

Question 1

1 pts

bioengineered genetic devices that send or receive signals via device-specific molecules (e.g., proteins) can be directly connected to one another in all arbitrary combinations

True

False

Question 2

1 pts

when designing a bacterial flash mob you should always start your DNA code with a(n):

A

C

T

G

plan for managing complexity

Question 3

1 pts

The designs of airplanes, computers, and engineered organisms all share a common functional architecture

True

False

Stanford statement on fact-finding review related to Dr. Jiankui He

Stanford University issued the following statement regarding the conclusion of a fact-finding review.



Following the claim by Chinese scientist Jiankui He that his research team had produced the world's first gene-edited babies, Stanford University undertook a fact-finding review of Dr. He's interactions with several Stanford researchers during and after the time he spent at Stanford as a postdoctoral scholar in 2011-12. The review was conducted by a Stanford faculty member and an outside investigator, as is the university's practice, and has now concluded.



Based on all of the available information, the reviewers found that the Stanford researchers were not participants in Dr. He's research regarding genome editing of human embryos for intended implantation and birth and that they had no research, financial or organizational ties to this research. The review found that the Stanford researchers expressed serious concerns to Dr. He about his work. When Dr. He did not heed their recommendations and proceeded, Stanford researchers urged him to follow proper scientific practices, which included identifying an unmet medical need, securing informed consent, obtaining Institutional Review Board (IRB) approval and publishing the research in a peer-reviewed journal. Finally, the reviewers found that Stanford researchers were told by Dr. He that he had secured IRB approvals for his work.

Stanford is committed to following ethical practices when providing medical treatments and conducting medical research. Editing of human genomes has raised important questions for the scientific community as a whole. Stanford will continue its longstanding tradition of working with national and international organizations to further develop shared professional guidelines for emerging technology, including genetic technology.

Stanford Clears Professor of Helping With Gene-Edited Babies Experiment



Stephen Quake, a professor of biotechnology at Stanford University.
Anastasiia Sapon for The New York Times

By Pam Belluck

April 16, 2019

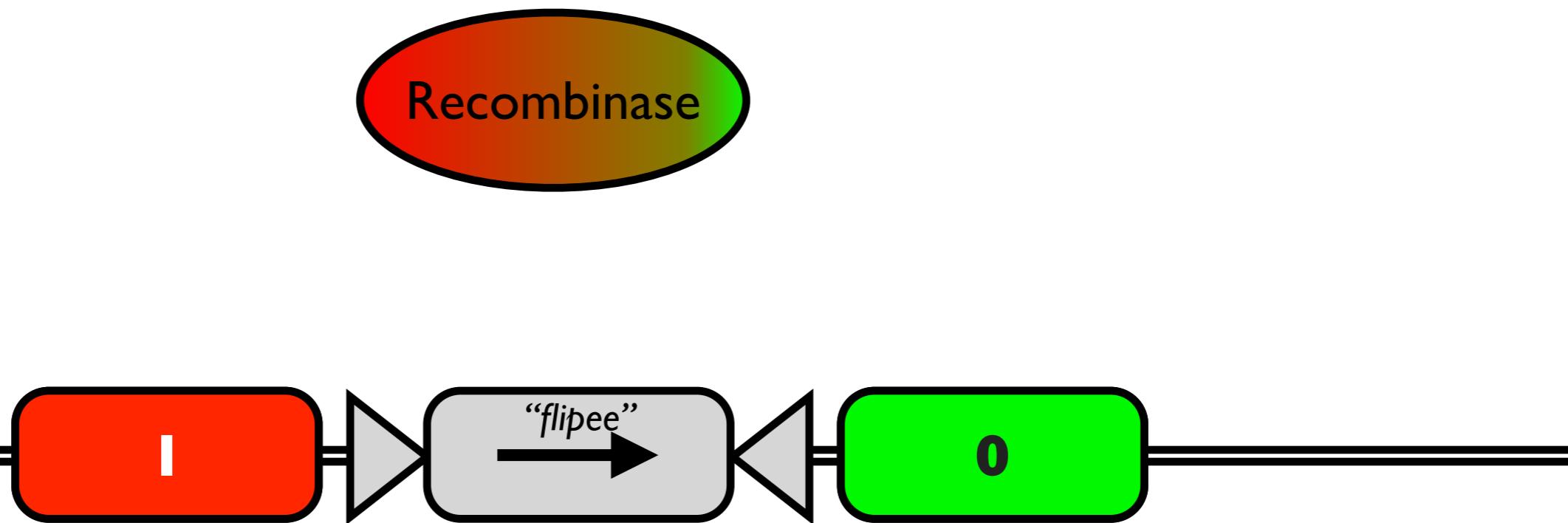


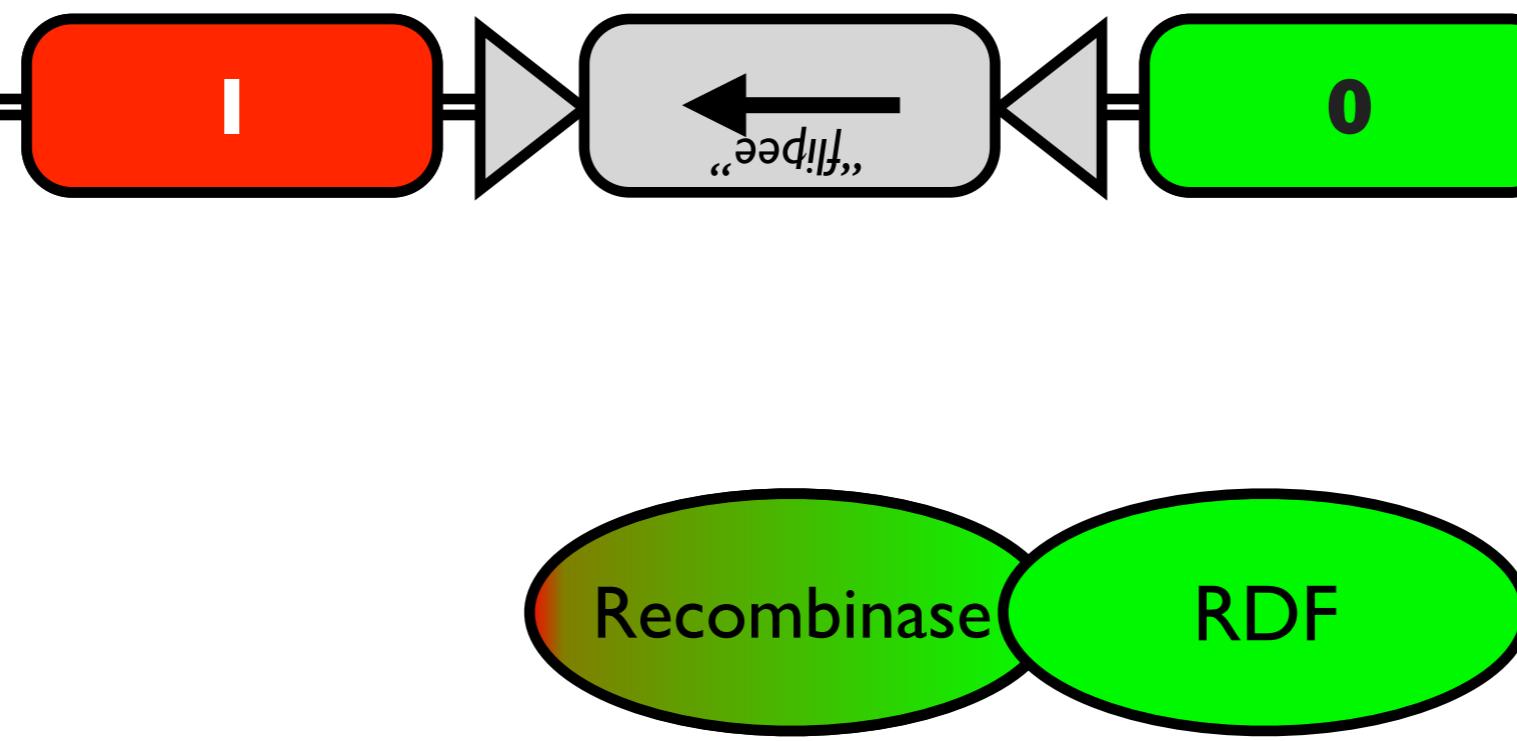
E.g., we now have an engineered genetic “black box” that allows us to program flipping of arbitrary DNA sequences.

Inputs: transcription signals that control levels of enzymes that mediate DNA flipping.

Output: Whatever is being flipped.

SET “flipper”



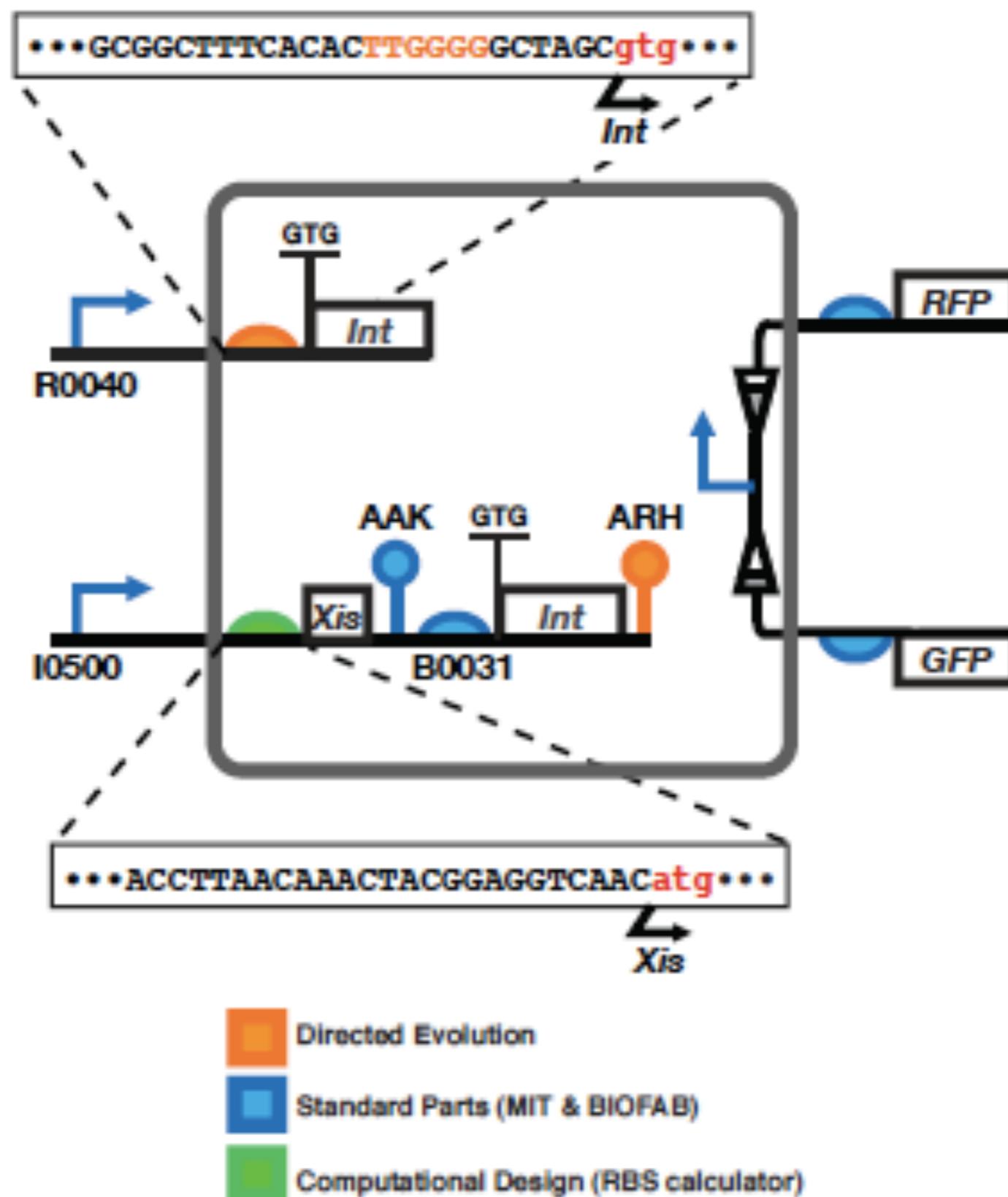


RESET “flipper”

Bonnet et al., PNAS USA, 2012



What does this bio-bit's DNA layout look like?





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Dual-recombinase-controller

(Plasmid #44456)



[Enlarge](#)

View all sequences



DEPOSITING LAB

Drew Endy

PUBLICATION

Bonnet et al Science. 2013 May
3;340(6132):599-603. doi: 10.1126/science.1232758.
Epub 2013 Mar 28. (How to cite ↓)

SEQUENCE INFORMATION

Depositor Sequences: Full (1)

Addgene Sequences: Partial (2)

ORDERING

Item	Catalog #	Description	Quantity	Price (USD)	
Plasmid	44456	Plasmid sent as bacteria in agar stab	1	\$65	Add to Cart

This material is available to academics and nonprofits only.

Synthetic recombinase-based state machines in living cells

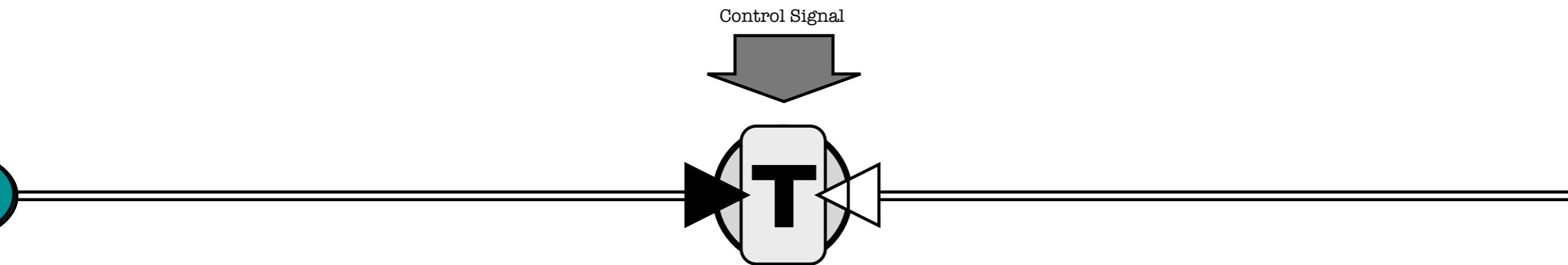
Nathaniel Roquet,^{1,2,3,4} Ava P. Soleimany,^{1,2,3} Alyssa C. Ferris,^{1,2,3,5}
Scott Aaronson,³ Timothy K. Lu^{1,2,3,4,6*}

State machines underlie the sophisticated functionality behind human-made and natural computing systems that perform order-dependent information processing. We developed a recombinase-based framework for building state machines in living cells by leveraging chemically controlled DNA excision and inversion operations to encode states in DNA sequences. This strategy enables convenient readout of states (by sequencing and/or polymerase chain reaction) as well as a computation framework by engineering state machines to respond to chemical inputs to control up to 16 DNA states. Our system can record the temporal order of all inputs and output states to enable gene expression. We also developed a computation framework for recording regulatory programs using recombinase-based logic gates. This work should enable new strategies for recording complex events and how these events regulate complex cell functions and behaviors.

ACKNOWLEDGMENTS

The dual recombinase controller was a gift from D. Endy (Addgene plasmid #44456) and is available at Addgene under a material transfer agreement. All plasmids created in this project are also available on Addgene. We thank J. Thomson (USDA-ARS WRRC, Albany, CA) for the *a118* gene, A. A. K. Nielsen and C. A. Voigt for the *phIF* gene, J. Shin and C. A. Voigt for hammerhead ribozyme parts, C. J. McClune and C. A. Voigt for helpful discussions on recombinase systems, and the FAS Division of Science, Research

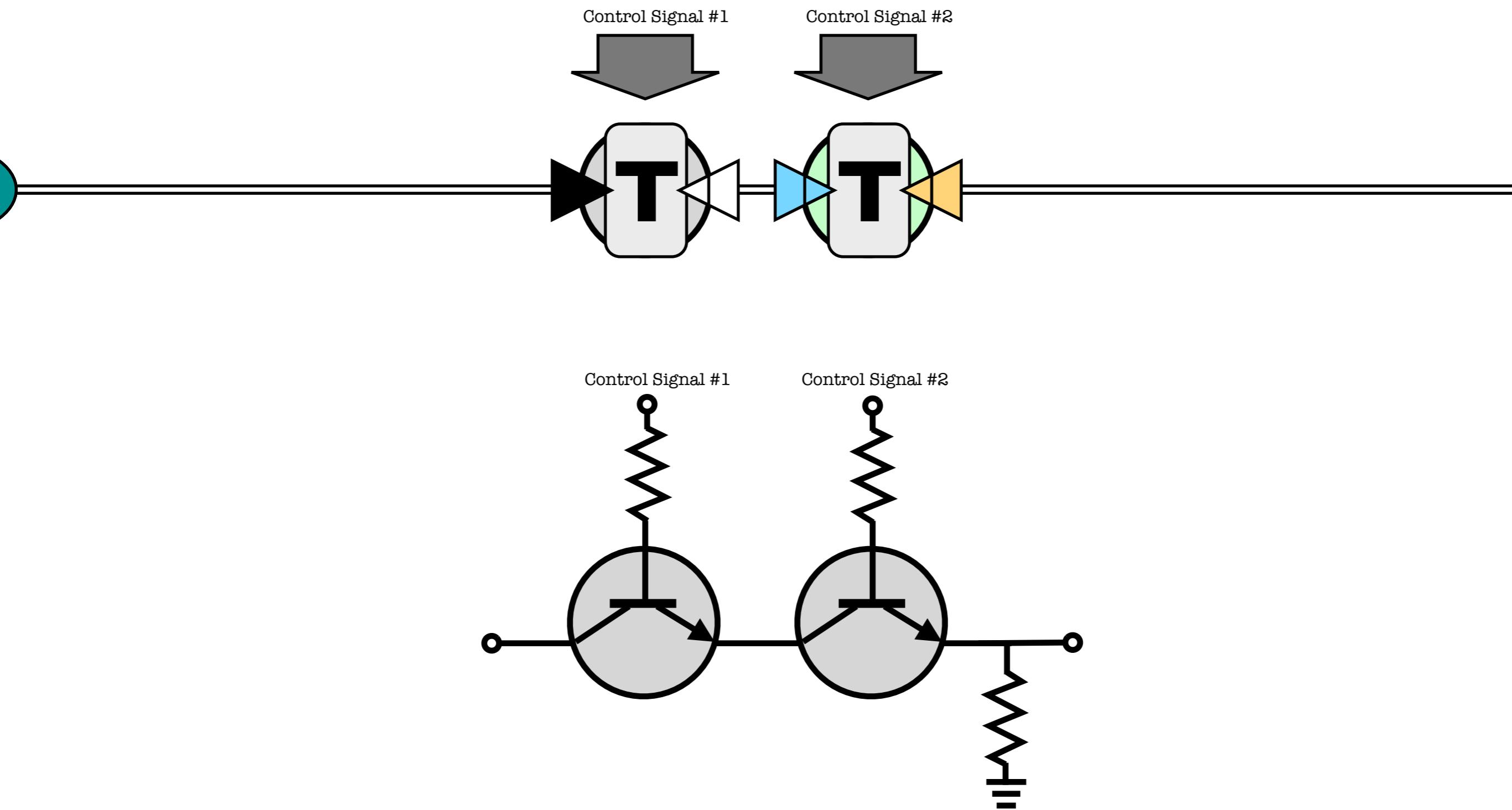
Can flip anything! (i.e., modular design)



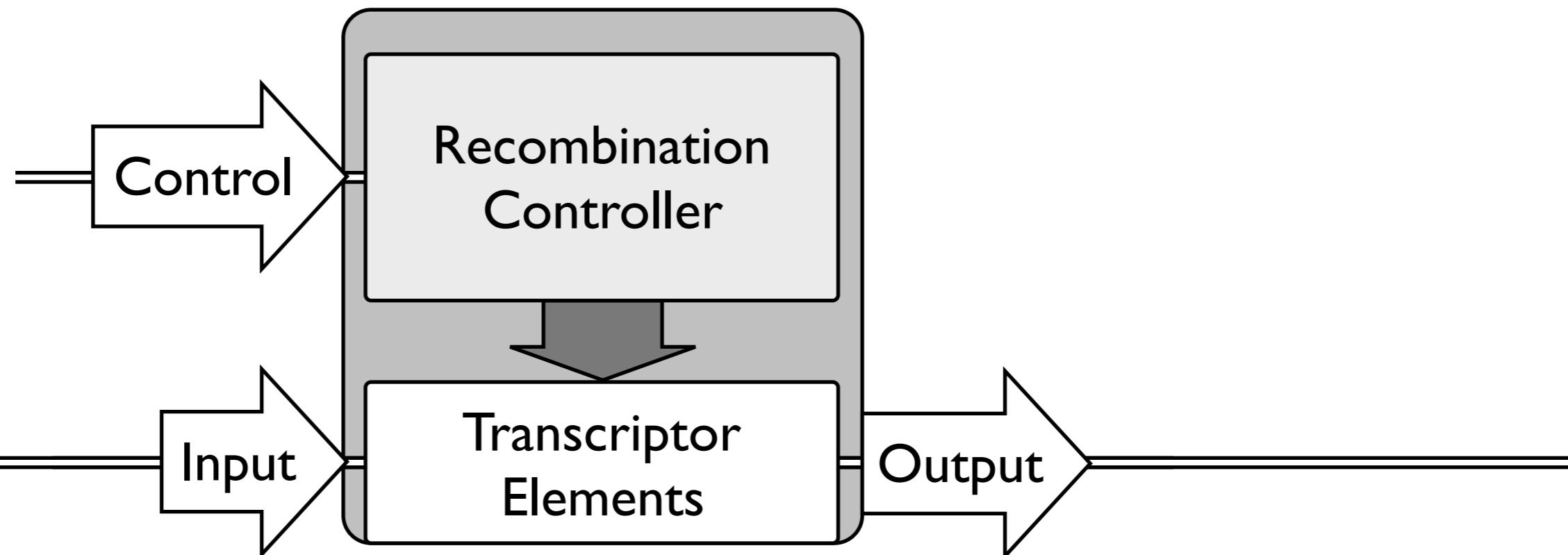
Transcriptor:

A control signal provided to a DNA terminal changes the number of RNA polymerase molecules flowing through another DNA element (T).

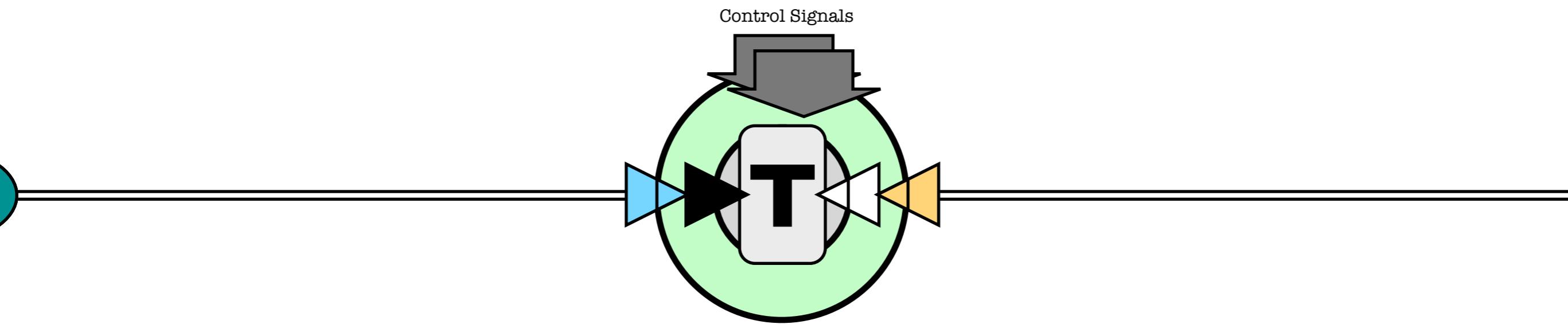
AND gate



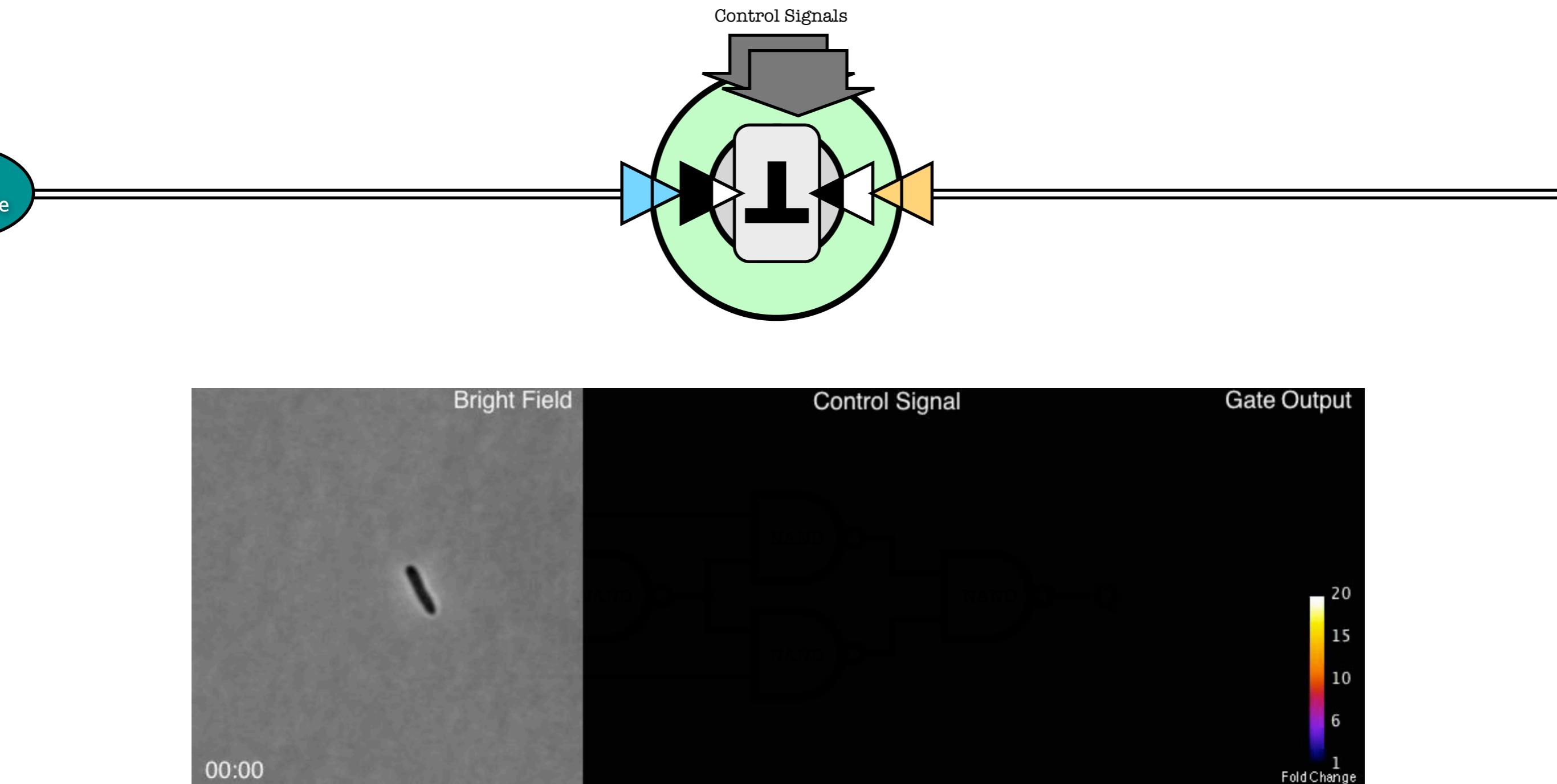
Abstract genetic logic device architecture



One transcriptor, nested = Mr. Boole's XOR



One transcriptor, nested = Mr. Boole's XOR





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Amplifying genetic logic gates.

Bonnet J, Yin P, Ortiz ME, Subsoontorn P, Endy D

Science. 2013 May 3;340(6132):599-603. doi: 10.1126/science.1232758. Epub 2013 Mar 28. [PubMed](#) [Journal](#)

Plasmids from Article

Showing 1 to 7 of 7 entries

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44452	NOR gate-V2.0	Add to Cart
44451	OR gate	Add to Cart
44449	AND-gate-V2.0	Add to Cart

Detection of pathological biomarkers in human clinical samples via amplifying genetic switches and logic gates

Alexis Courbet¹, Drew Endy², Eric Renard³, F

+ See all authors and affiliations

Abstract

Whole-cell biosensors have several substances and have proven to be hurdles have limited whole-cell bio unreliable operation in complex me that bacterial biosensors with gene switches can detect clinically relev These bactosensors perform signal processing with the use of B addition, we provide a framework v robustness in clinical samples toge the sensor module for distinct me that bactosensors can be used to c diabetic patients. These next-gene computing and amplification capa should enable new approaches for

Programmable probiotics for detection of cancer in urine

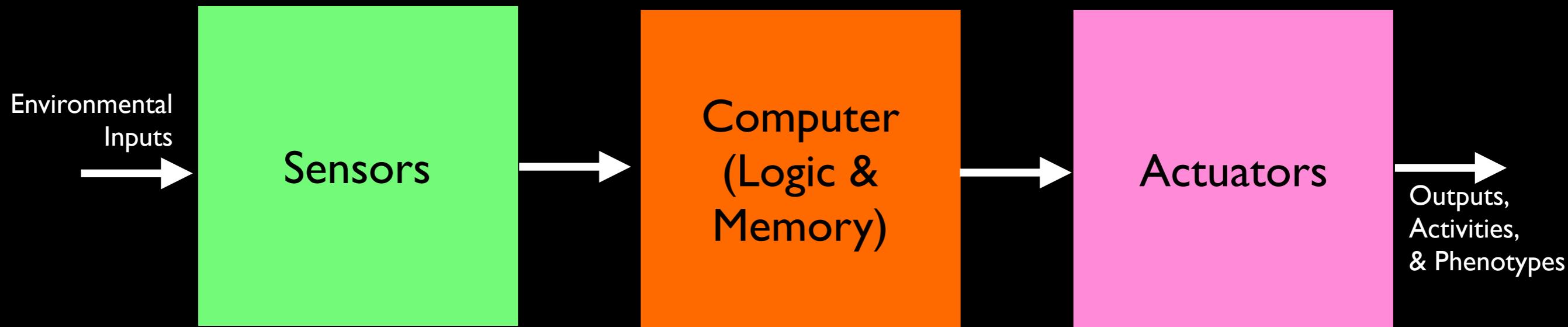
Tal Danino^{1,*}, Arthur Prindle^{2,*}, Gabriel A. Kwong^{1,†}, Matthew Skalak¹, Howard Li², Kaitlin Allen¹, Jeff Hasty...

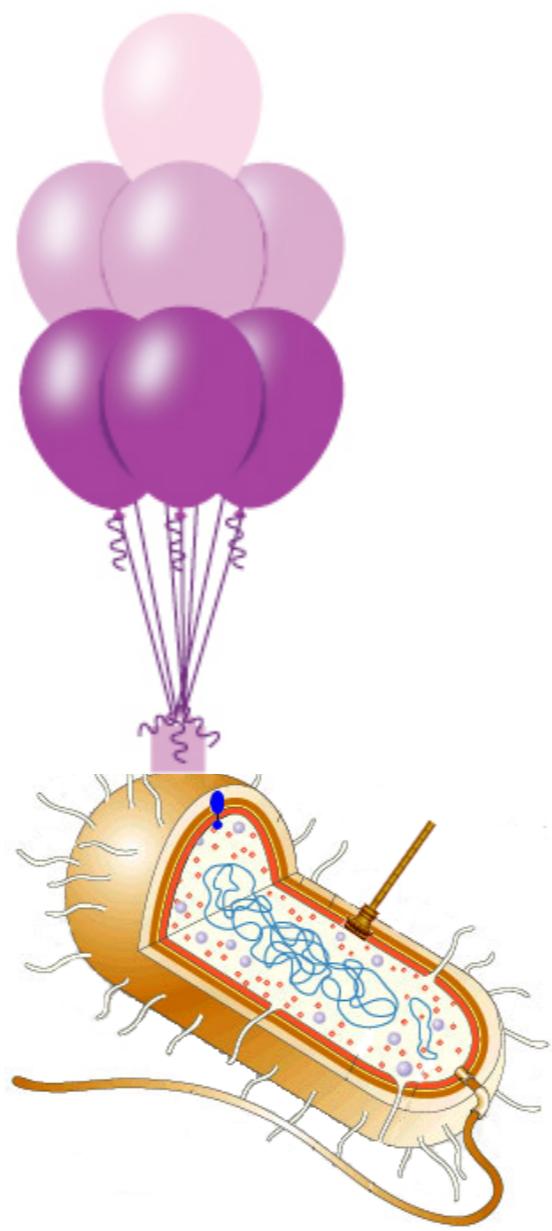
+ See all authors and affiliations

Abstract

Rapid advances in the forward engineering of genetic circuitry in living cells has positioned synthetic biology as a potential means to solve numerous biomedical problems, including disease diagnosis and therapy. One challenge in exploiting synthetic biology for translational applications is to engineer microbes that are well tolerated by patients and seamlessly integrate with existing clinical methods. We use the safe and widely used probiotic *Escherichia coli* Nissle 1917 to develop an orally administered diagnostic that can noninvasively indicate the presence of liver metastasis by producing easily detectable signals in urine. Our microbial diagnostic generated a high-contrast urine signal through selective expansion in liver metastases (10^6 -fold enrichment) and high expression of a lacZ reporter maintained by engineering a stable plasmid system. The lacZ reporter cleaves a substrate to produce a small molecule that can be detected in urine. *E. coli* Nissle 1917 robustly colonized tumor tissue in rodent models of liver metastasis after oral delivery but did not colonize healthy organs or fibrotic liver tissue. We saw no deleterious health effects on the mice for more than 12 months after oral delivery. Our results demonstrate that probiotics can be programmed to safely and selectively deliver synthetic gene circuits to diseased tissue microenvironments in vivo.

What about sensors and actuators?





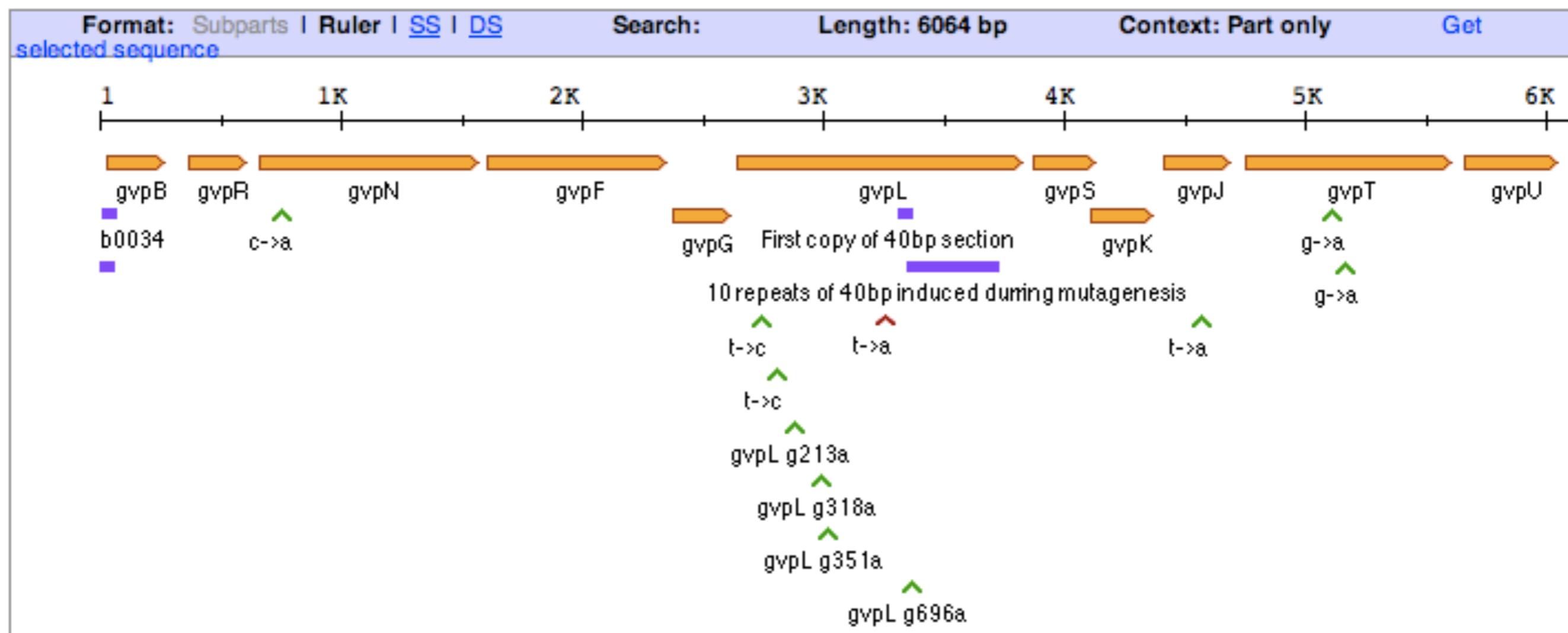
Part:BBa_I750016:Design



Designed by Phillip Dodson

Entered: 2007-10-21

Gas Vesicle polycistonic gene



Design Notes

[edit]

Site directed mutagenesis was performed in four rounds to remove 3 PstI sites and one EcoRI site from gvpL in the sequence.

Protein Balloon DNA



Registry of Standard Biological Parts

Featured Parts:Light Sensor

From Levskaya *et al.*

"We have designed a bacterial system that is switched between different states by red light. The system consists of a synthetic sensor kinase that allows a lawn of bacteria to function as a biological film, such that the projection of a pattern of light on to the bacteria produces a high-definition (about 100 megapixels per square inch), two-dimensional chemical image."

Sample photos

Here are a selection of sample **coliroid** taken with the bacterial photography system.



[Jeff Tabor](#) holding a **coliroid**.

Photo credit: Marsha Miller, University of Texas at Austin. Image courtesy of UT/UCSF.



Hello World **coliroid** published in Levskaya *et al.*, Nature, 2005.



This is a **coliroid** portrait of Andy Ellington. You can compare it with the [real Andy](#). Image courtesy of UT/UCSF.



This is a **coliroid** of the [Flying Spaghetti Monster](#). Image courtesy of UT/UCSF.

E.g., Do we always have to make them ourselves?



Registry of Standard Biological Parts



tools catalog repository assembly protocols help search

BBA_



iGEM 2019 Begins!

Registry News

- Registry Release
- Registry 6.0
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Many thousand so-called BioBrick DNA parts.

Freely available.

Today.

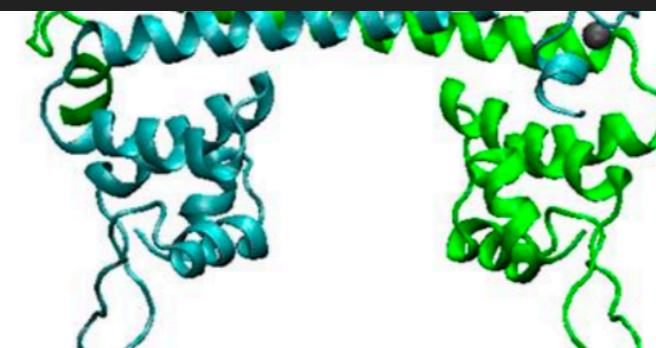
Features

Metal Binding

Every year, there is a wide variety of biosensor and bioremediation projects that involve metal-binding and metal-sensing.

Their focus may be on several pollutants or just one. iGEM teams have worked with metals like nickel, mercury, lead, arsenic, copper, amongst others.

We've put together a collection of projects and DNA parts that are responsible for both metal binding and metal sensing.



partner offers page for more info.

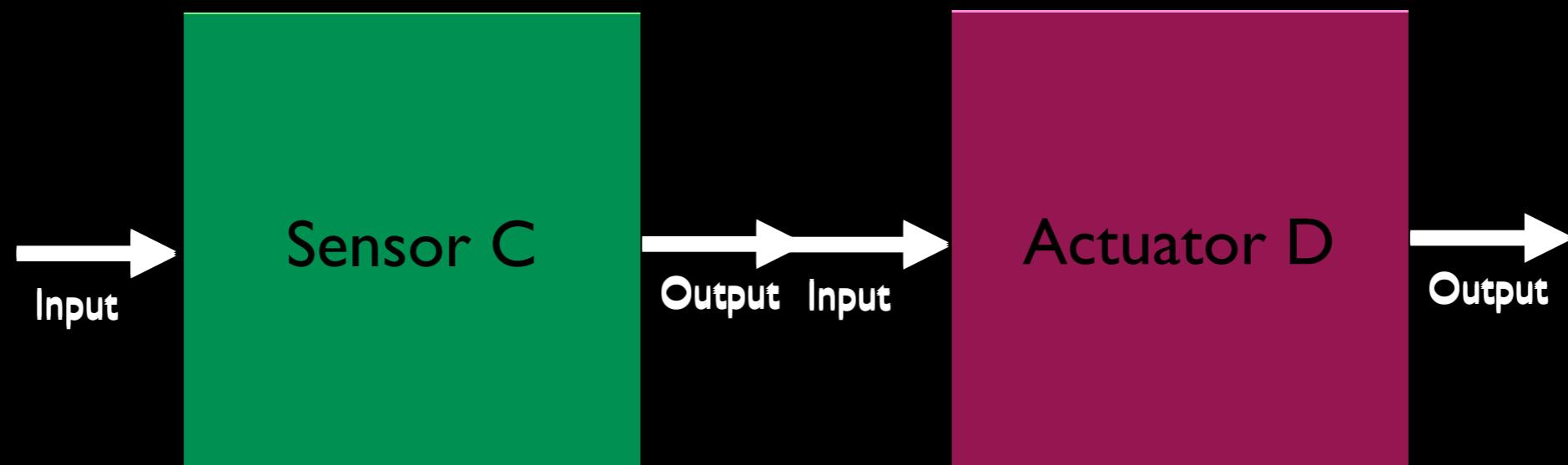
2019 DNA Distribution

The iGEM 2019 DNA Distribution has started shipping to registered and approved iGEM teams! Be sure to read through the 2019 Distribution Handbook for storage instructions and how to use your kit!

iGEM 2010



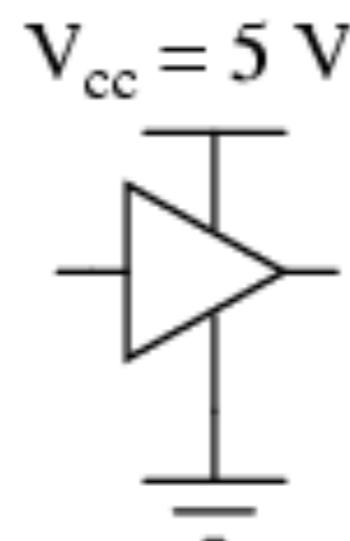
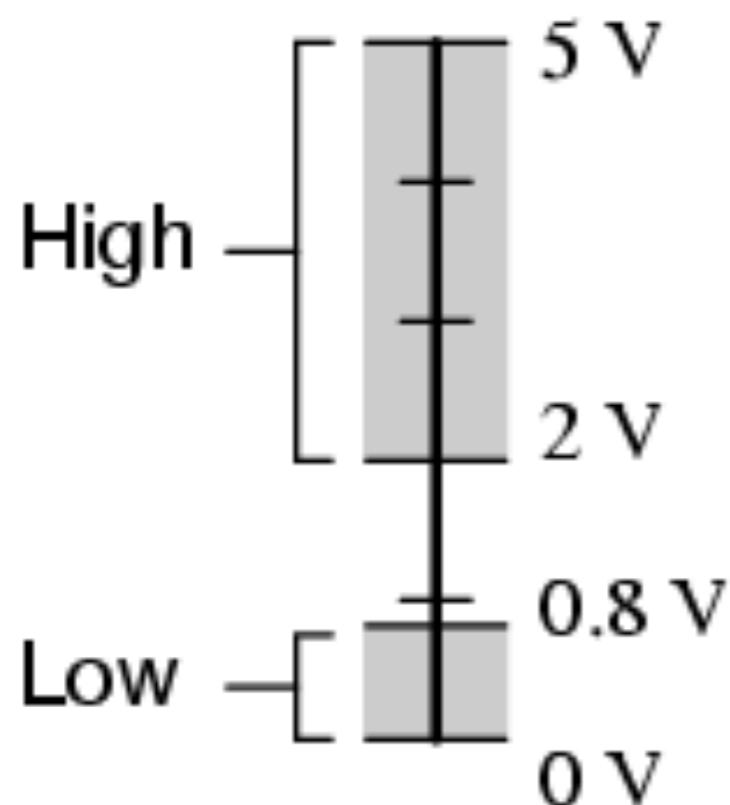
Functional composition... what should the “output” of any Sensor be so that it can connect with the “input” of any Actuator?



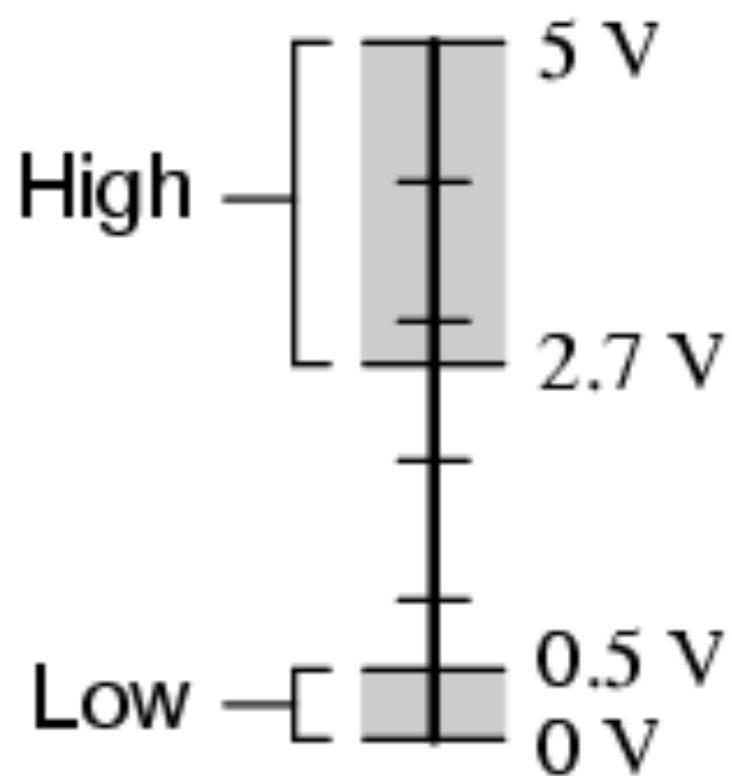
Polymerase Per Second (PoPS) as common signal carrier for transcription-based devices

Signal levels (standards) & digitization

*Acceptable TTL gate
input signal levels*



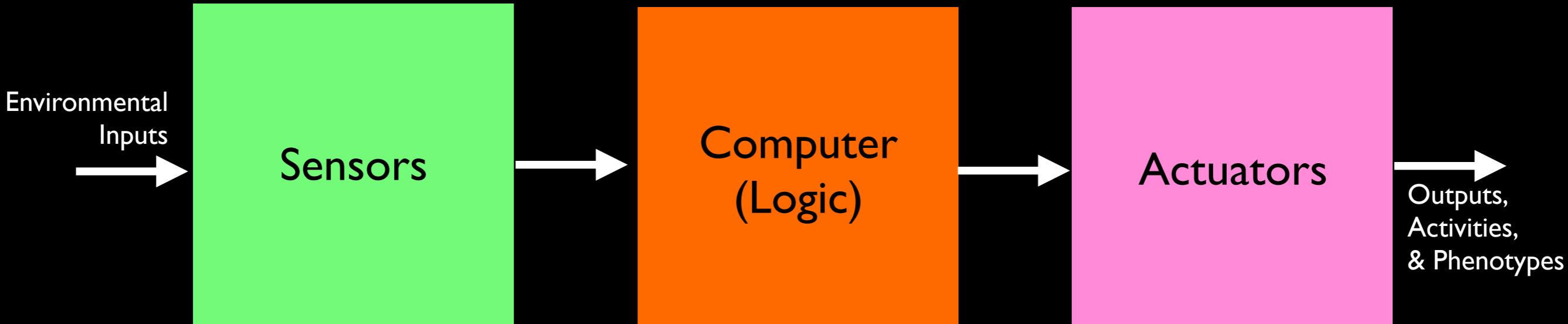
*Acceptable TTL gate
output signal levels*



You can make genetically-encoded molecular machines.

Doing so smartly requires going up and down our **abstraction** hierarchy (otherwise too complicated).

Most of these engineering approaches are entirely new to biology (i.e., this type of bioengineering is v. new).



Details include:

Identifying and implementing **device boundaries** & **common signal carriers**.

Considering signal **level matching** & **digitization/amplification**