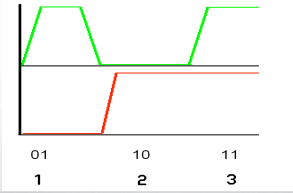
Modeling with two colours

- Current output of two colour model



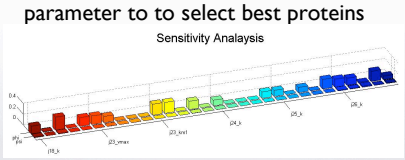
Goal

- We want to count as high as possible in binary
- Example with two colour system:

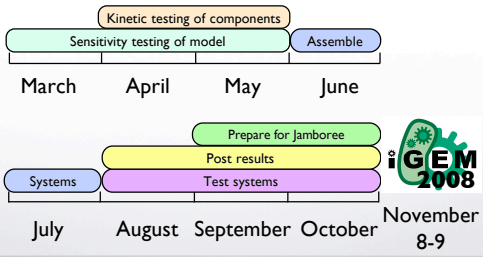


Sensitivity Analysis

- Code program that will produce sensitivity plot
- Plot sensitivities against each kinetic parameter to to select best proteins



Timeline



Budget

Lab Expenses		$10,000
Sequencing	3,000	
Synthesising	3,000	
SELEX	3,000	
Consumables	1,000	
Jamboree Expenses		$22,000
iGEM Registration	$1,000	
Jamboree Fee	$1,000	
Accommodation	$2,000	
Flights	$18,000	
Total		$32,000

Questions