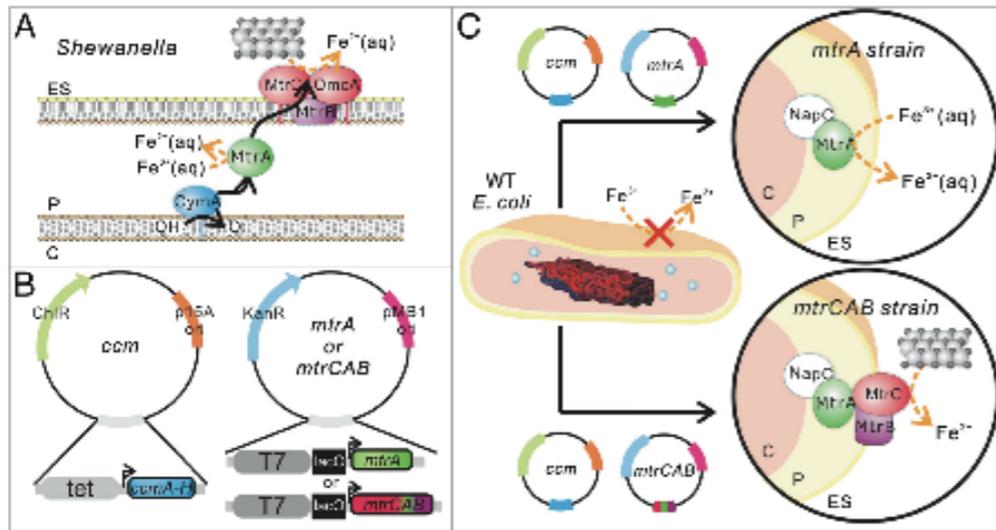
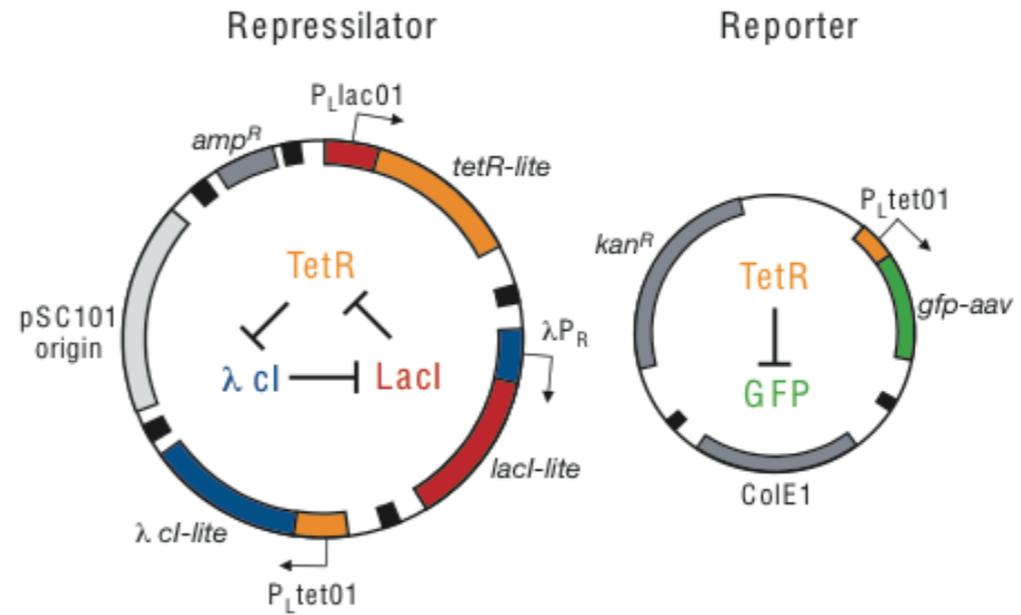
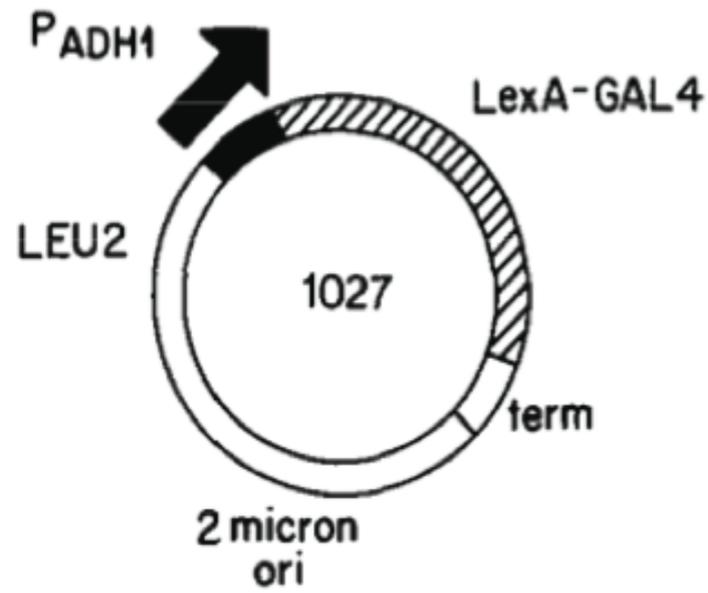


Synthetic Biology Open Language Visual

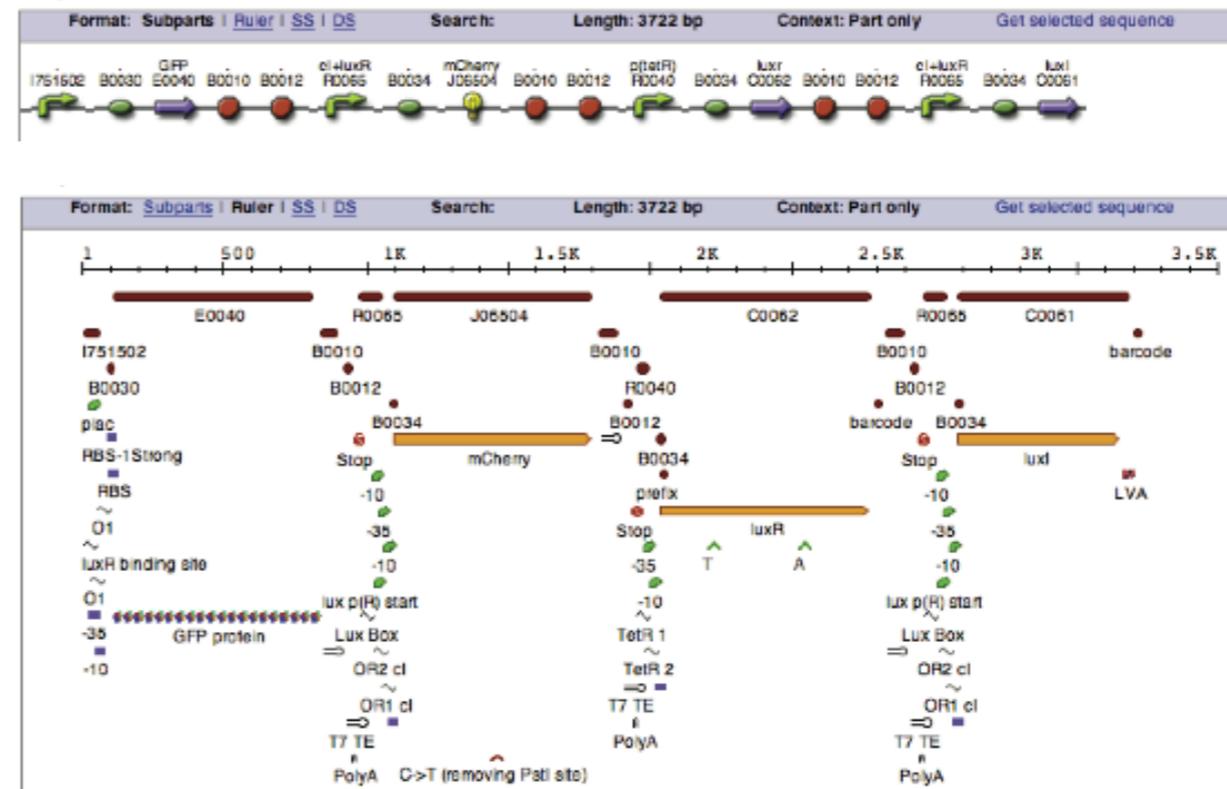
Graphical notation for forward engineering of biology

Jackie Quinn
COMBINE - August 19, 2014

SBOL and SBOL Visual **(the basics)**

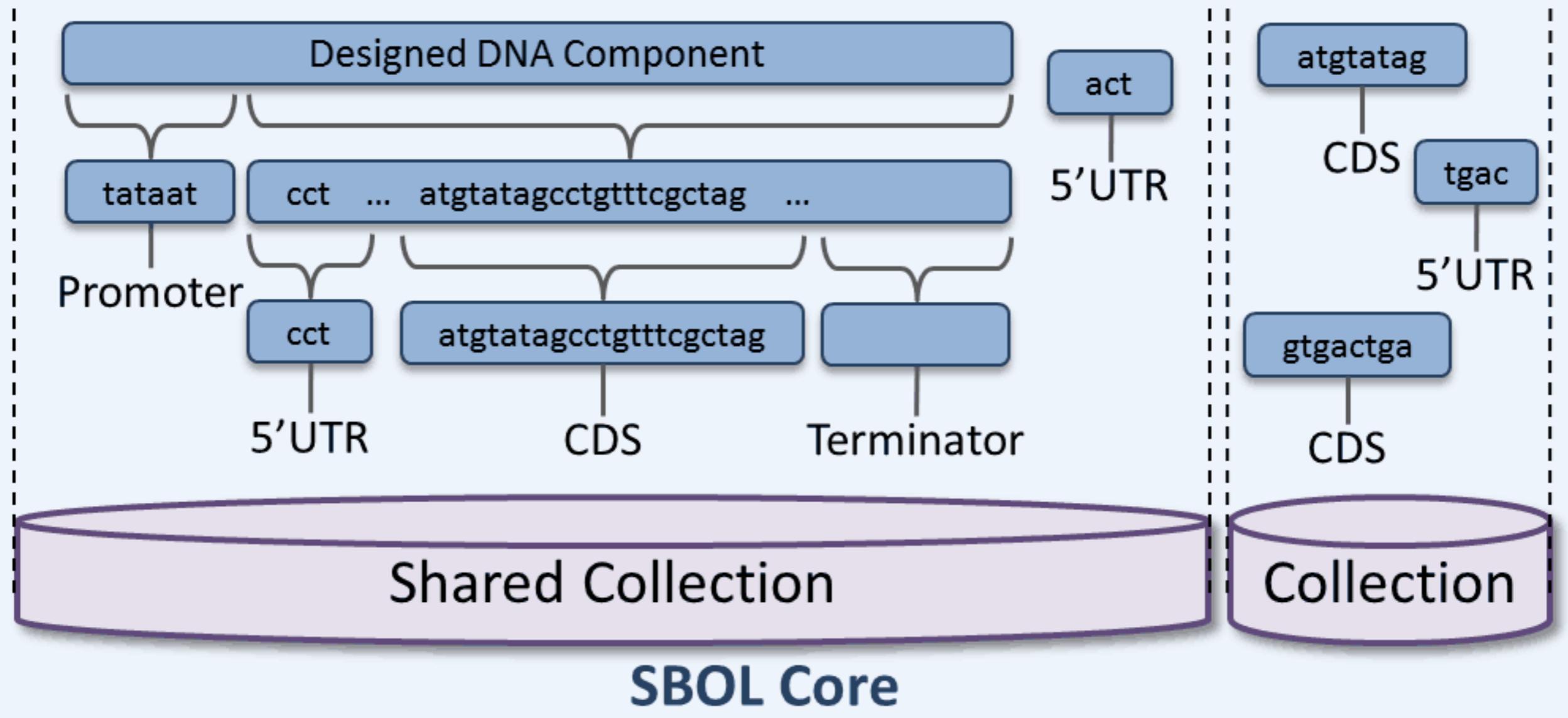


Sequence and Features



visual representation of genetic design

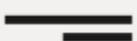
SBOL Visual



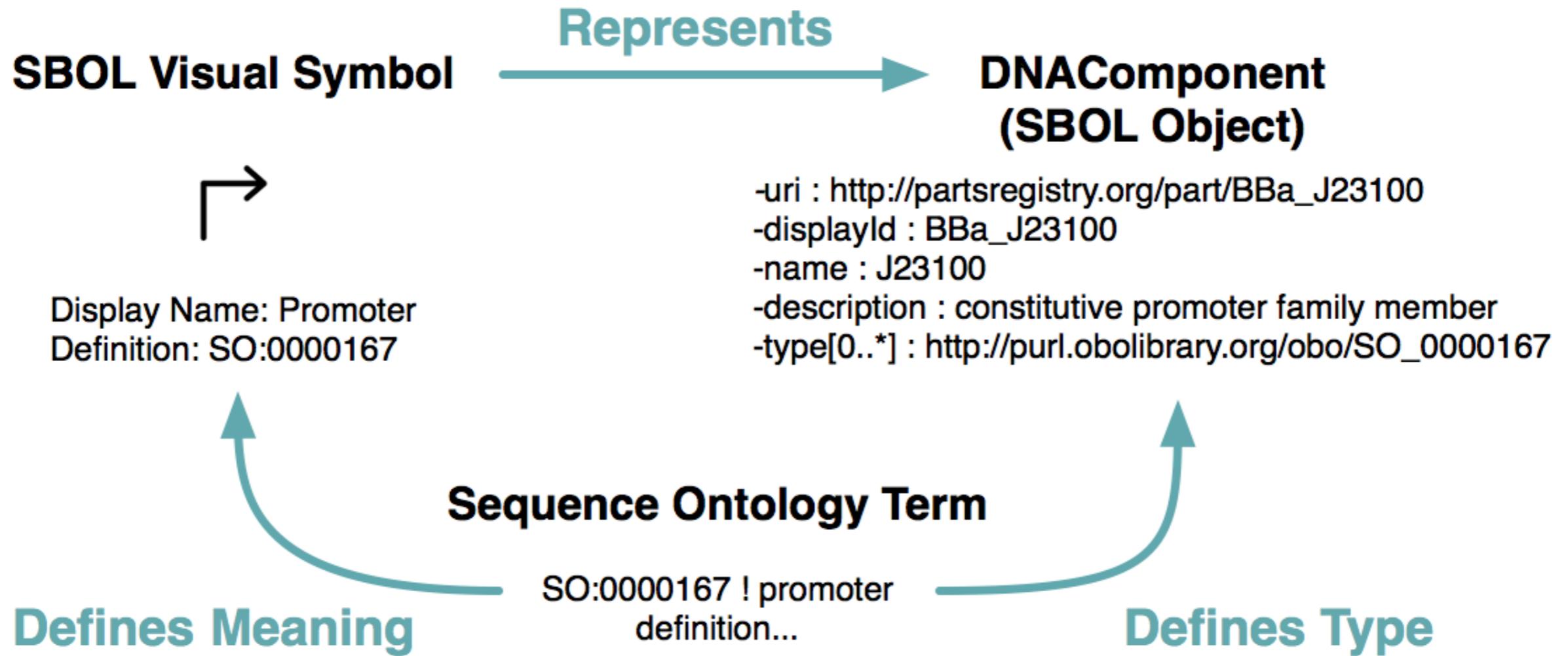
Symbol Design

(what we focus on)

- Compatibility with current practice
- Flexibility
- Ease of use

 promoter	 origin of replication
 cds	 primer binding site
 ribosome entry site	 blunt restriction site
 terminator	 sticky restriction site
 operator	 5' overhang
 insulator	 3' overhang
 ribonuclease site	 assembly scar
 rna stability element	 signature
 protease site	 user defined
 protein stability element	

symbol set



relationship to SBOL

use in various contexts

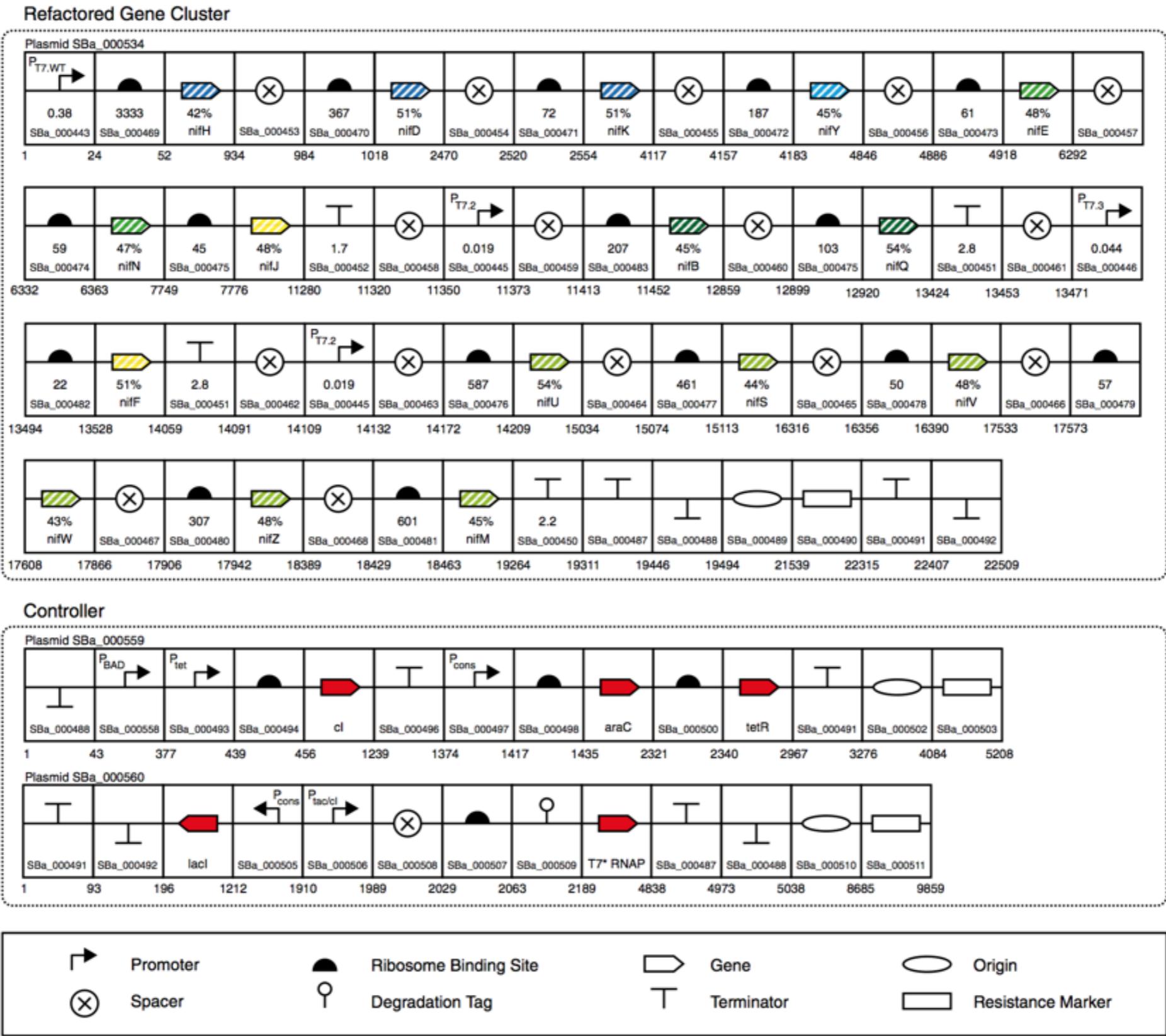
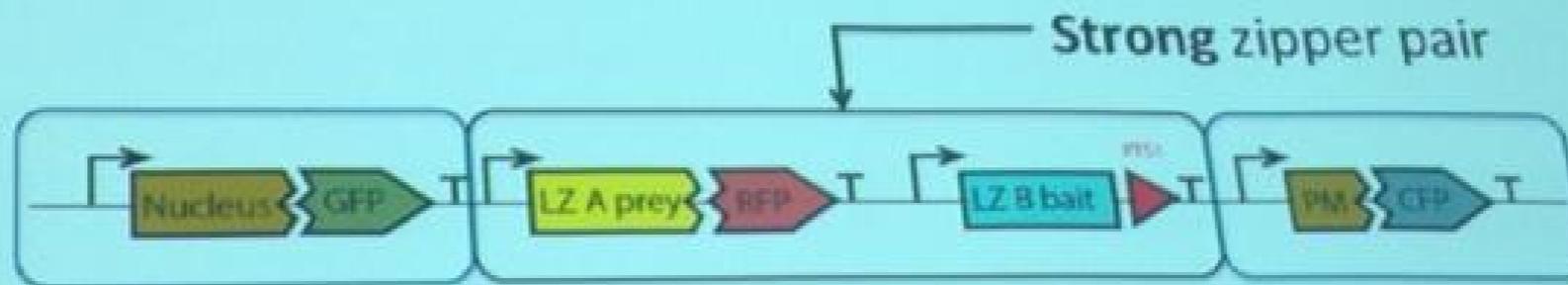
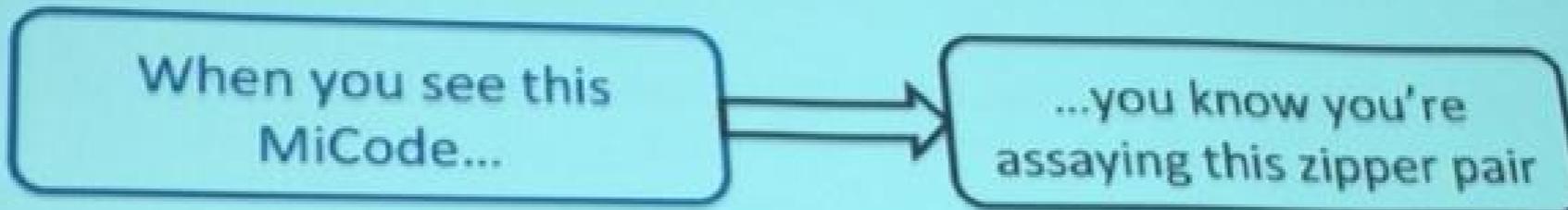


Fig. 4. Comprehensive schematic illustration for the complete refactored gene cluster and controller. Each of the 89 parts is represented according to the Synthetic Biology Open Language visual standard (www.sbolstandard.org), and the SynBERC Registry part number (registry.synberc.org) and part activity are shown. The full sequences of each plasmid have been deposited in GenBank (SBa_000534, JQ903614; SBa_000559, JQ903615; SBa_000560, JQ903616). The T7 promoter strengths are measured with monomeric red fluorescent protein and reported in *Materials and Methods*. Terminator strengths are measured in a reporter plasmid and reported as the fold reduction in monomeric red fluorescent protein (RFP) expression compared with a control plasmid without a terminator. The RBS strength is reported in as arbitrary units of expression from the induced P_{tac} promoter (1 mM IPTG) and a fusion gene between the first 90 nt of the gene and RFP. The nucleotide numbers for the plasmids containing the refactored cluster and controller are shown. The codon identity of each recoded gene compared with WT is shown as a percentage.

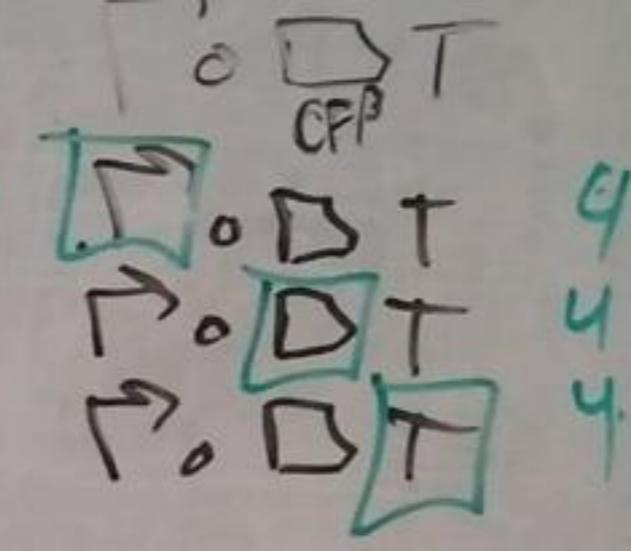
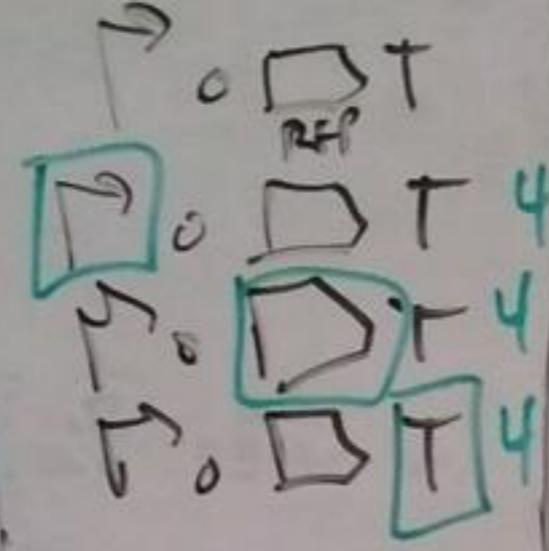
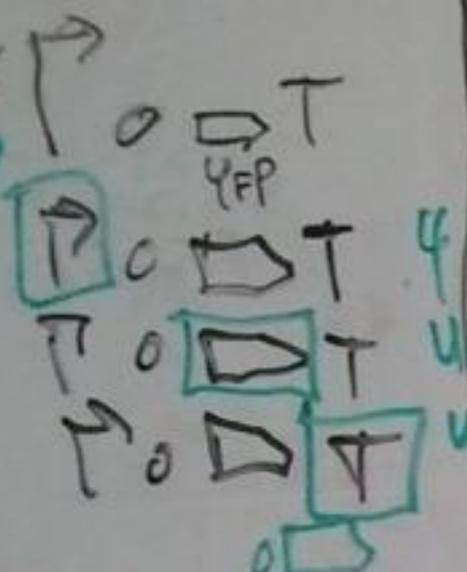


Using MiCodes in a zipper assay



MiCodes

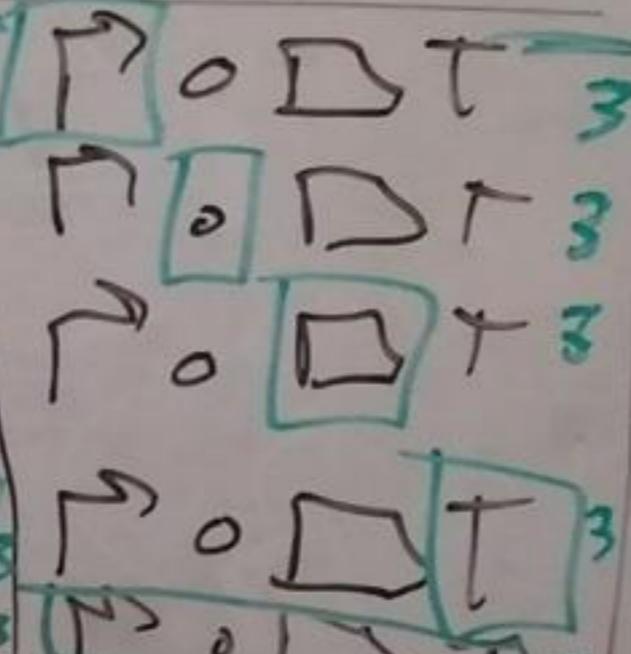
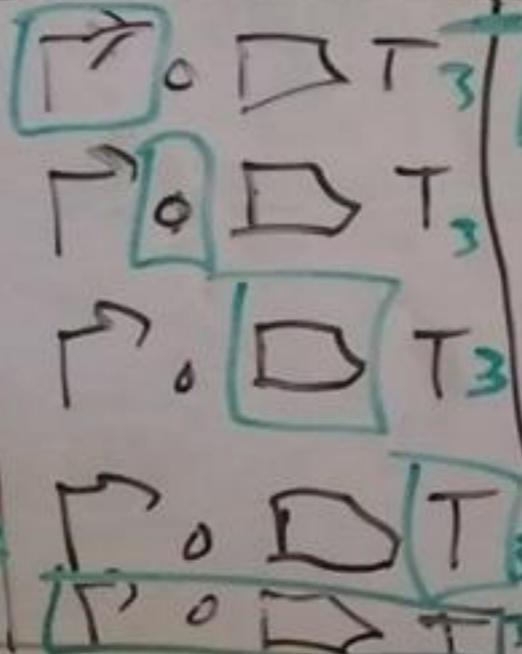
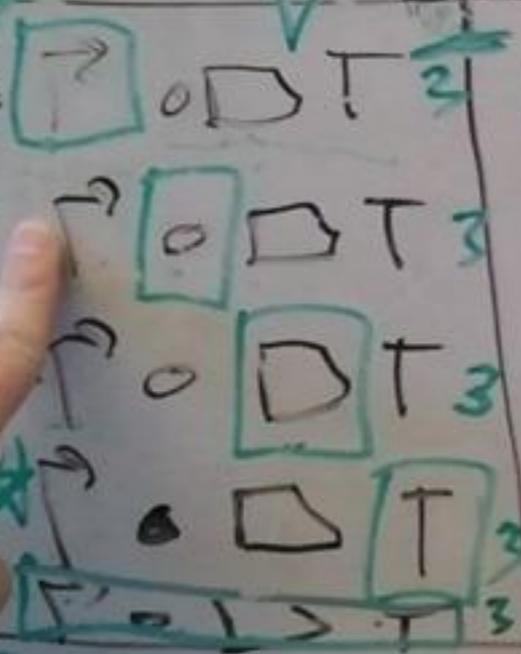
5th. circuit
1:V
OPT.



1:1	1	2	3
5:1	4	5	6
10:1	7	8	9
20:1	10	11	12

36

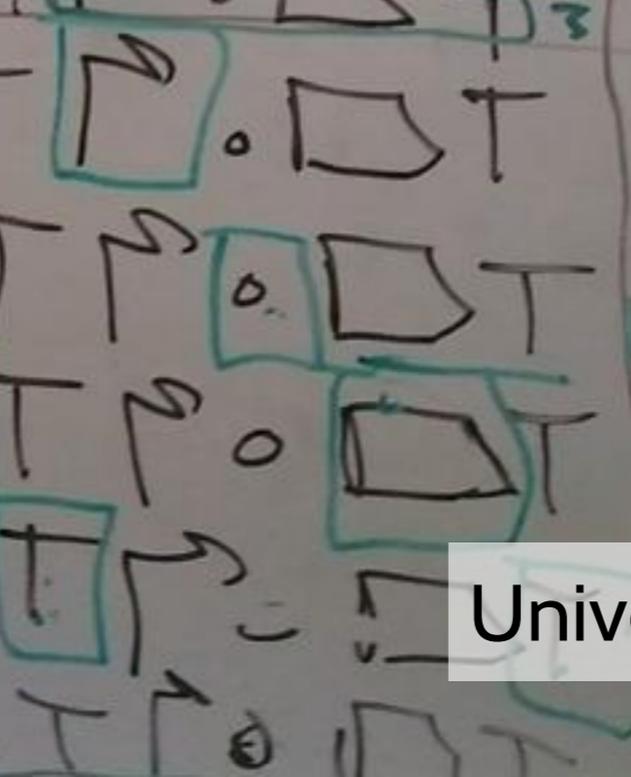
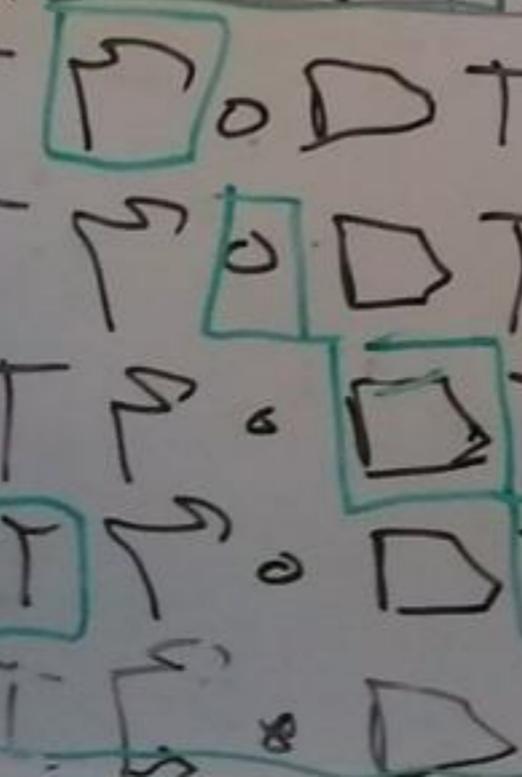
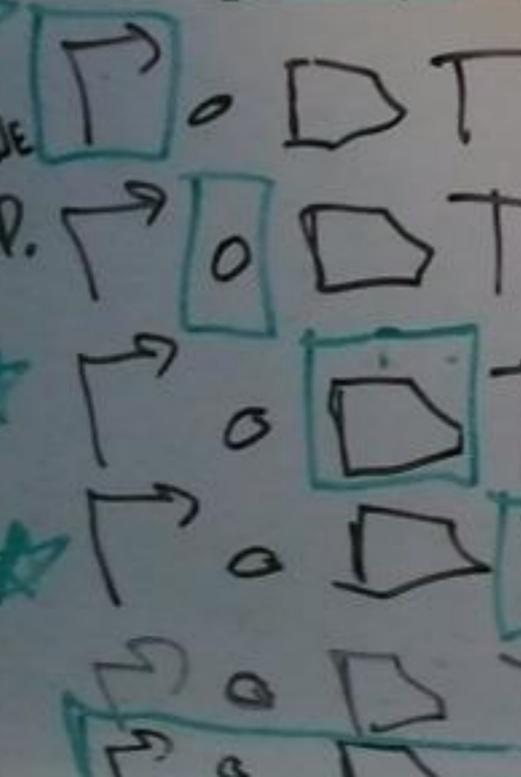
1-GENE
RAND.



1:1	1	2	3	4	5
5:1	6	7	8	9	10
10:1	11	12	13	14	15

45

3-GENE
RAND.



1:1	1	2	3	4	5	6
-----	---	---	---	---	---	---

x3

software

File Edit

J5 BJR_Library

The DeviceEditor interface displays a grid of components for assembly. The components are organized into columns: Bkbone_Gene1, UTR_RBS2_5, UTR_RBS2_3, RBS2_Gene2, BbScar, Barcode, RBS3, and Gene3. Each component is represented by a small icon and a text label. The Part Info panel on the right shows the following details:

Part Info Collection Info

J5 Ready: True
Combinatorial: True
Circular Linear

Column Name	Direction	Items	FAS
Bkbone_Gene1	forward	38	
UTR_RBS2_5	forward	1	Reverse Primer
UTR_RBS2_3	forward	1	Forward Primer
RBS2_Gene2	forward	38	
BbScar	forward	1	
Barcode	forward	38	Direct Synthesis
RBS3	forward	1	Direct Synthesis
Gene3	forward	38	

Add Column Remove Column Expand Table

Abbreviations
FAS: Forced Assembly Strategy
Column Contents

DeviceEditor
j5.jbei.org

GenoCAD
CAD Software for Synthetic Biology v.2.2.1

Welcome, Guest | Sign Up | Log In

STEP 1: PARTS STEP 2: DESIGN STEP 3: SIMULATE

Grammar/Library: Basic Grammar -- No Simulation E.coli public New Design Load Design...

New Design

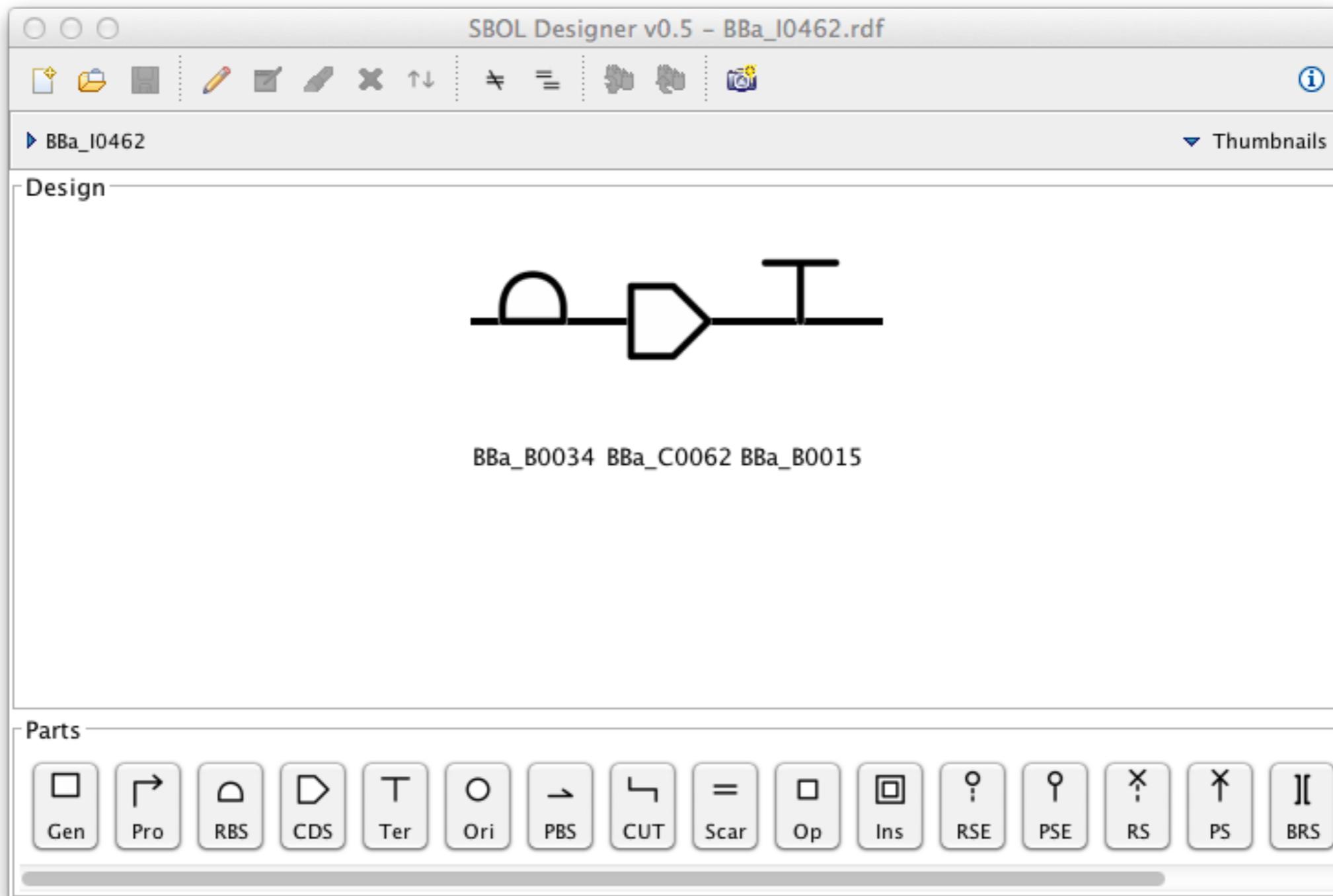
History

Step 1
Step 2
Step 3
Step 4
Step 5
Step 6
Step 7
Step 8

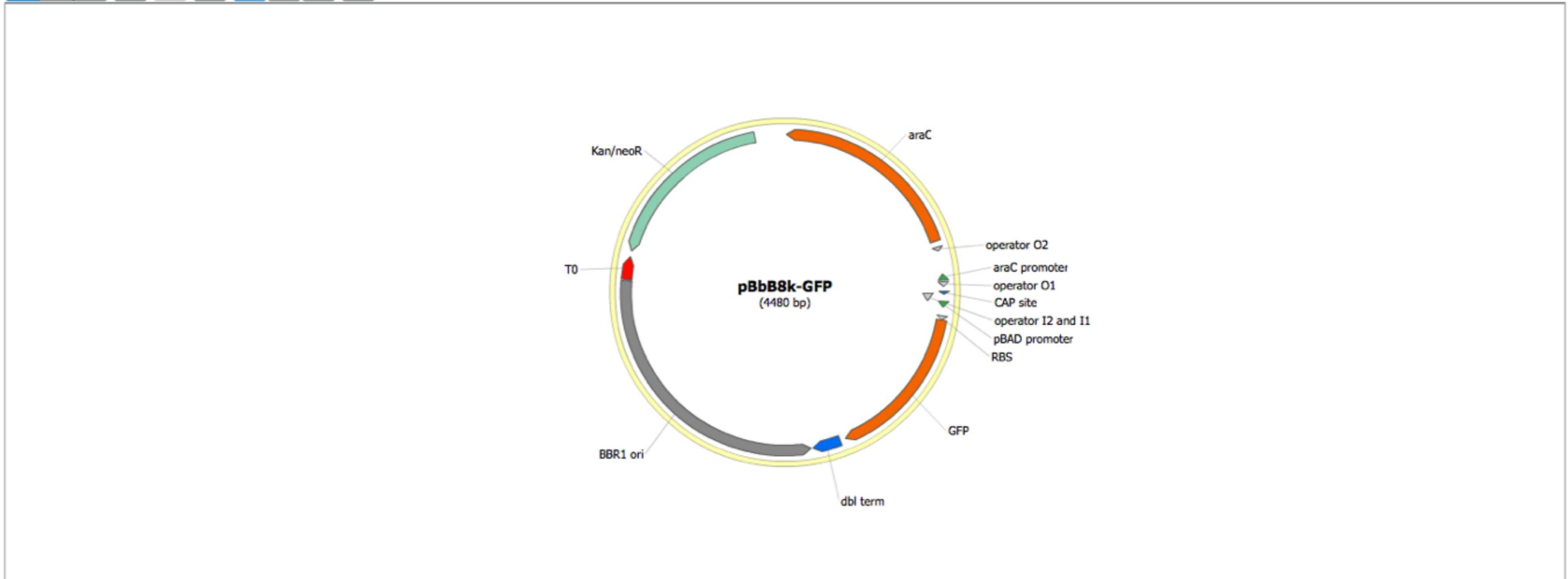
PRO RBS CDS TER PRO RBS CDS TER

a022f a022m a0223 a022q a021n a022i a021w a022q
 a022r a021o a022j a022r
 a022s a021p a022k a022s
 a021q a022l
 a021r a022m
 a021s a022n
 a022e a022o
 a022f a022p
 a022g
 a022h

GenoCAD
genocad.org



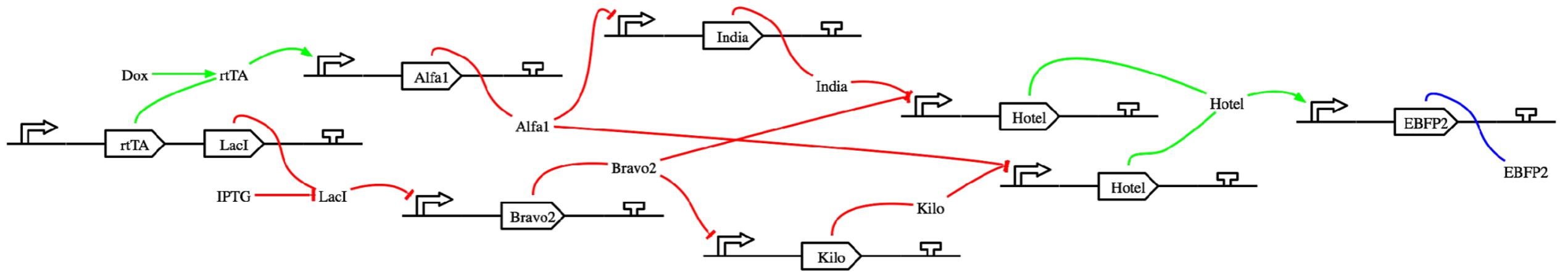
SBOL Designer
<http://clarkparsia.github.io/sbol/>

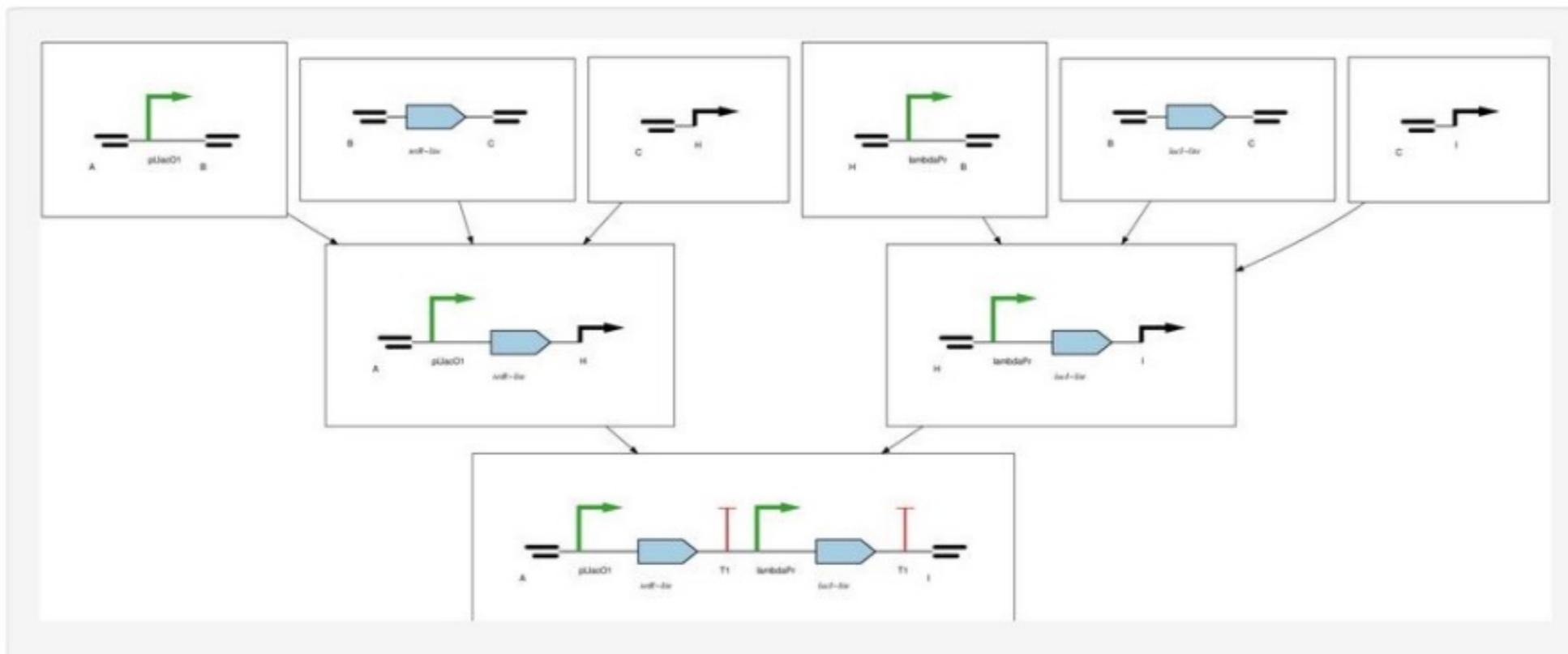


Done

Read only | - : - | 4480

JBEI-ICE, Pigeon
public-registry.jbei.org, pigeoncad.org





Assembly Statistics Graph structure verified!

Number of Goal Parts	1
Number of Assembly Steps	3
Number of Assembly Stages	2
Number of Reactions	12
Number of Recommended Parts	0
Number of Discouraged Parts	0
Assembly Efficiency	1.0
Parts Shared	0

[Submit as Example](#)
[Save to working library](#)

Download Options

Please use right-click, then save as to download the files

[Download Graph Image](#)
[Download Instructions](#)
[Download Parts/Vectors List](#)
[Download Pigeon File](#)
[Download Puppeteer Arcs File](#)

Vector NTI Express Designer - Molecule Editor

File Edit Curate Discover Design Confirm Tools Help

Properties

General Description

DNA 'pUC18'

ATCC 37253: very usable general purpose vect

Author: Kevin Clancy. Original author: NCBI Entrez

Created: 1996-01-01 12:00:00.281

Last Modified: 2013-07-22 13:57:27.984

Length: 2686 bp

Storage Type: Basic

Form: Circular

Descendants

Hexokinase_PUC18

Standard Fields

Keywords: ATCC

Modification Date in the Original DB: 26-AUG-2

Accession Number: [pUC18](#)

References

Author

NCBI Entrez

National Center for Biotechnology Information

National Library of Medicine

Building 38A, Room 8N805

Bethesda, MD 20894, U.S.A.

TEL: (301)496-2475

FAX: (301)480-9241

EMAIL: info@ncbi.nlm.nih.gov

Original Author

NCBI Entrez

National Center for Biotechnology Information

National Library of Medicine

Building 38A, Room 8N805

Bethesda, MD 20894, U.S.A.

TEL: (301)496-2475

FAX: (301)480-9241

EMAIL: info@ncbi.nlm.nih.gov

pUC18 2686bp

P(BLA)

BglII (252)

ALPHA

BamHI (430)

XbaI (424)

SmaI (437)

PstI (416)

HindIII (400)

EcoRI (451)

P(LAC)

BglII (1820)

AP(R)

1 TCGCGCGTIT CCGIGATGAC GGIGAA
AGCGCGCAA GCCACTACTG CCACTI
101 TCAGGGCGCG TCAGCGGGTG ITGGCG
AGTCCCGCGC AGTCGCCAC AACCGC
201 CCGCACAGAT GCGTAAGGAG AAAATA
GGCGTGTCTA CGCATTCTTC TTTTAT
301 TACGCCAGCT GCGCAAAGGG GGATGT

Vector NTI Express Designer - Designer Canvas

File Edit Curate Discover Design Confirm Tools Help

Generic Parts

Regulation

- Promoter - Constitutive
- Promoter - Inducible
- Insulator
- Promoter
- Origin of Replication
- Promoter - Repressive
- Ribosome binding site
- RNA stabilizing element
- Terminator
- Ribozyme
- 10 signal
- 35 element
- ORF
- Coding Sequence
- Protease enzyme
- ORF + Construction
- Construction

Generic Parts

My Freezer

My Favourites

Library

pUC Project

beta Galactosidase

beta Lactamase

RNA Polymerase

beta Lactamase Cloning cassette...

Beta lactamase Cloning cassette...

pUC18 ORI (101...)

Ampicillin Resistance cassette (9...)

Project Properties Characterization Truth Table Rules/Auto Design Variants Job

Circuit: Circuit_1

Core

Name: Circuit_1

Sequence: 1482bp

Classification

Source

Intellectual Property

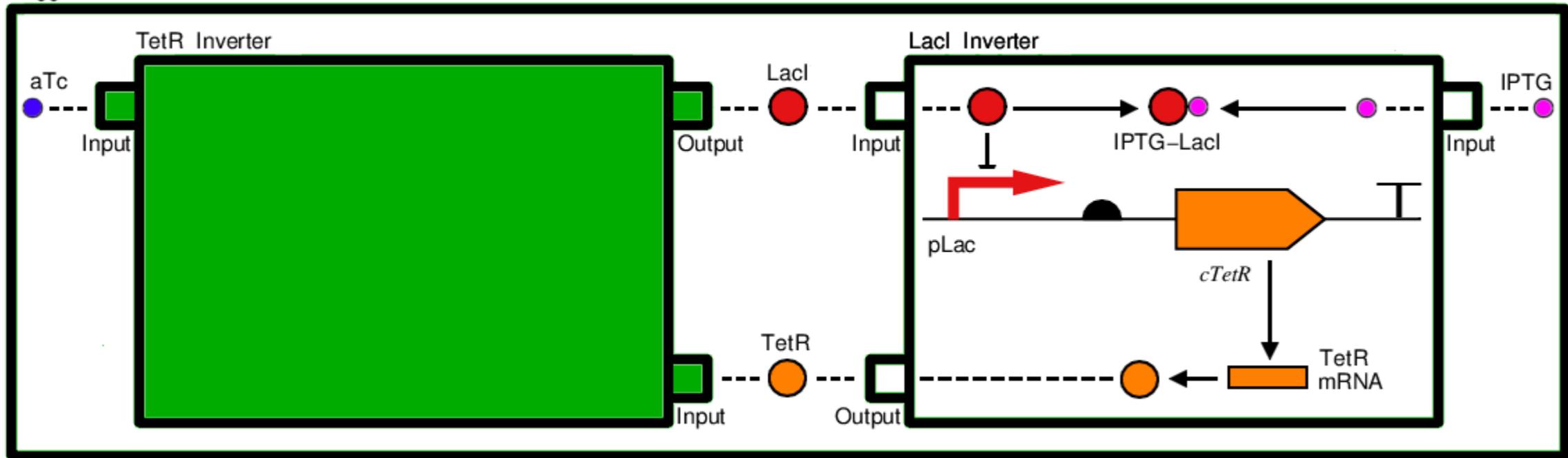
Alternatives...

Save As...

Remove

VectorNTI Express Designer

Toggle Switch



SBOL Visual 2.0?



+



SBOL Visual Working



Aaron Adler

Jacob Beal

Swapnil Bhatia

Patrick Cai

Joanna Chen

Kevin Clancy

Robert Sidney Cox III

Michal Galdzicki

Nathan Hillson

Cory Li

Chris Myers

Umesh P

Matthew Pocock

Jackie Quinn

Cesar Rodriguez

Herbert Sauro

Larisa Soldatova

Guy-Bart Stan

Grimaldo Urena

Alan Villalobos

Mandy Wilson

Thank You!

**www.sbolstandard.org/visual
visual@sbolstandard.org**