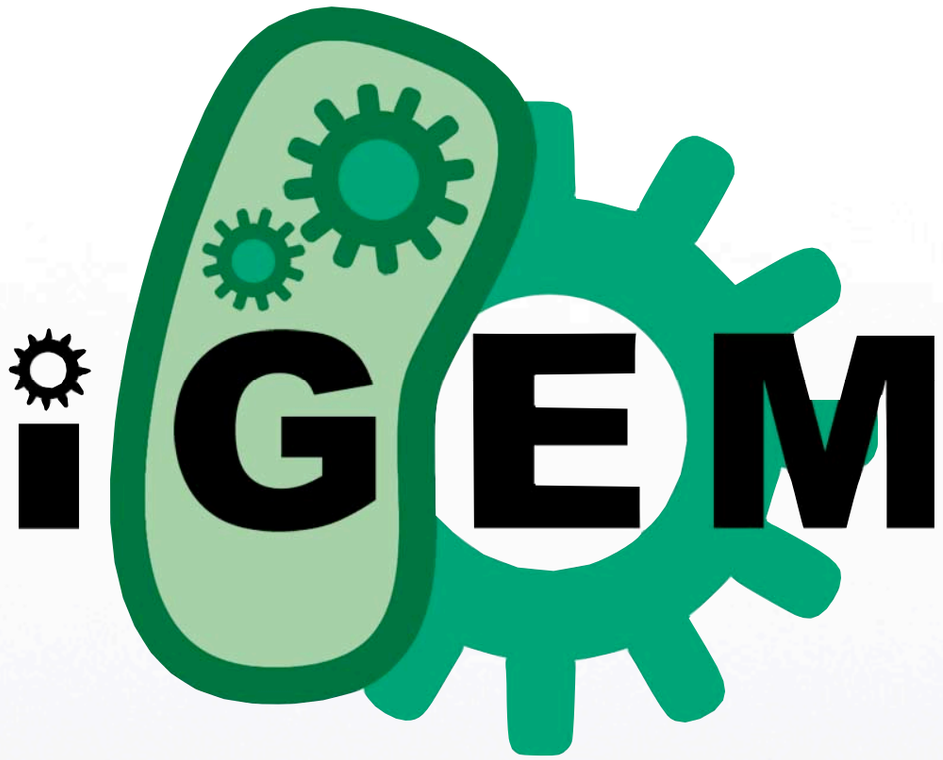
Melbourne Uni



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

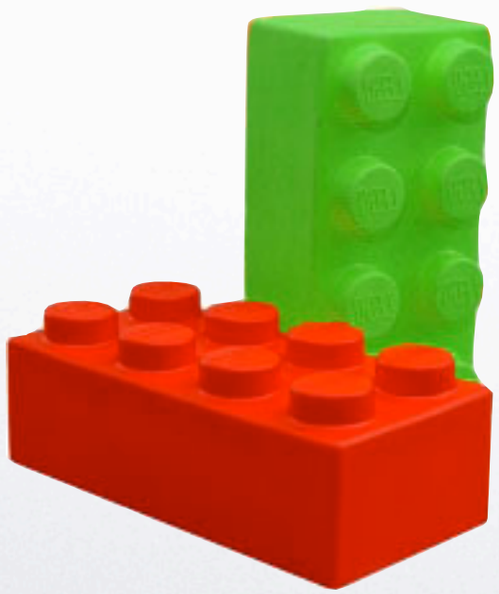
- Teams of students use principles of synthetic biology to create biological systems

What is Synthetic Biology?

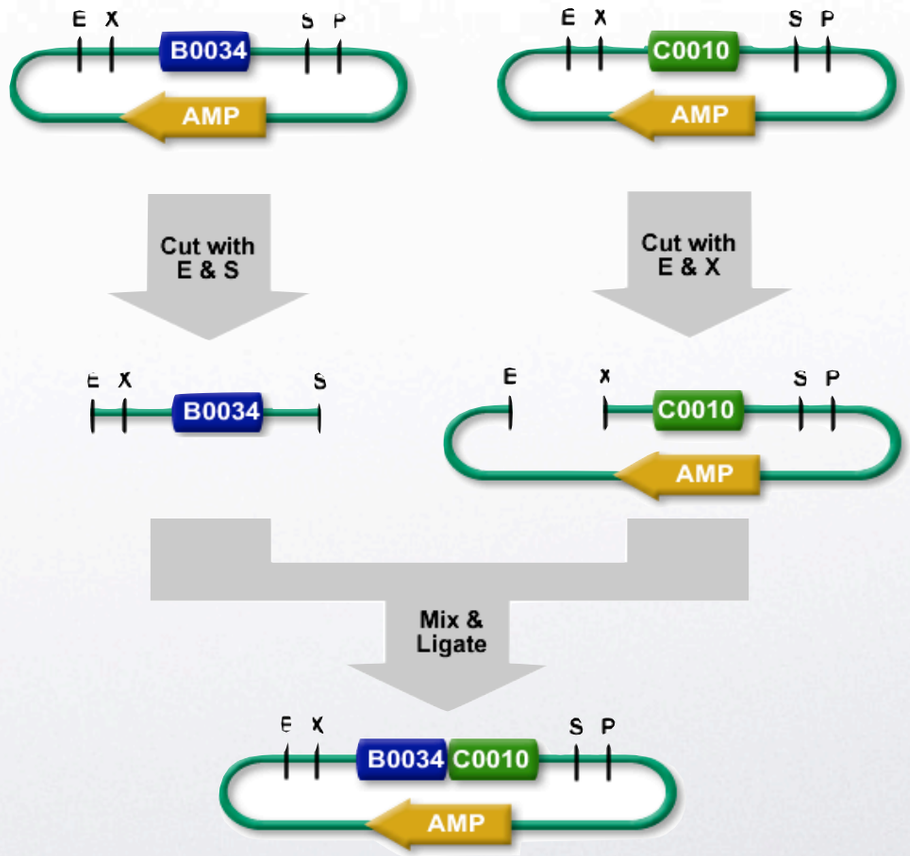
- Builds on genetic engineering technologies
- Adds a set of guiding principles to aid coordination of activities
  - Standardisation
  - Abstraction

Standardisation

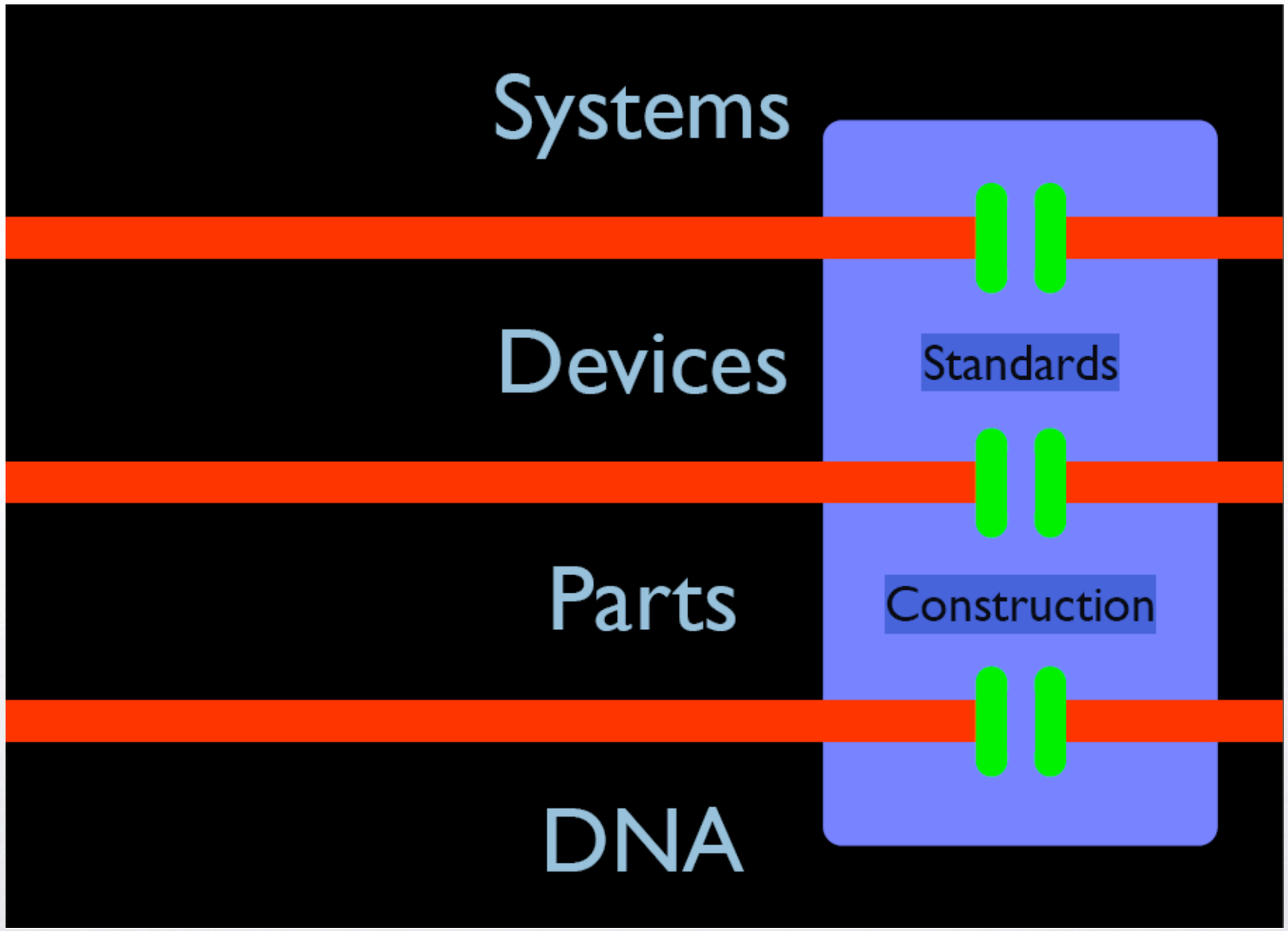
Lego Brick



BioBrick

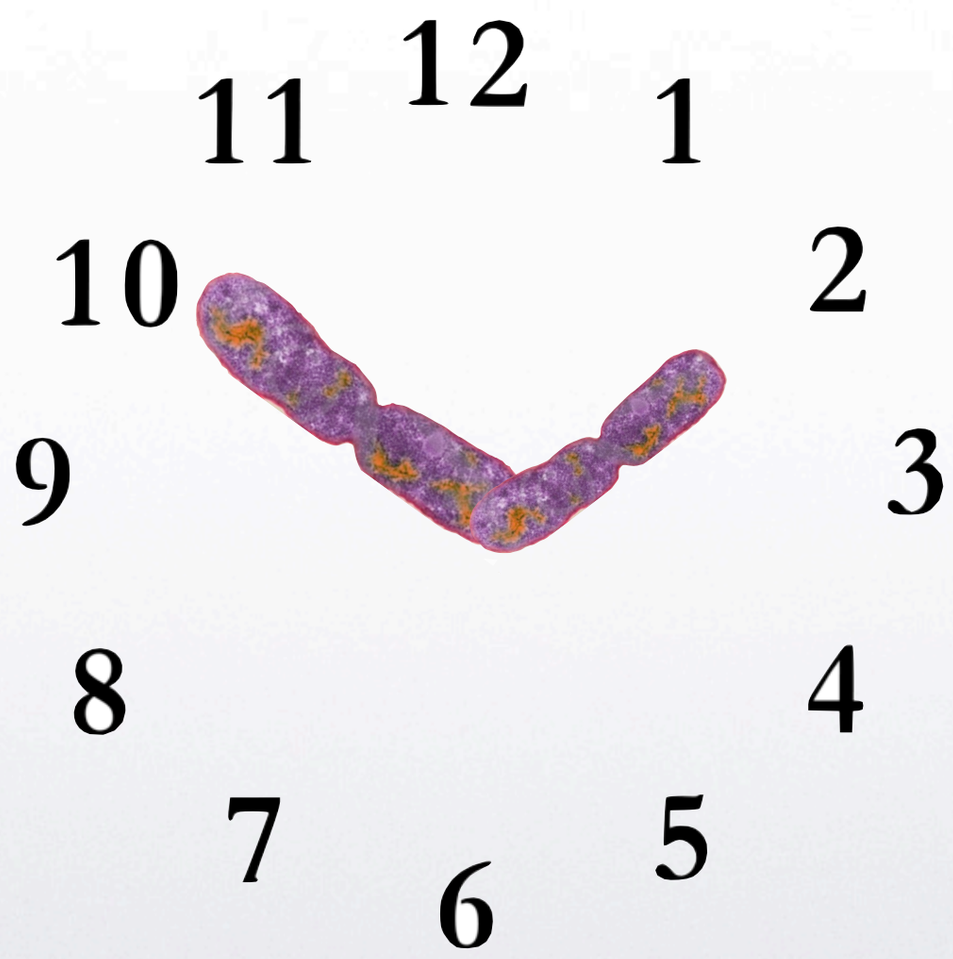


Abstraction



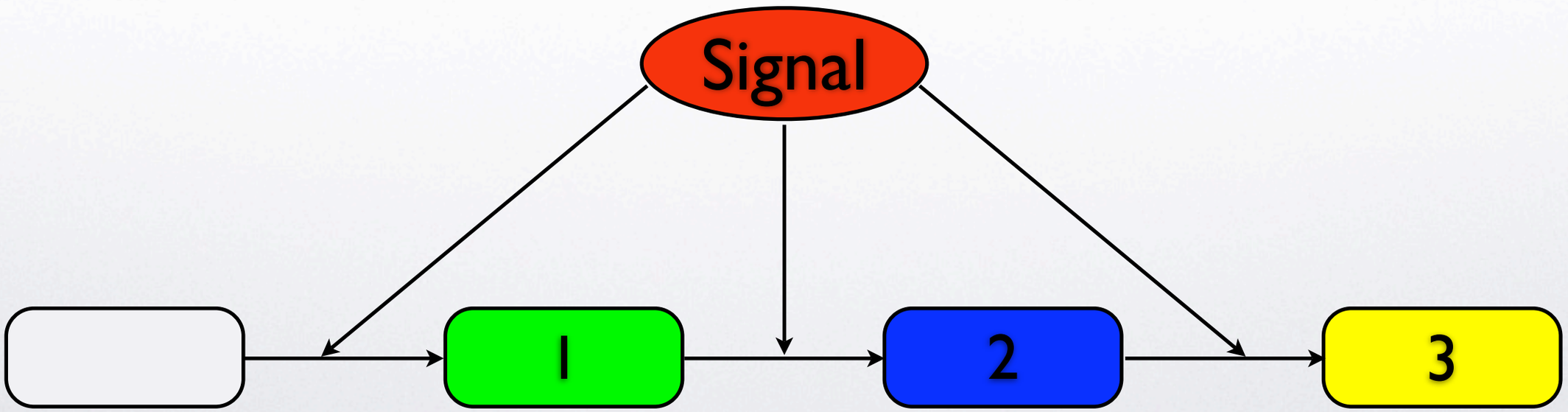
2008 Team Project

BioClock

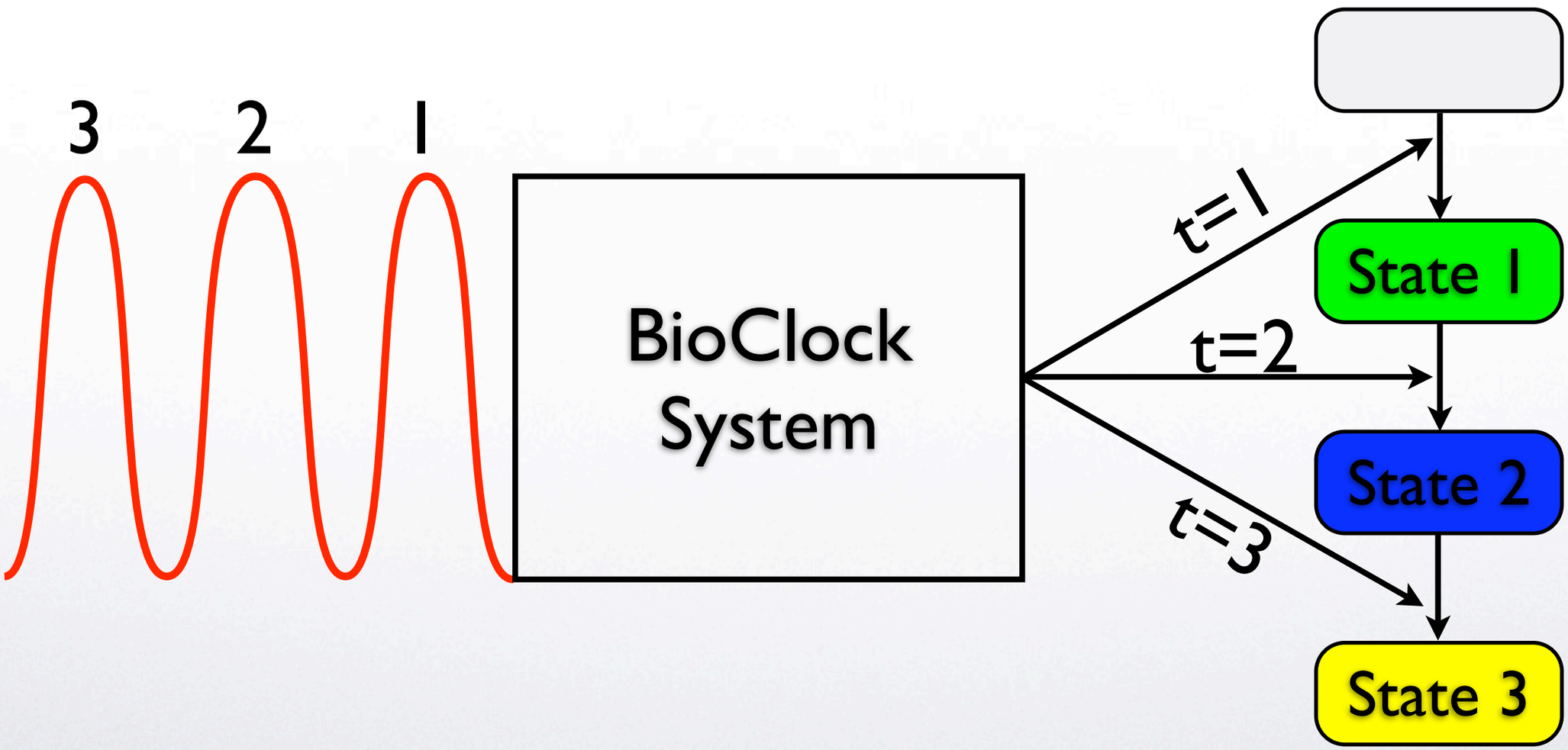


BioClock

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



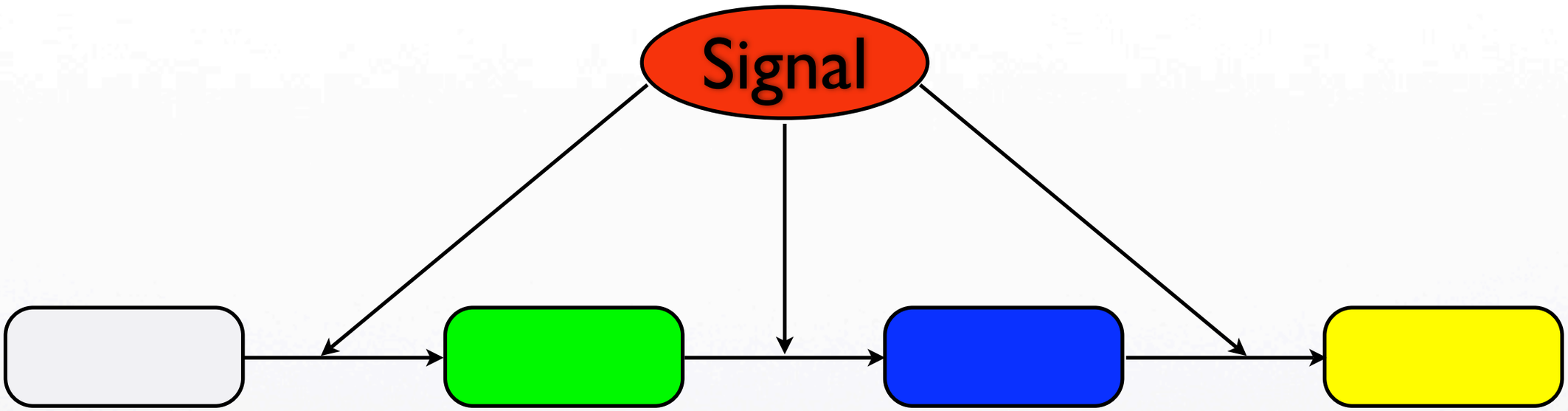
Input Logic Output



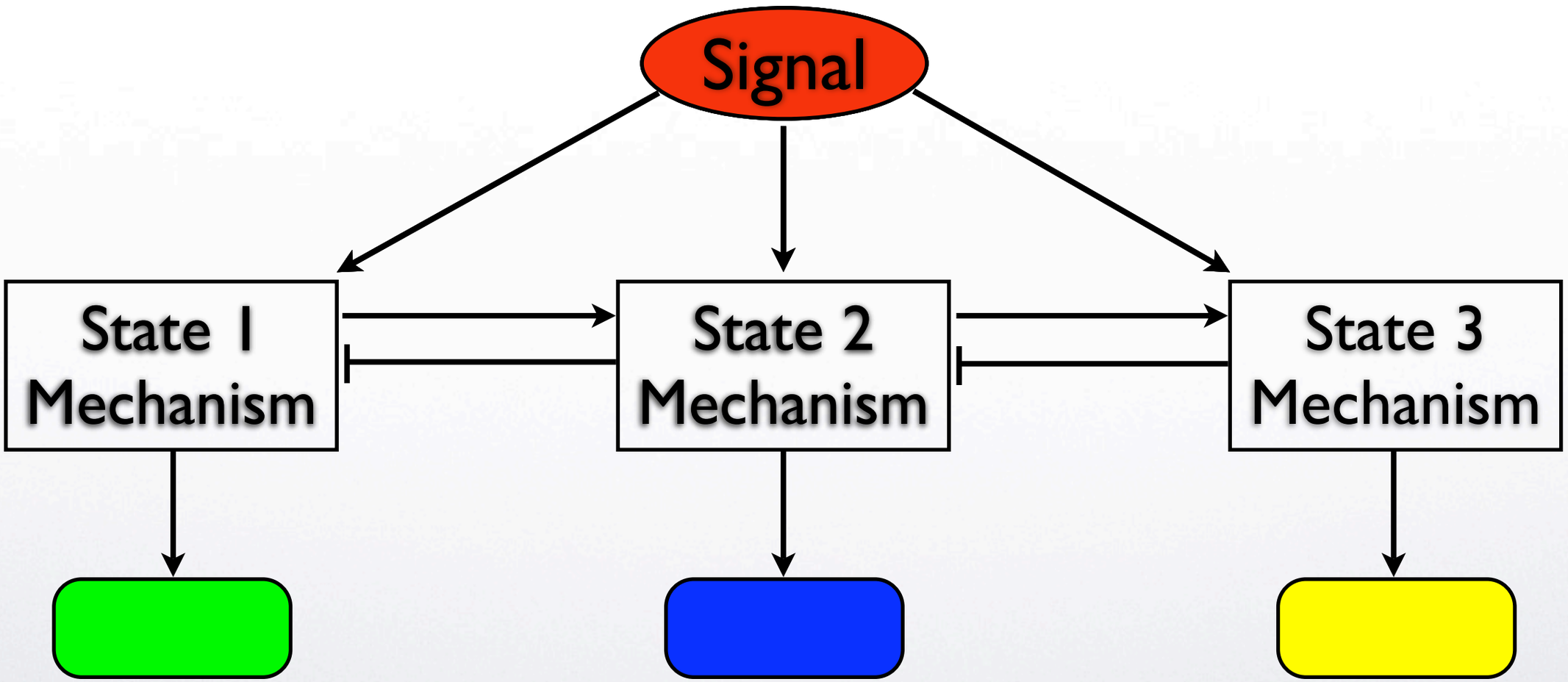
How will it work?

- 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

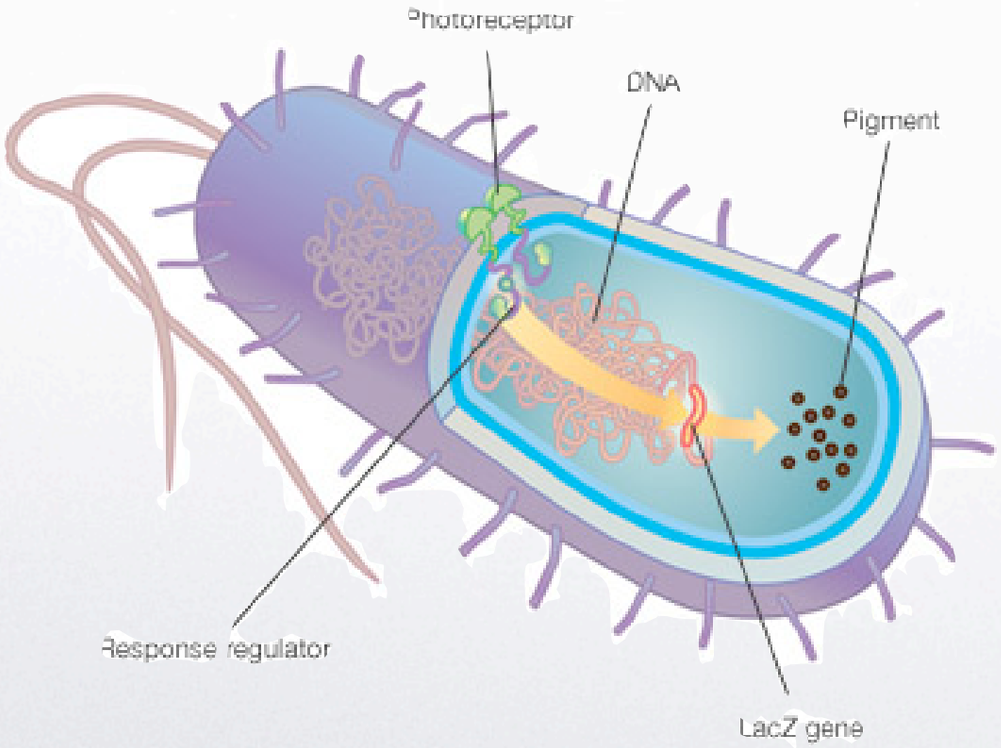
- Small teams researching different parts of system
  - Signaling
  - Riboswitch
  - Positive feedback
  - Modeling

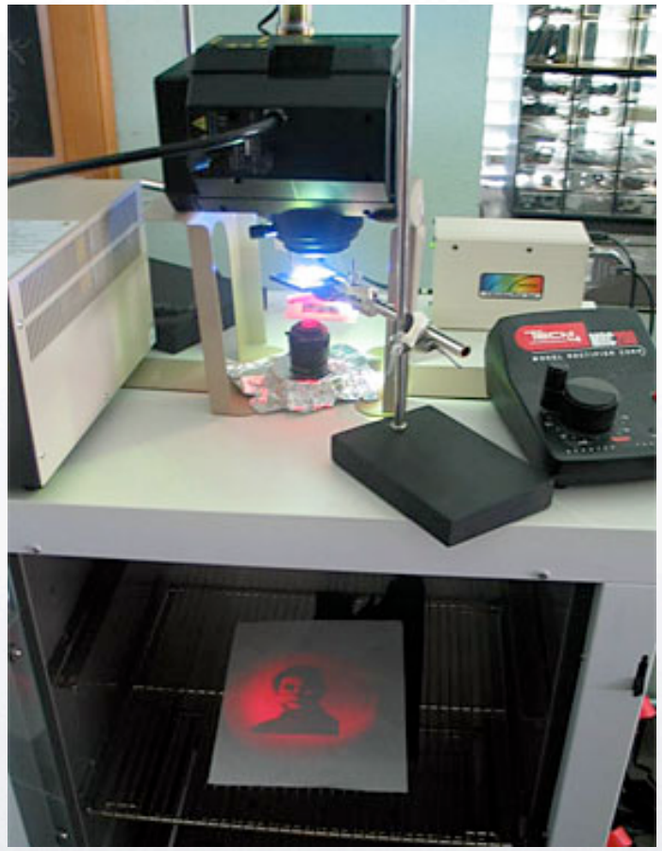
Signal Sensor

Engineering *Escherichia coli* to see light

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

Anselm Levskaya*, Aaron A. Chevalier†, Jeffrey J. Tabor†, Zachary Booth Simpson†, Laura A. Lavery†, Matthew Levy†, Eric A. Davidson†, Alexander Scouras†, Andrew D. Ellington†‡, Edward M. Marcotte†‡, Christopher A. Voigt*§||





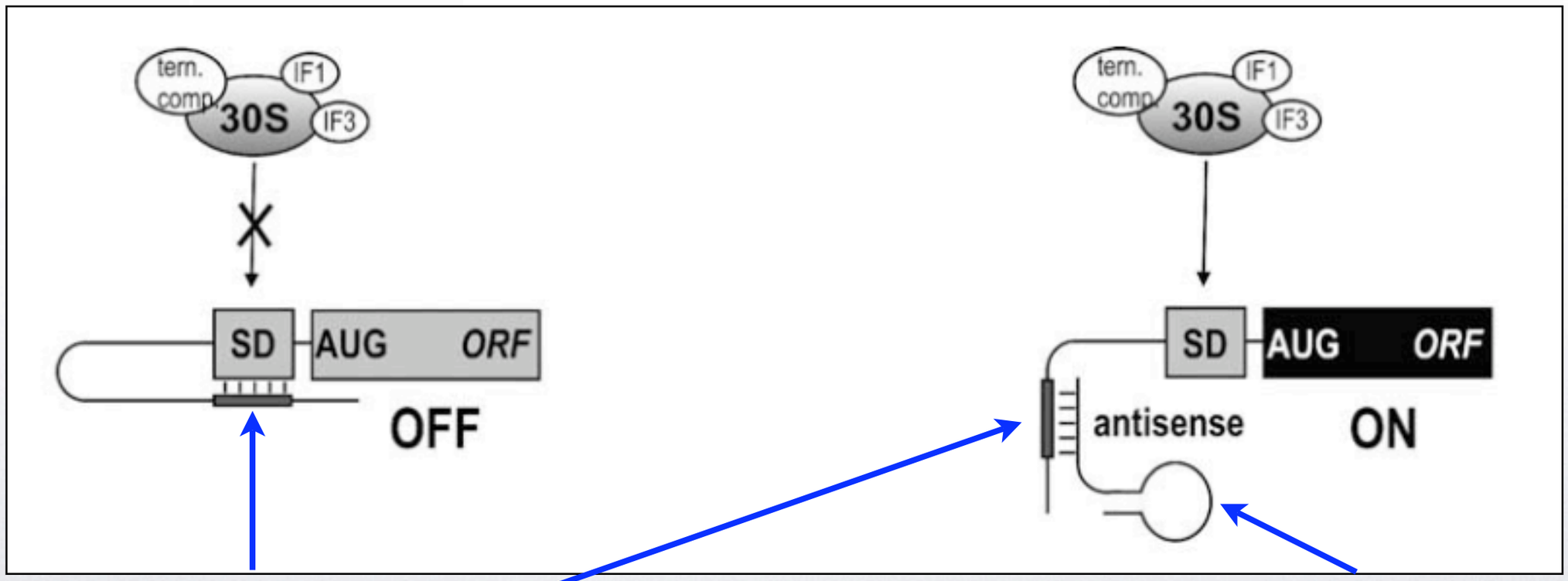
Riboswitch

Review

Engineered riboswitches as novel tools in molecular biology

Gesine Bauer, Beatrix Suess *

Journal of Biotechnology 124 (2006) 4–11

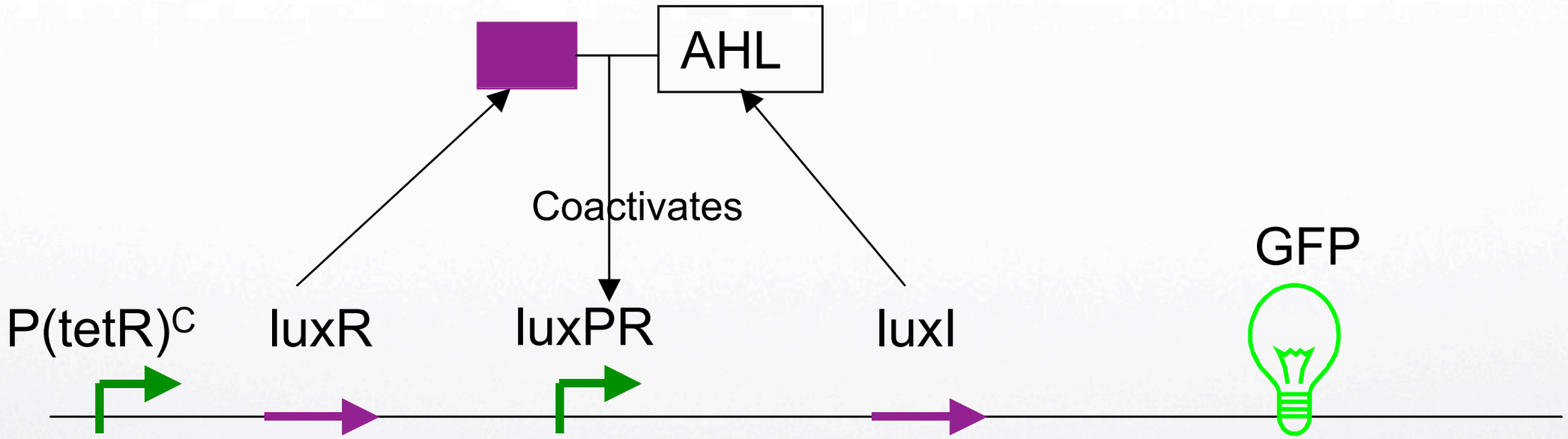


RiboLock

RiboKey

Positive Feedback

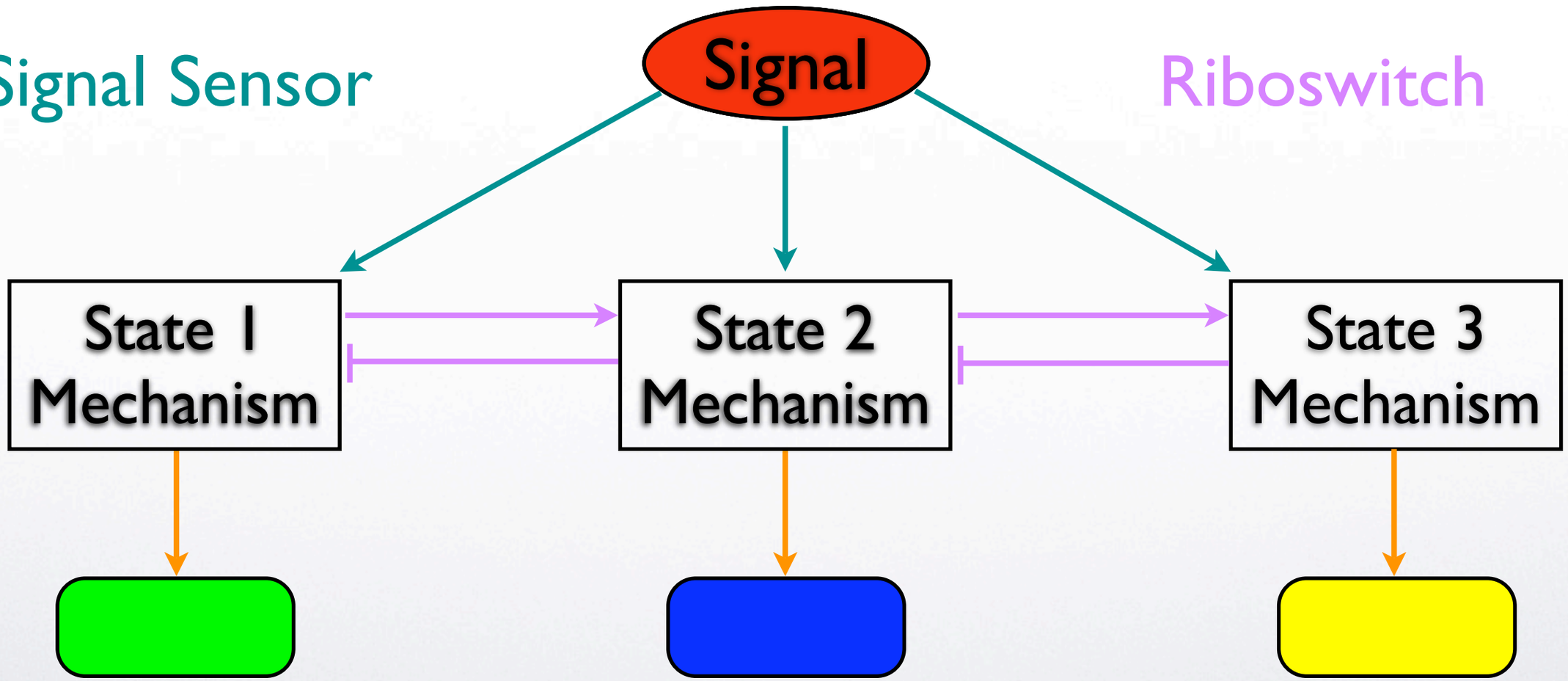
- Feedback loop that upregulates itself



Where they fit in

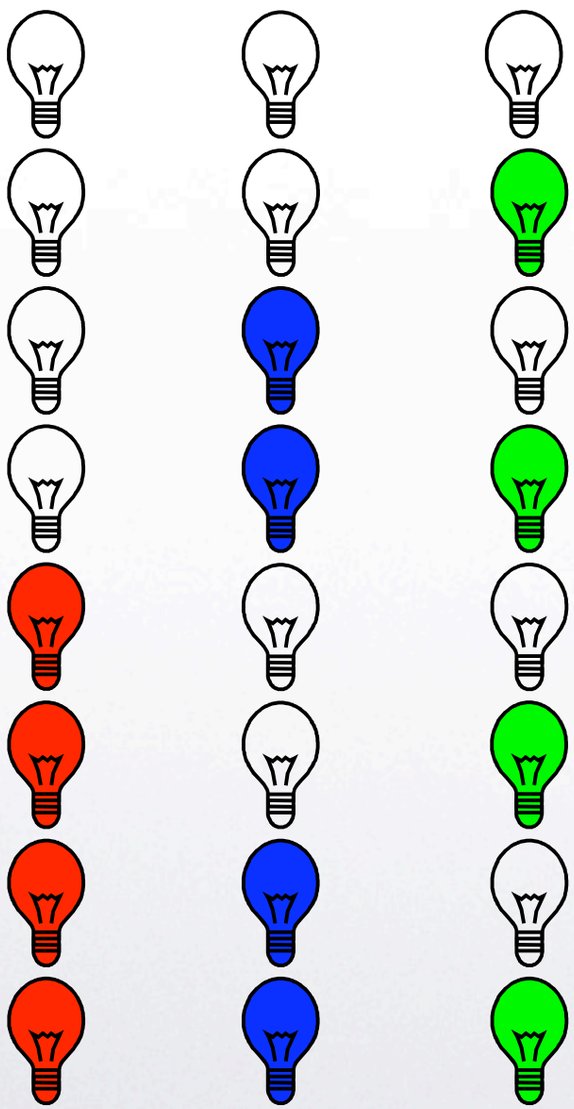
Signal Sensor

Riboswitch



Positive Feedback

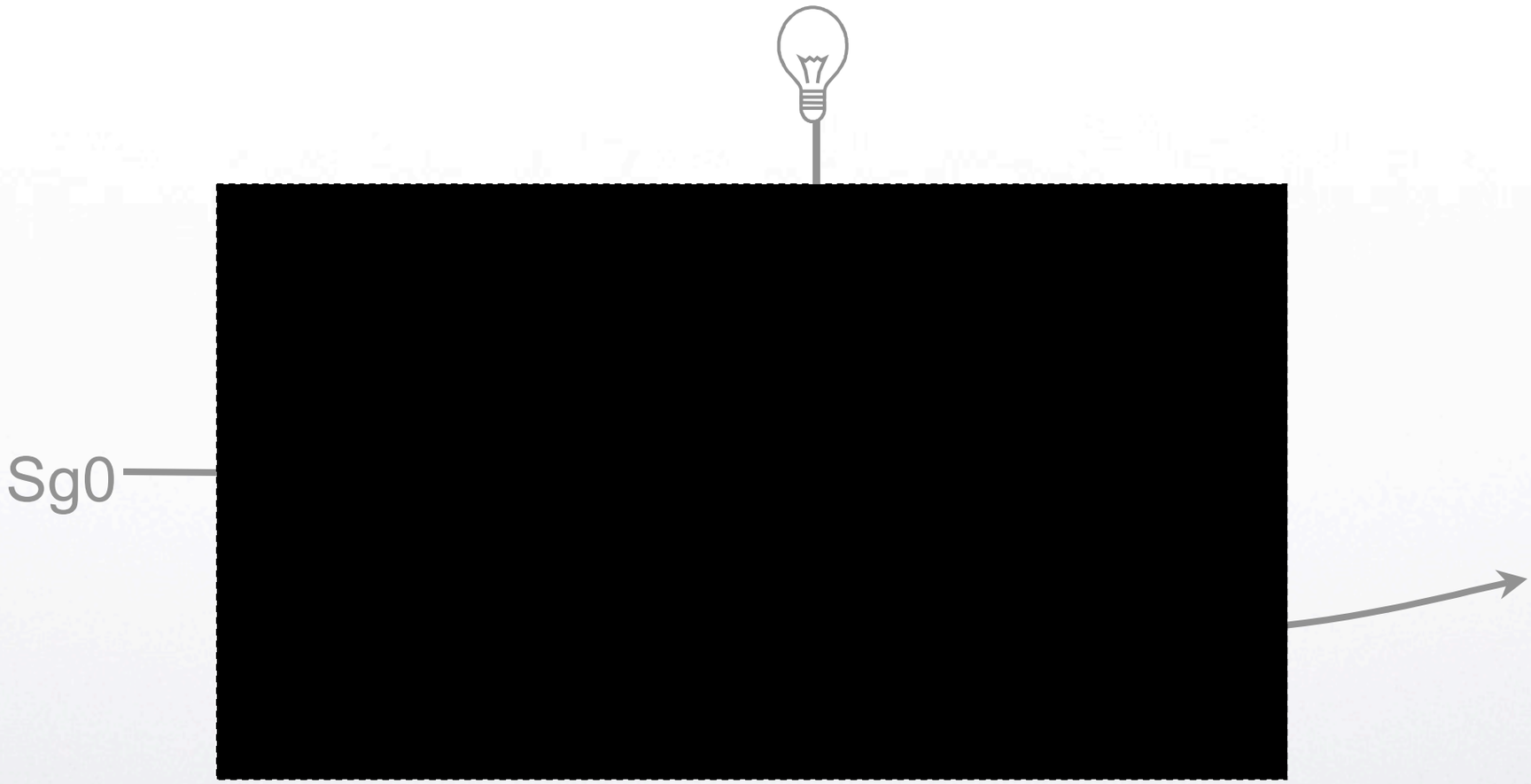
Binary Model



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	$=2^2 + 2^1 + 2^0$	7

Binary Model

Green Globe Off



Red Blue Green

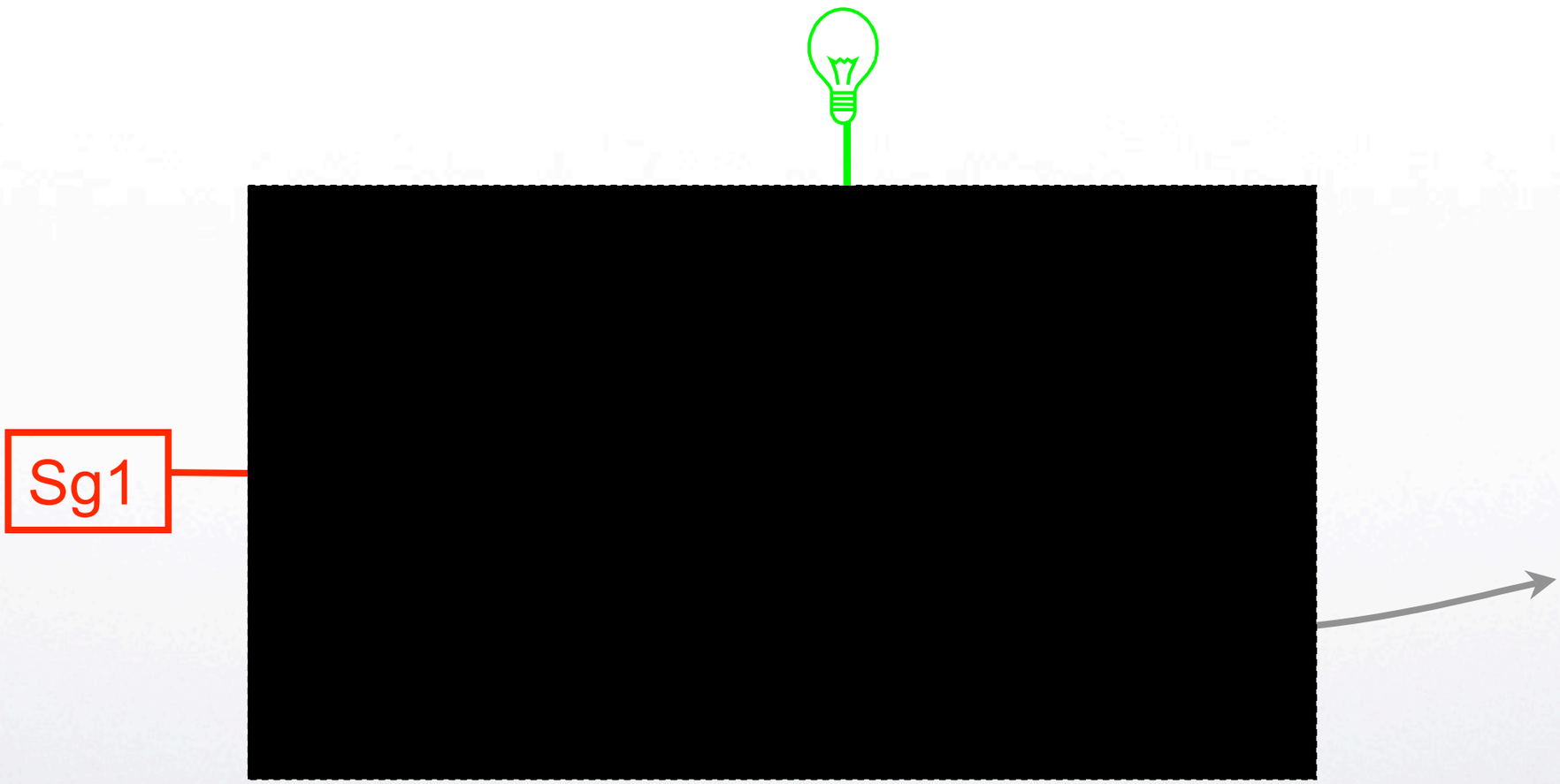
R	B	G
0	0	0

Correspond to Time

0

Binary Model

Green Globe On



Red Blue Green

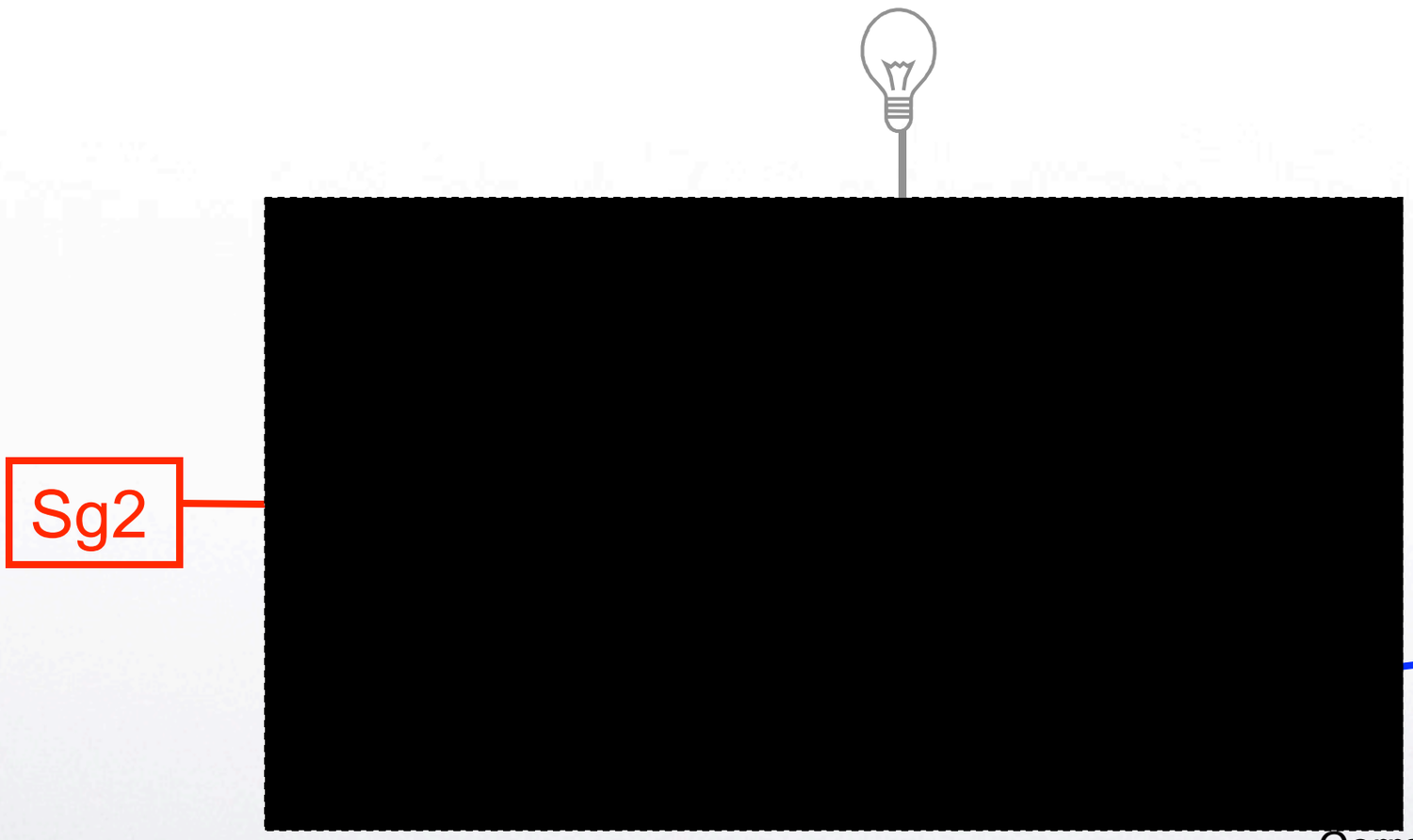
R	B	G
0	0	1

Correspond to Time

1

Binary Model

Green Globe Off



Sg2

Trigger
Blue
Light

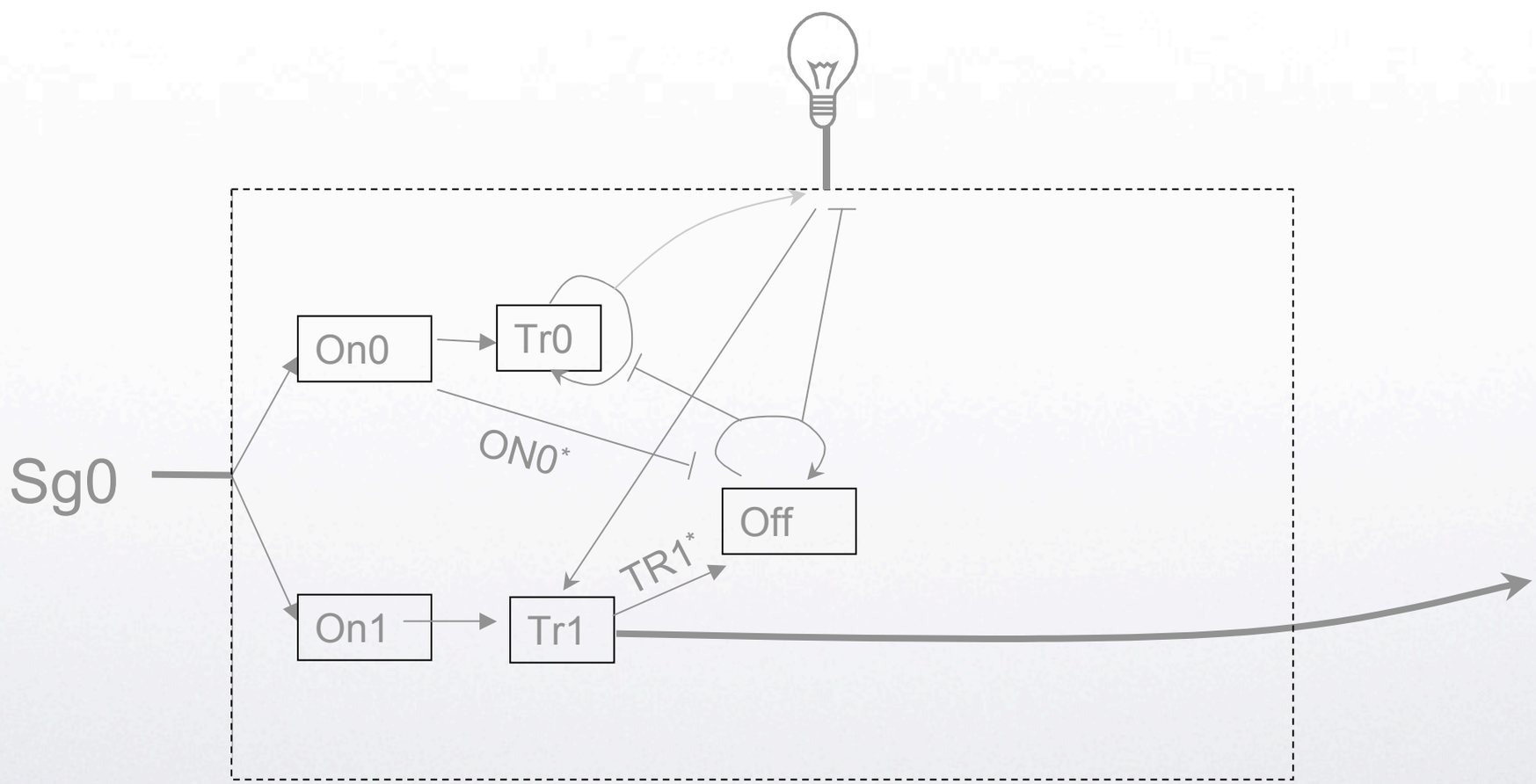
Red Blue Green

R	B	G
0	1	0

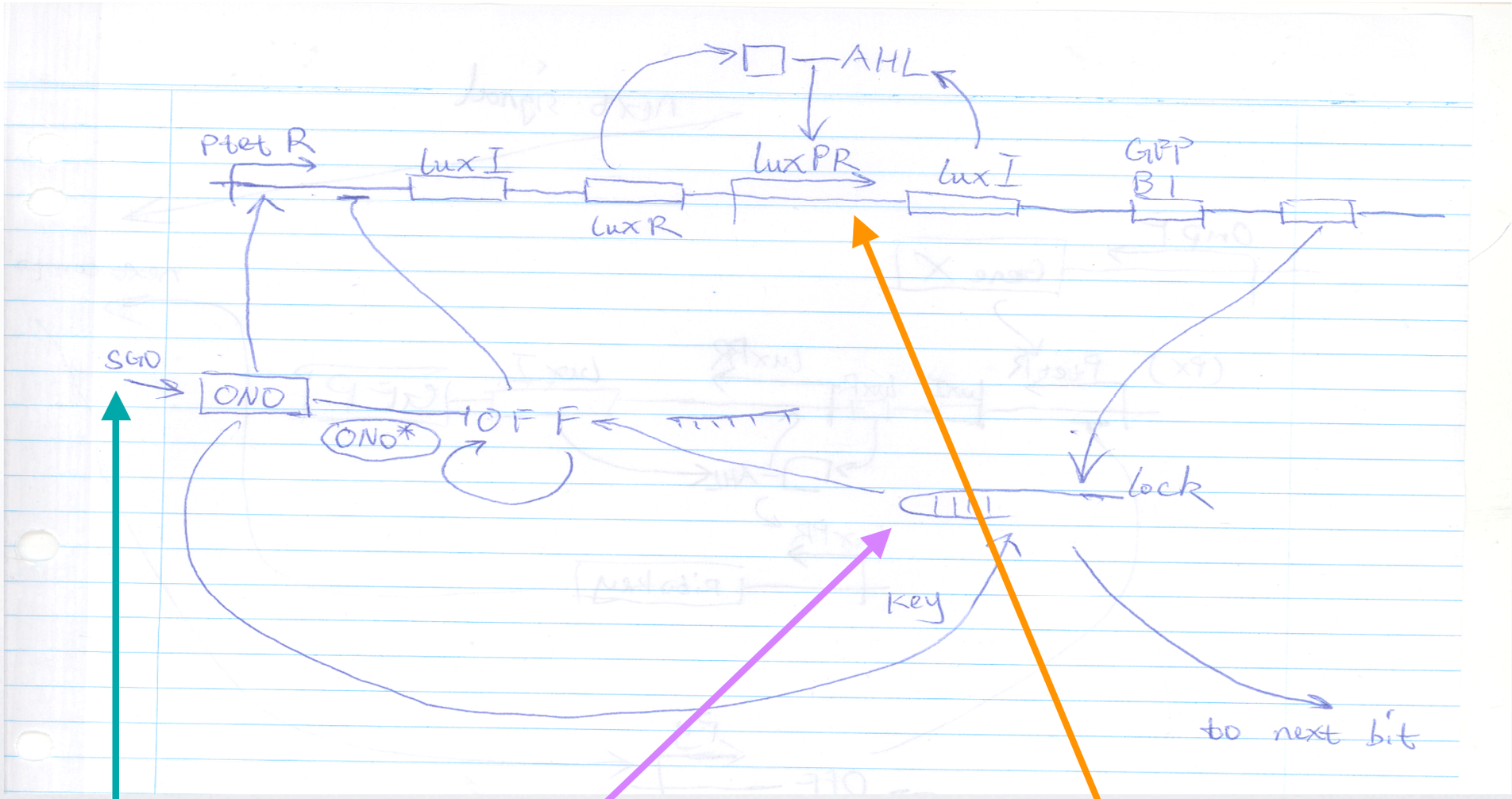
Correspond to
Time

2

Binary Model



Genetic map from circuit



Receptor

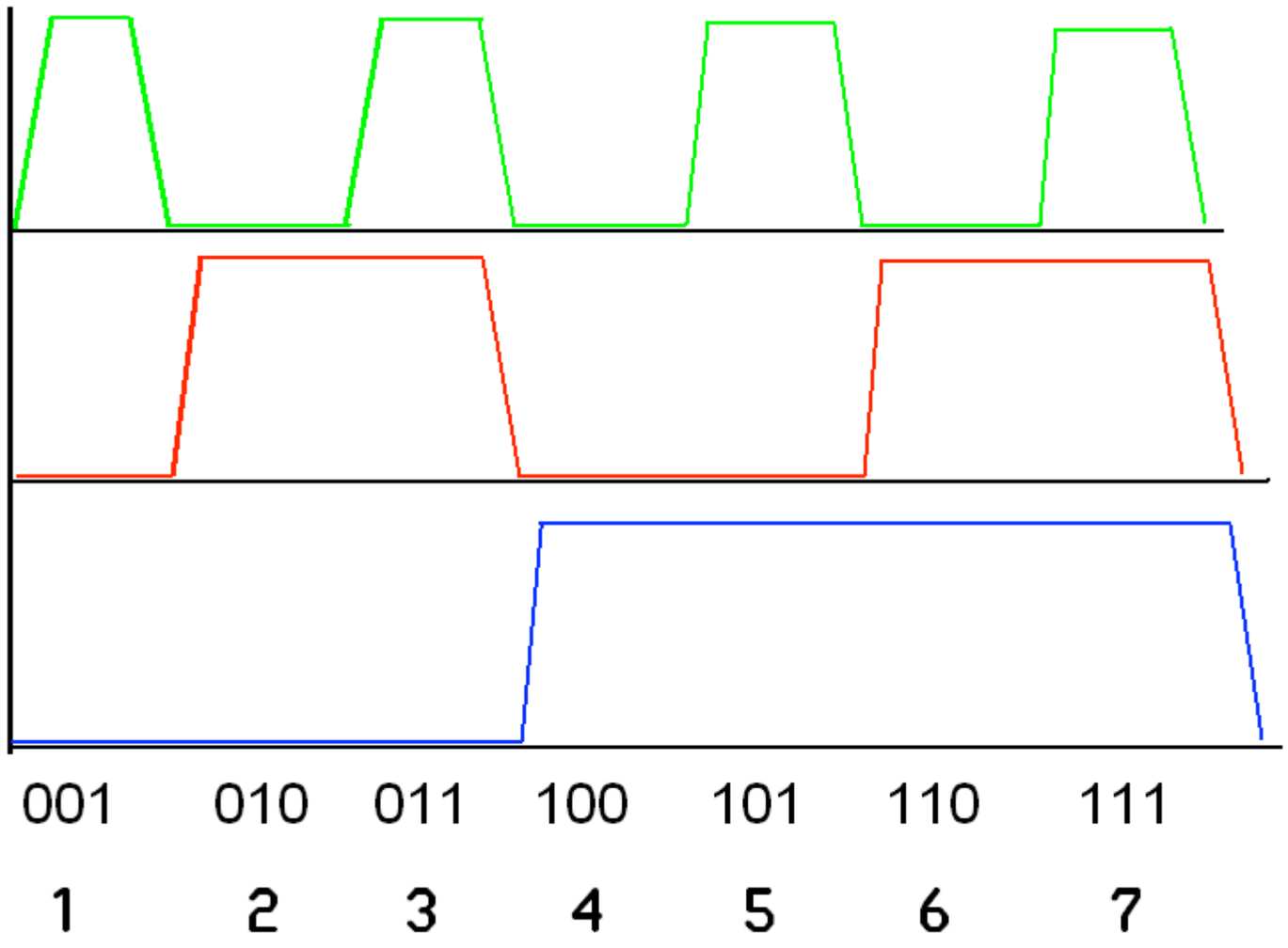
Riboswitch

Positive feedback loop

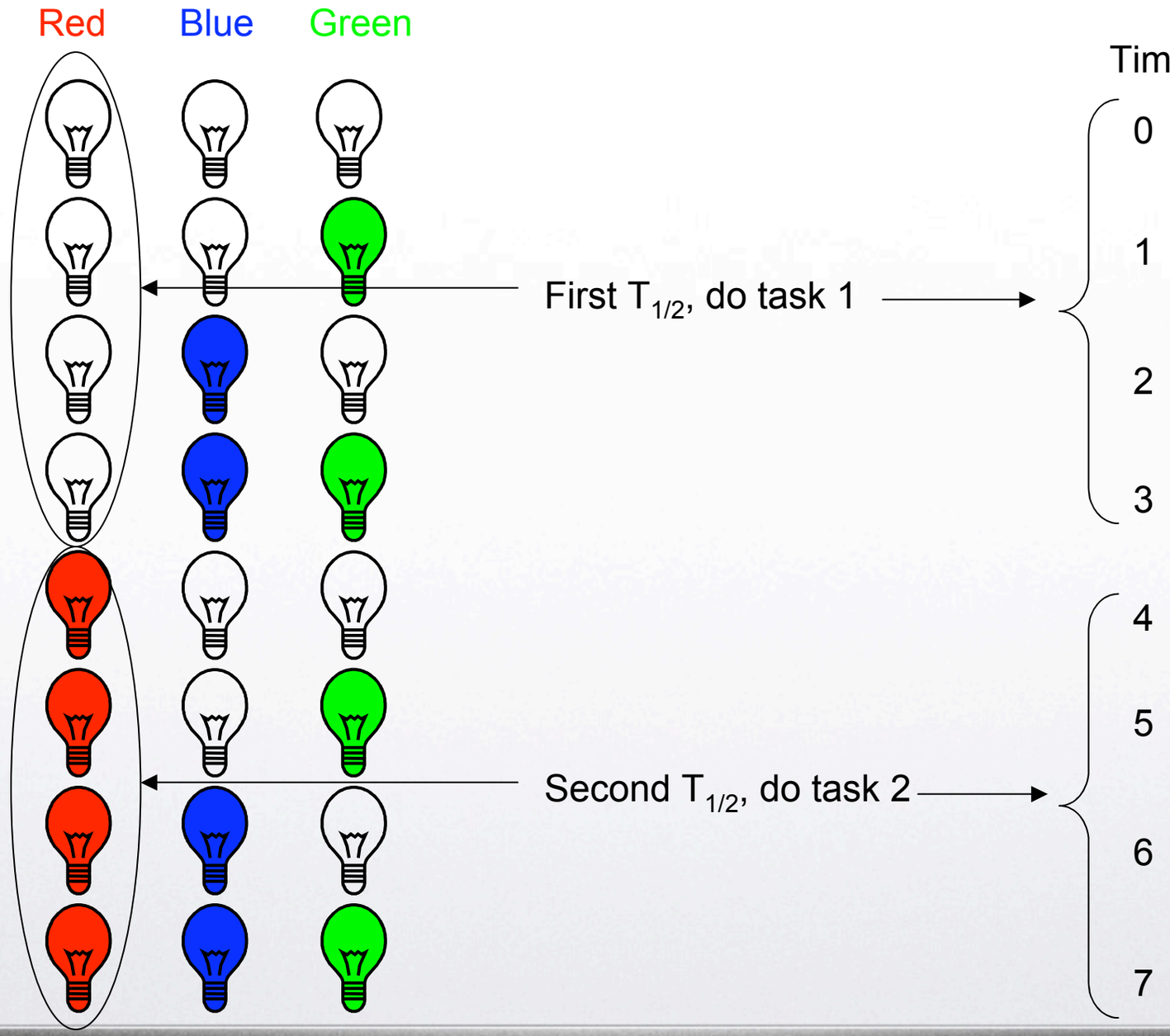
Binary Model

Goal

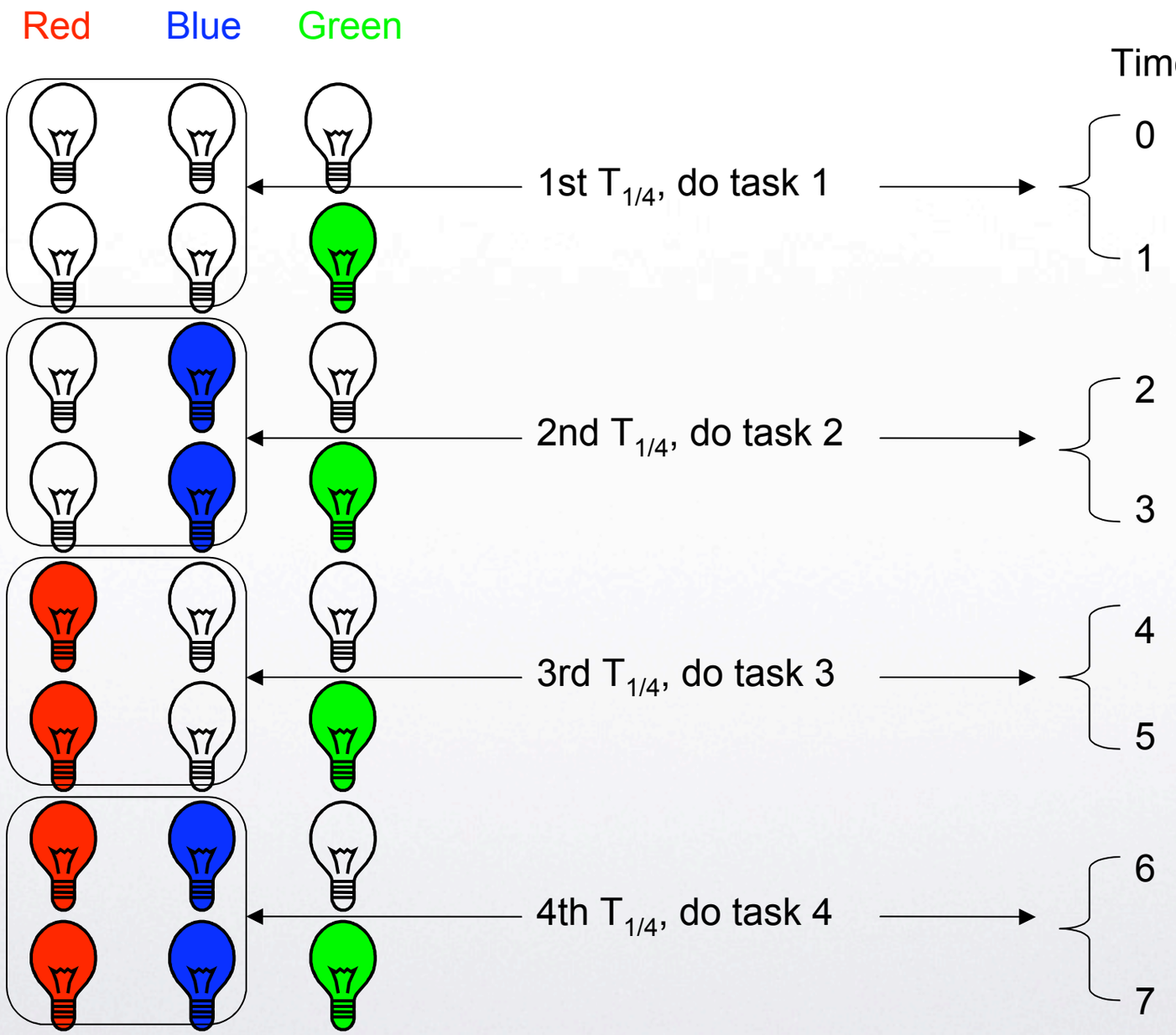
Ex: Counting to seven with three-color system



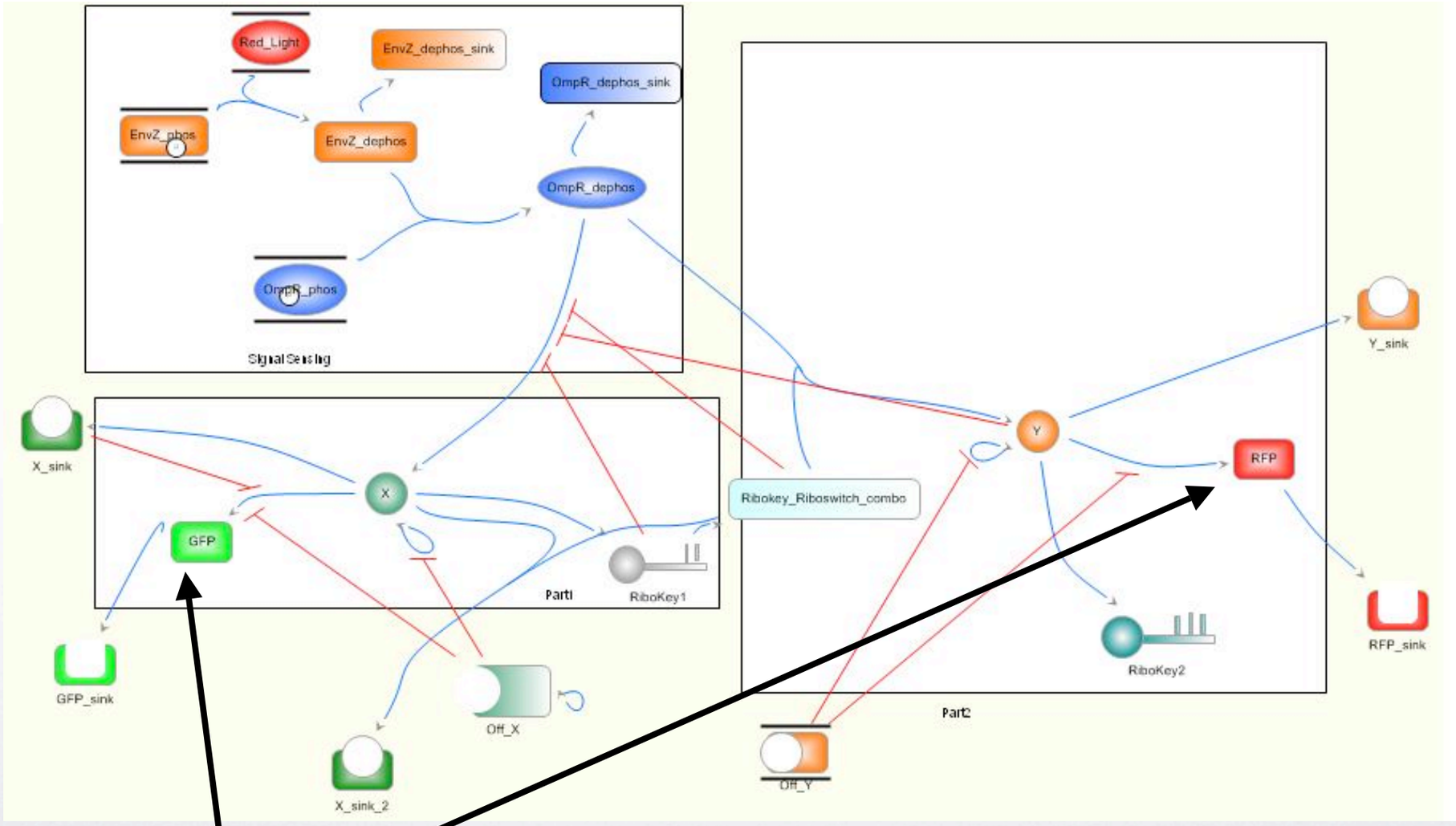
Time Division Tasking



Time Division Tasking



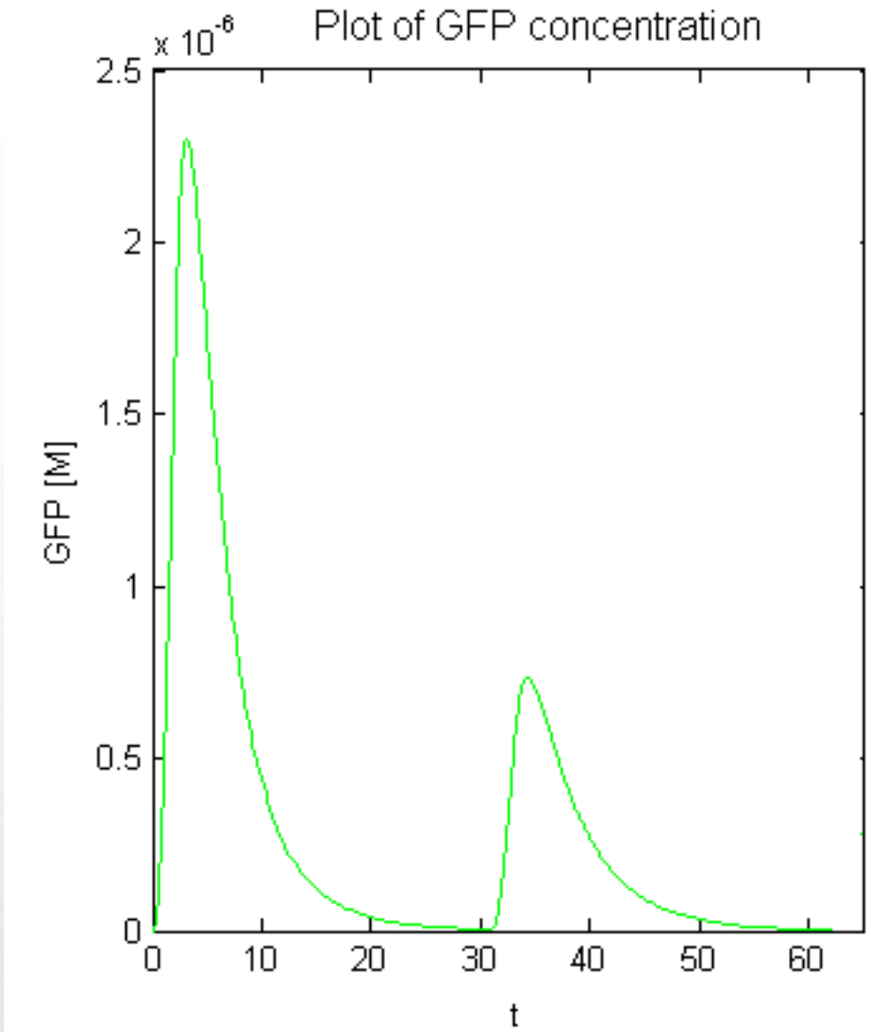
Modeling with two colours

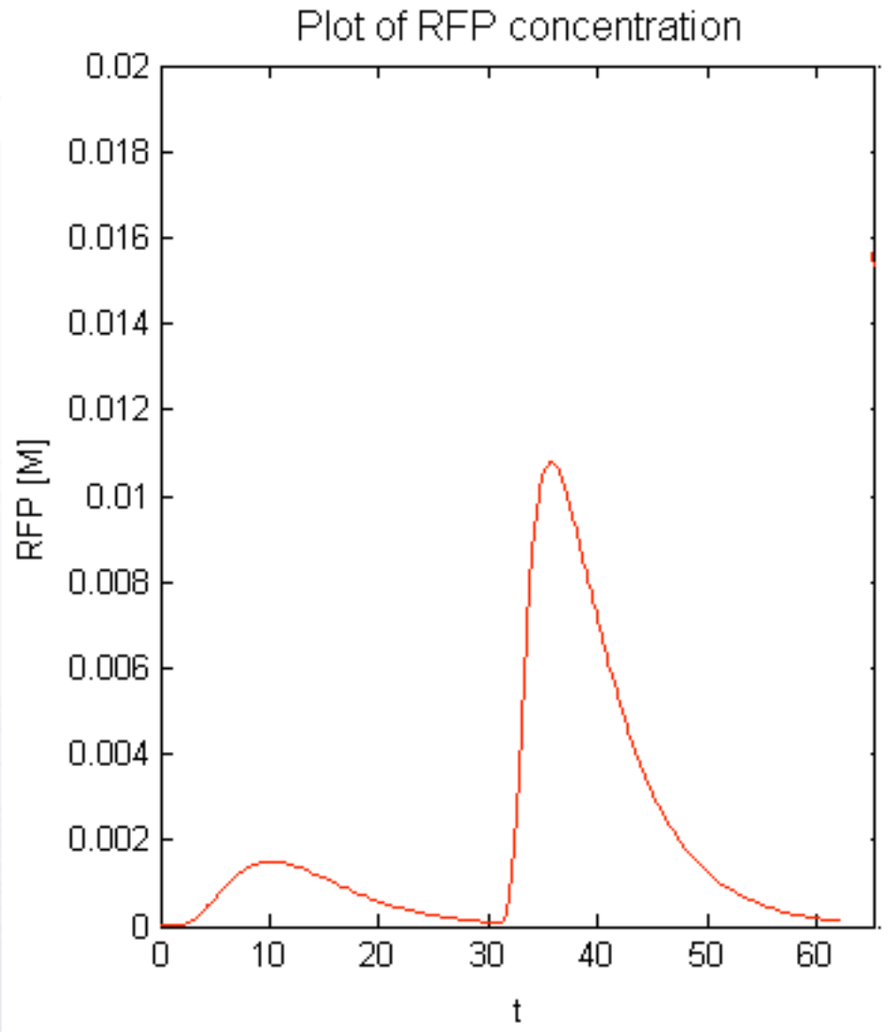


Currently outputs GFP, RFP

Modeling with two colours

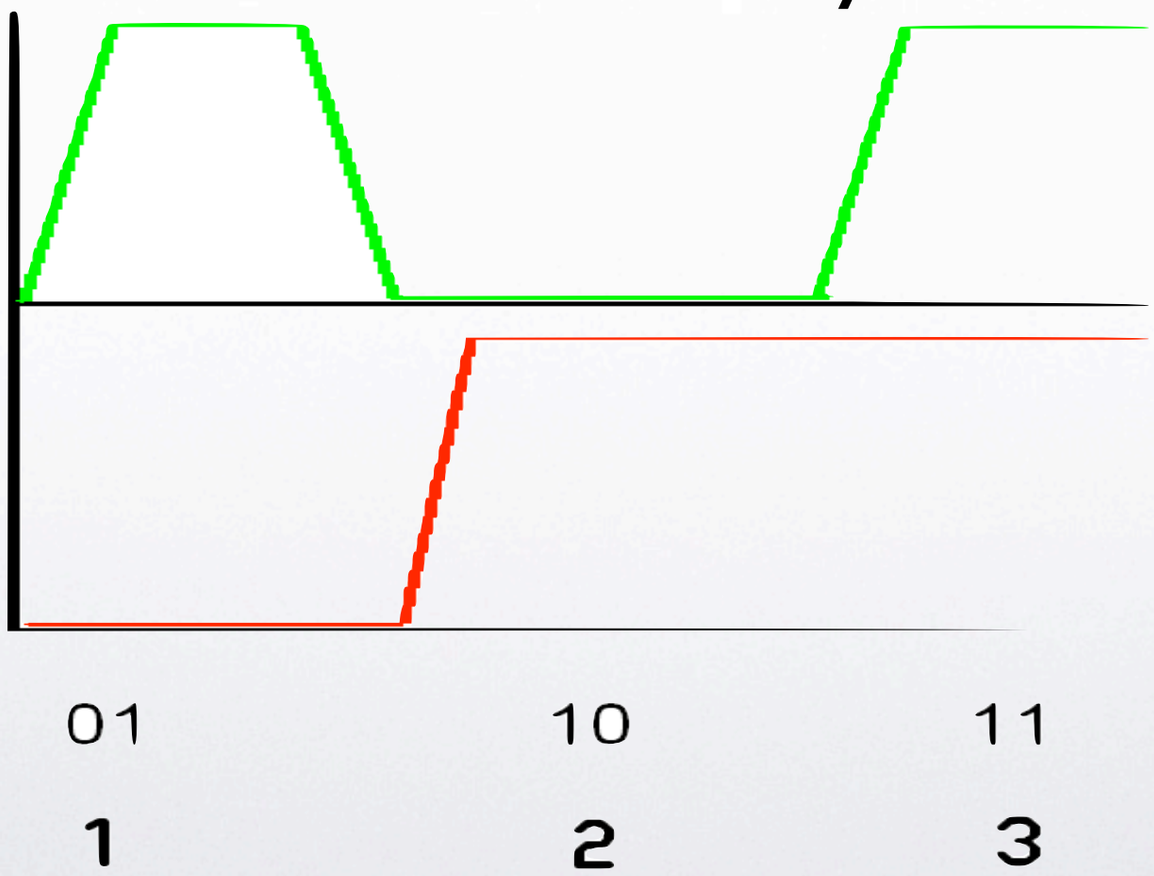
- Current output of two colour model





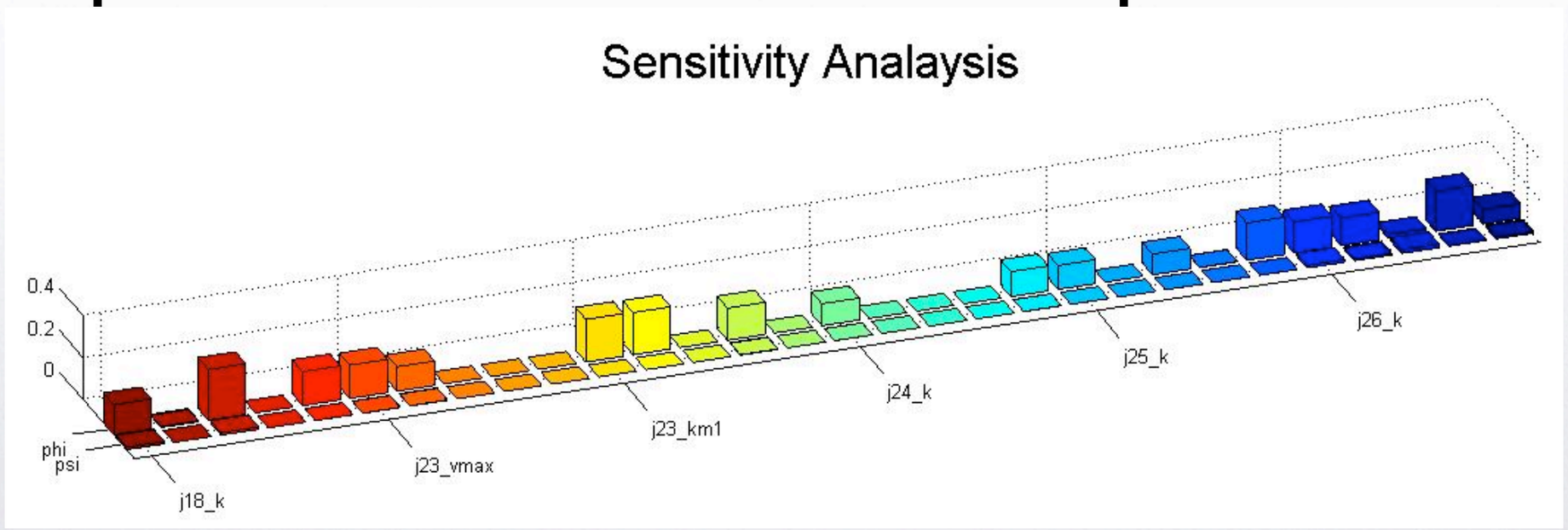
Goal

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

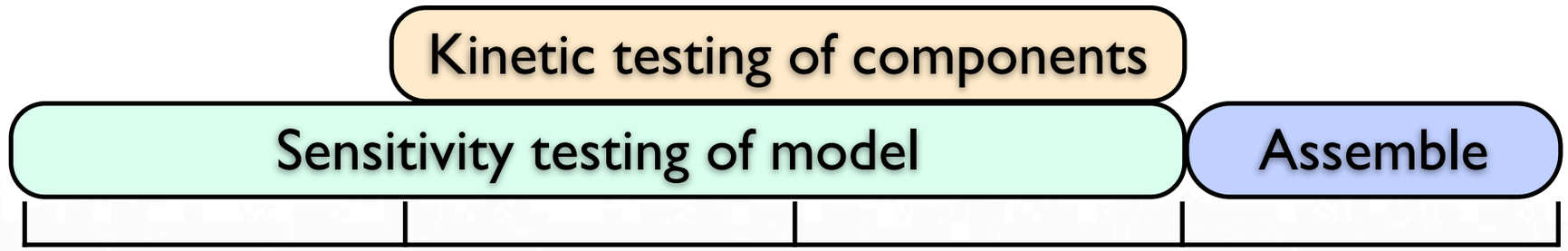


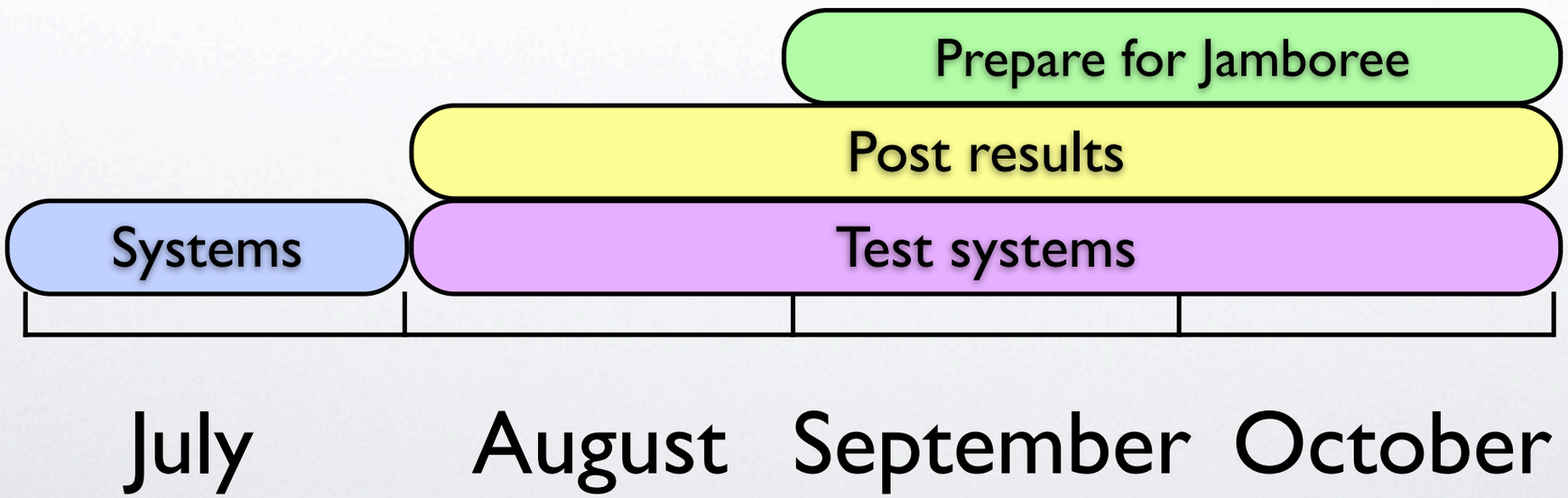
Sensitivity Analysis

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



Timeline


Kinetic testing of components
Sensitivity testing of model
Assemble
March
April
May
June


Prepare for Jamboree
Post results
Systems
Test systems
July
August
September
October
November
8-9

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