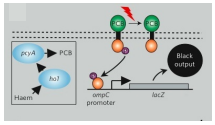
System Engineering

20.109 (F14)
Lecture M2D1
10.07.14

Overview of System Engineering Module

Experimental Context: Bacterial Photography System



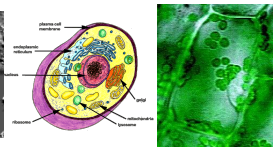
Design Goal: Enhance contrast

Approach: Screen a library of mutants

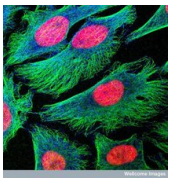
Overarching Programmability of biology
"synthetic biology"

Roadmap for System Engineering Module

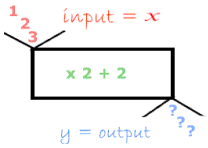
Day	Lab	Lecture
1	Testing v1.0	System Eng: Bact. Photography
2	Measuring	Two Component Signaling
3	Tools	Synthetic Biology + Genetics
4	Journal Club	Expt'l Design & Statistics
5	Re-tune	Tools for examining the C-dog
6	v2.0	Analysis at the DNA level
7	v2.0	Analysis at the protein level
8	Journal Club	Group Meeting/Journal Club



What is the best way to describe cells?

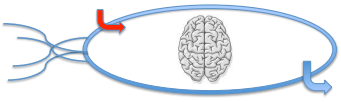


The cell as an I/O machine



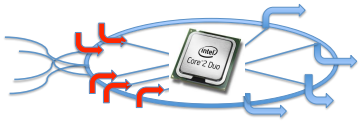
input value x	output value y
1	4
2	6
3	8

The cell as an I/O machine: living software

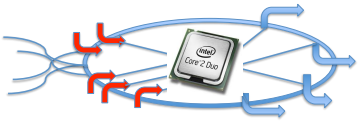


INPUT
Yummy food

The cell as a processing machine

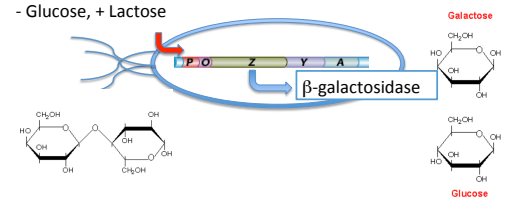


The cell as a processing machine

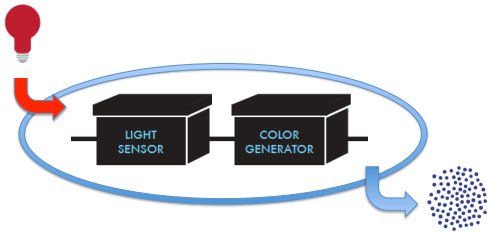


Reduce the problem

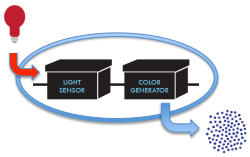
- Glucose, + Lactose

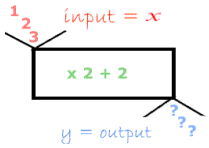


Bacterial Photography Strain as I/O machine



Abstracted View of Bacterial Photography

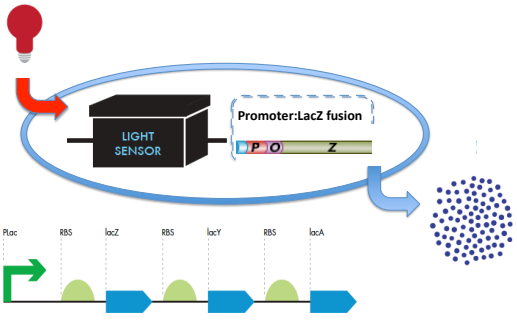




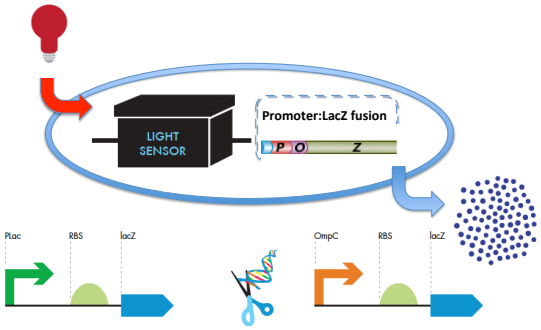
Photons	Color
1	0
0	1

Input x	Output y
1	4
2	6

Abstracted View of Bacterial Photography

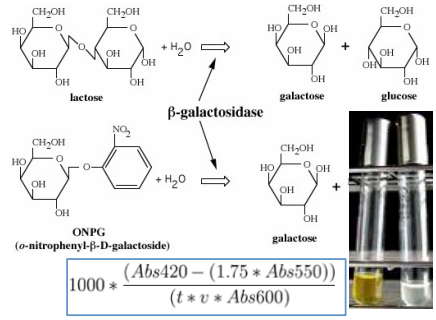


Abstracted View of Bacterial Photography



β-gal activity reflected with indicator compounds

COLOR GENERATOR



$$1000 * \frac{(Abs420 - (1.75 * Abs550))}{(t * v * Abs600)}$$

Sample β-gal activity calculation

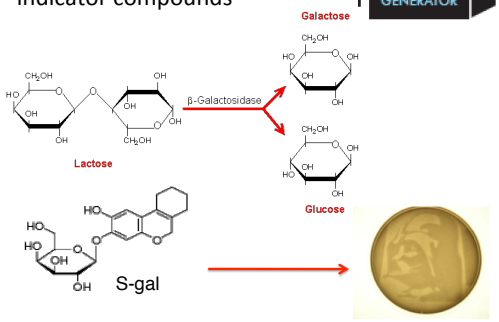
COLOR GENERATOR

Tube #	Sample	OD600	Start	Stop	Elapsed	OD420	OD550
0	blank		00:00				
1	undiluted		00:10				

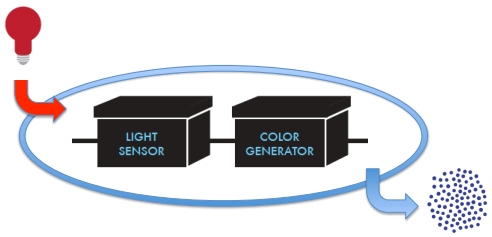
$$1000 * \frac{(Abs420 - (1.75 * Abs550))}{(t * v * Abs600)}$$

β-gal activity reflected with indicator compounds

COLOR GENERATOR



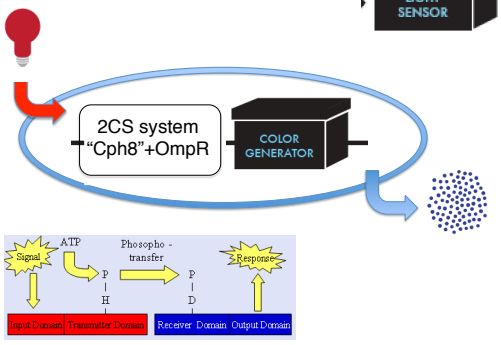
Abstracted View of Bacterial Photography



Input = photons	Output = color
1 (= cells are in the light)	0
0 (= cells are in the dark)	1

Sensor/Responder Pair

LIGHT SENSOR

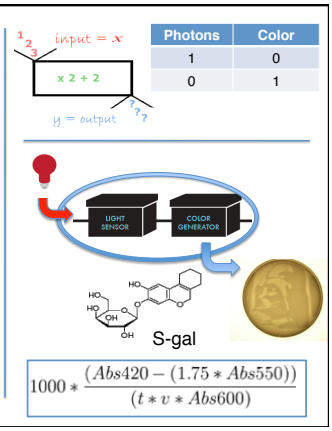


Summary

Cells as processors of information

Reductionist view
e.g lac operon

Bacterial photography abstraction
β-gal measurement



Photons	Color
1	0
0	1

$$1000 * \frac{(Abs420 - (1.75 * Abs550))}{(t * v * Abs600)}$$