

Bioengineering: making life from scratch

Must build it to understand it

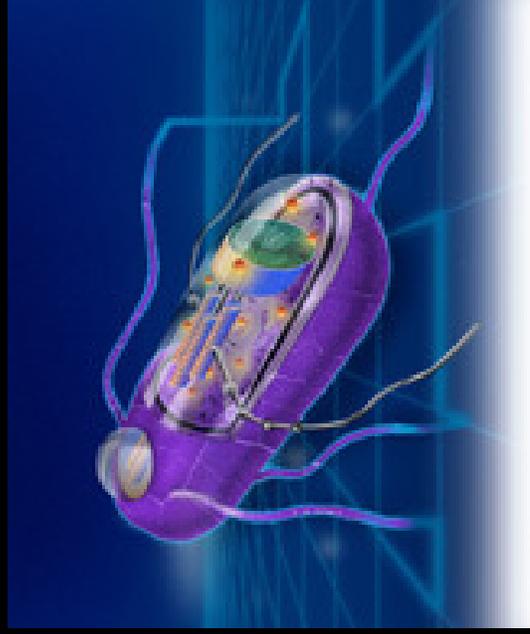


**NIH, Bethesda MD
September 25, 2008**

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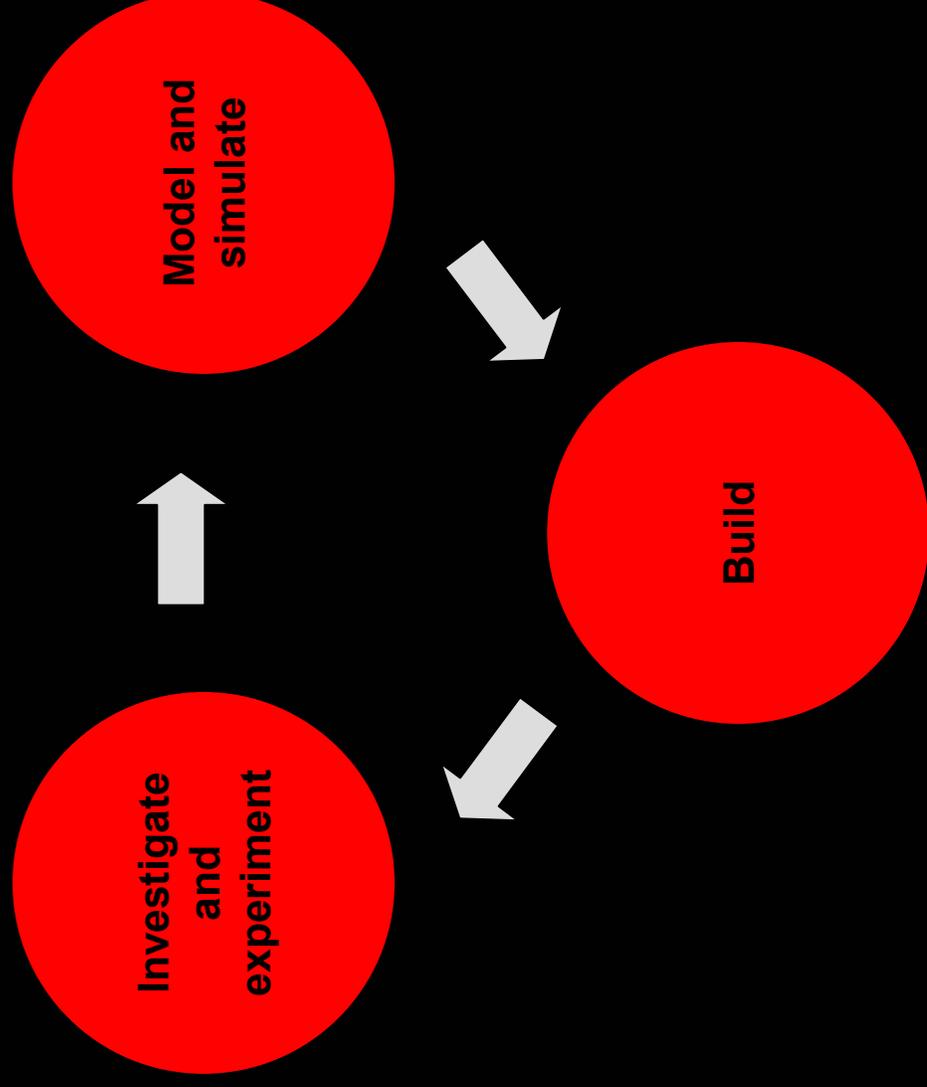
Slides: <http://slideshare.net/LaBlogga/slideshows>

Synthetic biology

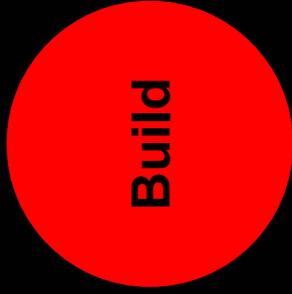


Novel biological system

The new biology: virtuous feedback loop



Registry of Standard Biological Parts



Registry of Standard Biological Parts

Registry Tools
 Add a part
 Search Parts
 More...
 Measurement
 Add
 Repositories
 Sequence
 Analysis
 Add parts to the Registry

Users & Groups
 Apply here for a Registry account

Help & Documentation

Featured Parts

Browse Parts by Type

Systems

- Measurement ?
- Measurement (Under Development) ?
- Projects(empty)

Devices

- Reporters ?
- Inverters ?
- Signalling ?
- Protein Generator ?
- Composite Devices ?
- Measurement ?
- Ribosome Binding Sites ?
- Regulatory ?
- RNA ?
- DNA ?
- Protein Coding ?
- Terminators ?
- Conjugation ?

Parts

Chassis

- E.coli Strains ?
- Cell-Free Systems ?
- Mammalian

Vectors

- Plasmids ?
- Other
- Yeast Parts ?
- A-B Construction Intermediate ?
- PCR Primer ?
- Tags ?
- Other
- Deleted
- Bacteriophage T7

<http://partsregistry.org>

Parts Registry: select measurement device

Measurement Devices

Information about measurement systems

Table of promoter output high measurement system parts

Available Measurement Devices [Show 165 more parts](#) [Edit](#)

Name	Type	Description	Output	Length
AW_BB_113513	Measurement	Screening Plasmid 2		2885
AW_BB_113515	Measurement	Screening Plasmid 4		2825
AW_BB_15131	Measurement	Screening Plasmid 3		906
AW_BB_17100	Measurement	TetR repressible GFP generator		940
AW_BB_1732901	Measurement	R0010		3438
AW_BB_1732902	Measurement	R0010		597
AW_BB_1732903	Measurement	R0011		452
AW_BB_1732913	Measurement	[aTC] -> RFP		1757
AW_BB_1732914	Measurement	P_NAND_U073026D001016 + RFP		989
AW_BB_1732916	Measurement	P_NOR_U037011D002022 + RFP		954
AW_BB_1732917	Measurement	P_NOR_U035044D001022 + RFP		951
AW_BB_15517	Measurement	Arabinose -> LacI s -I GFP		3473
AW_BB_15518	Measurement	Arabinose -> LacI ts -I mRFP		3458
AW_BB_113008	Measurement	RBS_Test R0011.B0031.E0130		942
AW_BB_113011	Measurement	RBS_Test R0040.B0030.E0130		943
AW_BB_113012	Measurement	RBS_Test R0040.B0031.E0130		942
AW_BB_113013	Measurement	RBS_Test R0040.B0032.E0130		941
AW_BB_113014	Measurement	RBS_Test R0040.B0033.E0130		939
AW_BB_113512	Measurement	Screening plasmid 1		2887
AW_BB_113514	Measurement	Screening Plasmid 3		2825
AW_BB_113529	Measurement	Screening Plasmid 2.1		2911
AW_BB_113530	Measurement	Screening Plasmid 2.2		2911
AW_BB_113533	Measurement	Screening Plasmid 2.5		2945
AW_BB_113534	Measurement	Screening Plasmid 2.6		2945
AW_BB_113606	Measurement	Reporter Construct (Ty+Lc+)		1966
AW_BB_113614	Measurement	Cascaded Tet (medium) and Lac (medium) QPIs		2284
AW_BB_113617	Measurement	Cascaded Tet (elowitz) and Lac (medium) QPIs		2282
AW_BB_113623	Measurement	Cascaded Lac (medium) and Tet (weak) QPIs		2281
AW_BB_113624	Measurement	Cascaded Lac (medium) and Tet (medium) QPIs		2284

Parts Registry: obtain part sequence

Part: BBa_I7100

Designed by Jennifer Braff



DNA Available
Experience Works

Entered: 2004-10-26

TetR repressible GFP generator

BBa_I7100 is a composite part consisting of a TetR repressible promoter (BBa_R0040) and a GFP generator (BBa_E0840). Thus, BBa_I7100 produces fluorescence in either the absence of TetR or in the presence of the inducer aTC.

Usage and Biology

See BBa_R0040 for details on the TetR repressible promoter.

Sequence and Features

Get selected sequence

Context: Part only

Length: 940 bp

Search:

Format: Subparts | [Ruler](#) | [SS](#) | [DS](#)

p(tetR)
R0040 B0030 E0040 B0010 B0012



Part-only sequence for BBa_I7100 (940 bp)

```
tccctatcagtgatagagattgacatccctatcagtgatagagatactgacactactagagataaagaggagaaaataactagatgctgtaaaggagaaga  
acttttcactggagtgccccattctgttgaattagatggtgattgtaattggccacaaaattttctgtcagtgaggaggtgaaggtgatgcaacatac  
ggaaaacttaacccttaaatattttgcaactctggaaaactacctgttccatggccaaacttgcactacttctcggttatgggttcaatgctttgoga  
gataccagatcataTgaaaacagcatgactttttcaagagtgccatgcccgaaggttatgtacaggaagaactatattttcaaaagatgacgggaaacta  
caagacaagtgtgaagtcaagtttgaagtgatacccttgtttaaataagattgattttaaagaagatggaaaacattcttg  
aaattggaaatacaactataactcacacaattgatacatatggcagacaaaacaaagaatggaatcaaaattcaacttcaaaattagacacacaact  
atggaagcgttcaactagcagaccattatacacaaaatactccaattggcctgtccctttaccagacaaccattacctgtccacacaactctgc  
cctttcgaaagatcccaacgaaaagagagaccacatgctcctcttgagttgtaacagctgctggattacacatggcatggatgatacaatacaaaa  
taatactagcaccaggtcatcaataaaaacgaaaggctcagtcgaaaagactgggcccctttctgtttttatctgttctggtggaacgctctctactaggt  
cacactggtcaccttgggtggcctttctgctttata
```

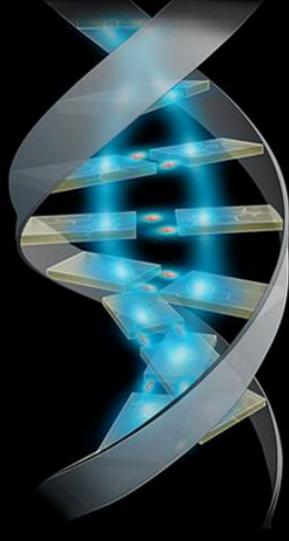


DNA Synthesizer

<http://partsregistry.org>

The story of biocomputing

- Mapping genes to proteins -> life can be engineered
- Genes can be turned on and off -> gene as binary switch
- Systemic understanding of DNA -> genes as circuits
- Cell noisiness -> need for stable and predictable circuits



Genetic toggle switch



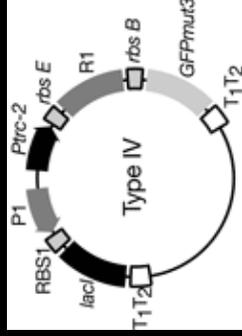
Gardner



Cantor



Collins



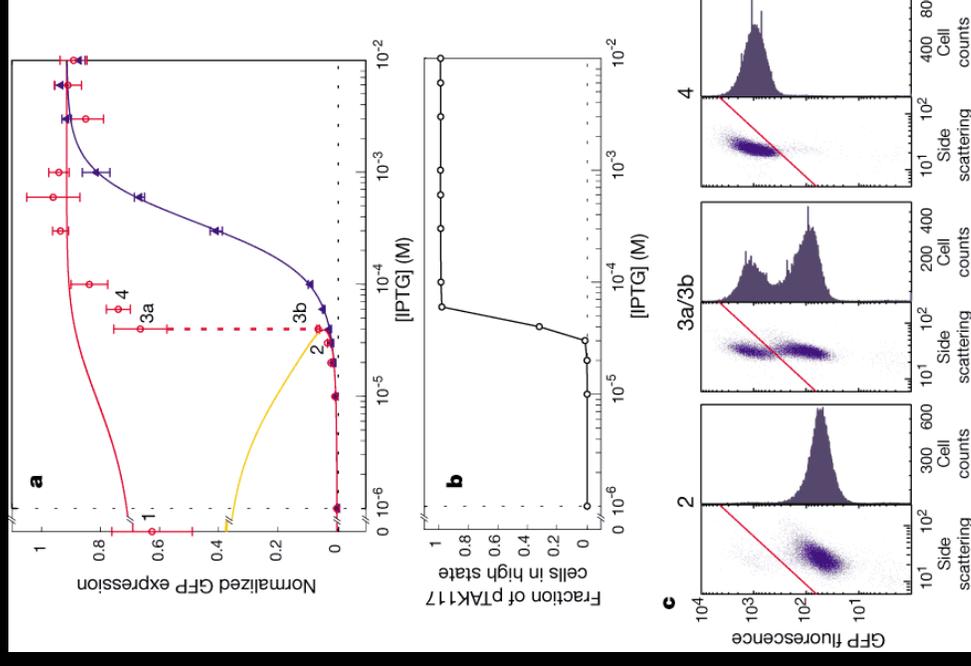
Toggle switch plasmid

Construction of a genetic toggle switch in *Escherichia coli*

Gardner TS, Cantor CR, Collins JJ

Nature. 2000 Jan 20;403(6767):339-42.

<http://www.ncbi.nlm.nih.gov/pubmed/10659857>

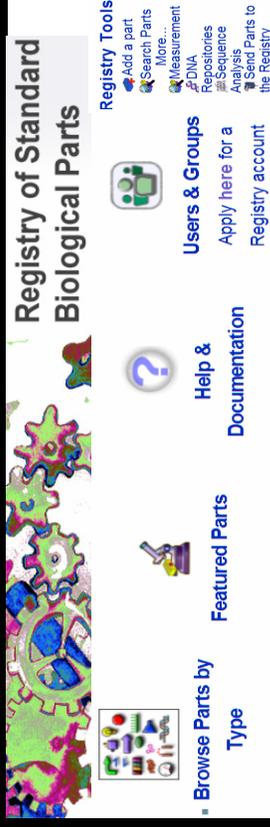
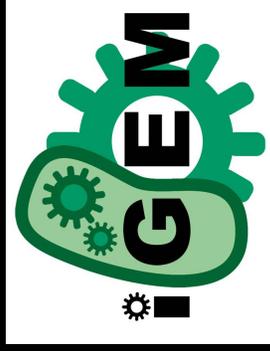


Toggle switch induction threshold

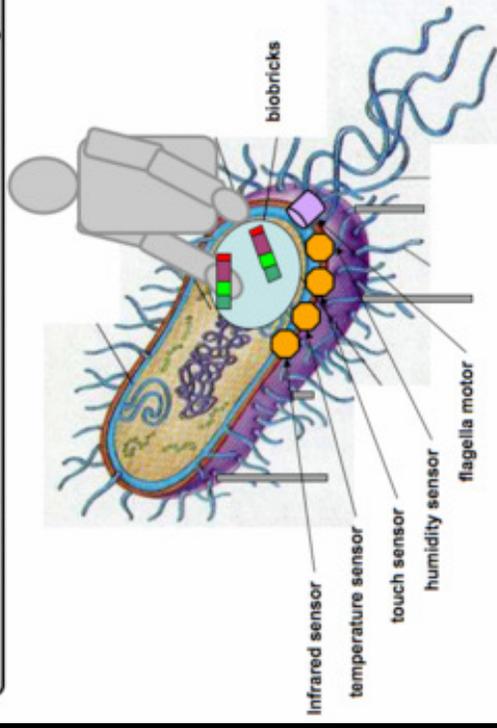
Open wetware



Drew Endy



Hands-on BioBrick activity



- Parts Registry
- BioBricks Foundation
- iGEM competition

<http://openwetware.org/>

<http://bbf.openwetware.org/>

<http://www.igem.org/>

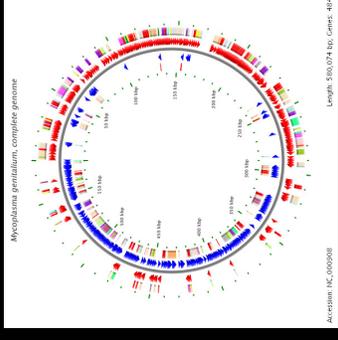
<http://partsregistry.org>

Synthetic life



Craig Venter

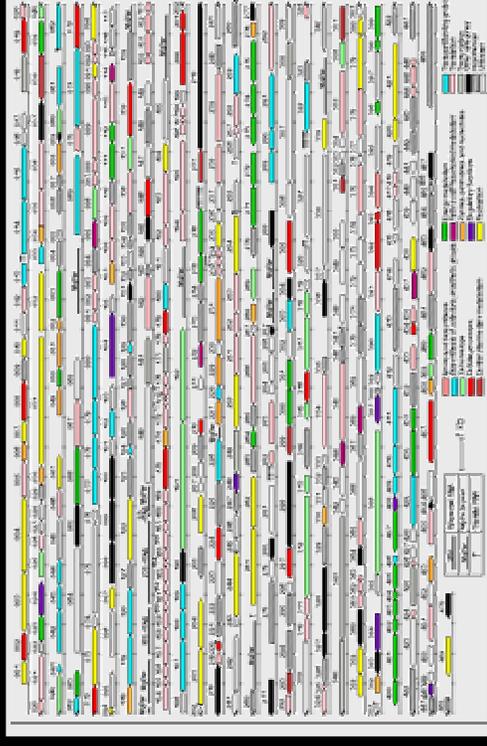
Mycoplasma genitalium



Bacterial image

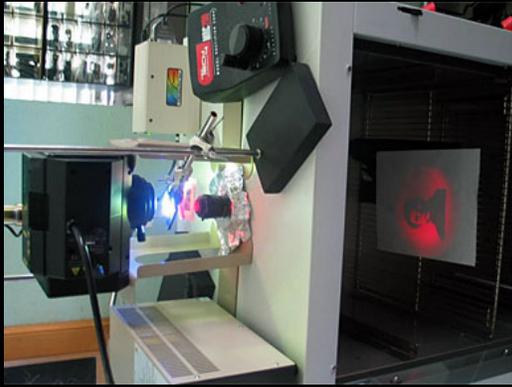
Genetic map

- Synthetic life
- Fourth-generation biofuels

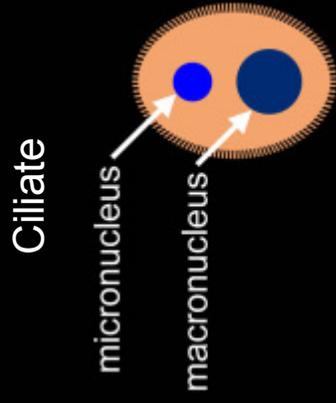


Genome

Further applications of bioengineering

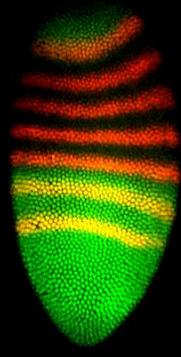


Coli-roid
microbial camera

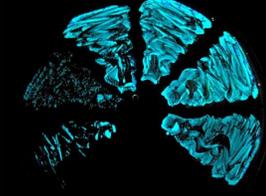


Ciliate

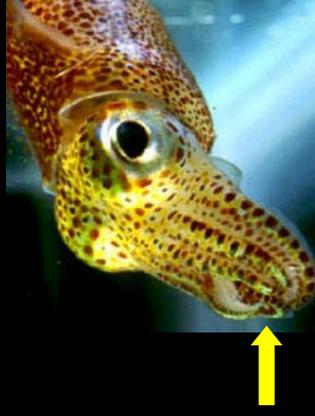
Natural genetic
engineering



Amorphous computing

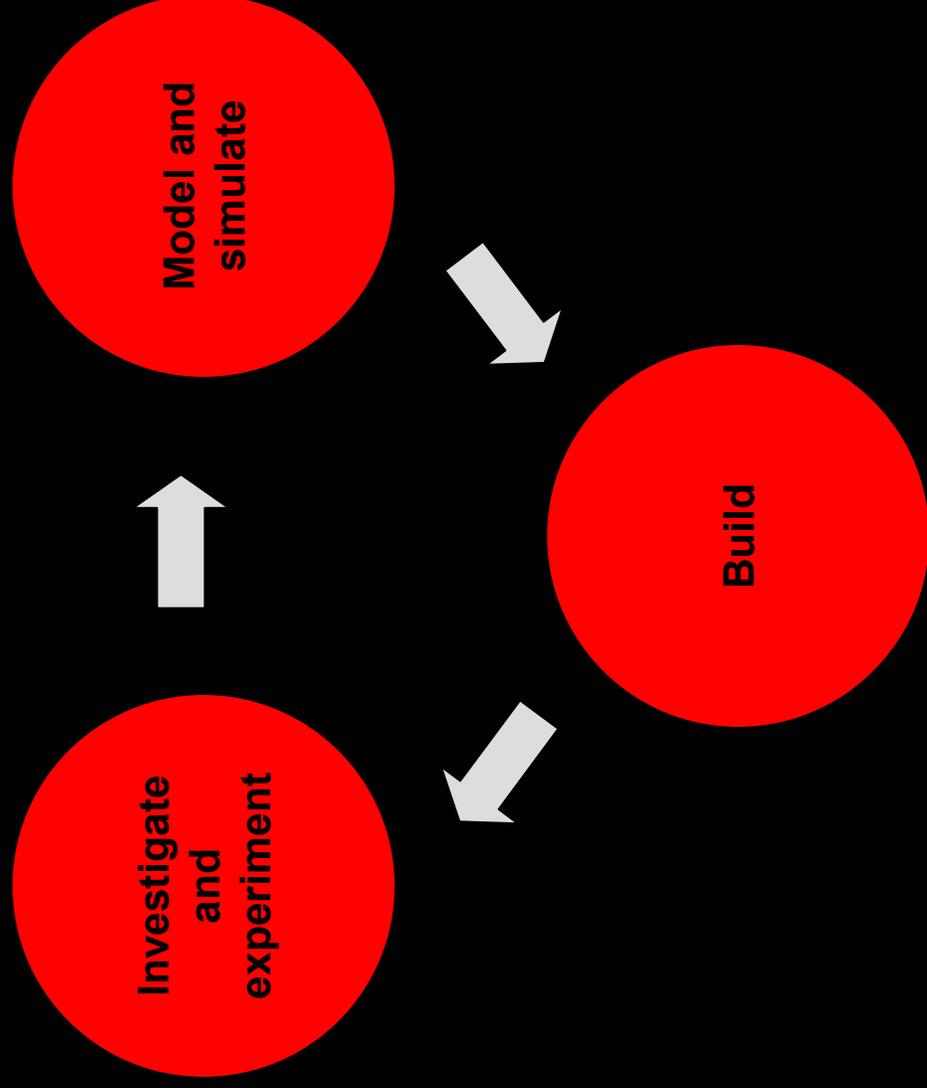


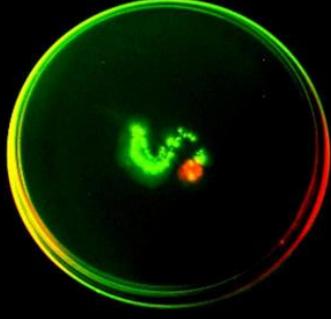
Landmine sensing plant:
Arabidopsis thaliana



Cellular colonies

Summary





Thank you

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