Synthetic Biology Open Language Visual

An open-source graphical standard for synthetic biology

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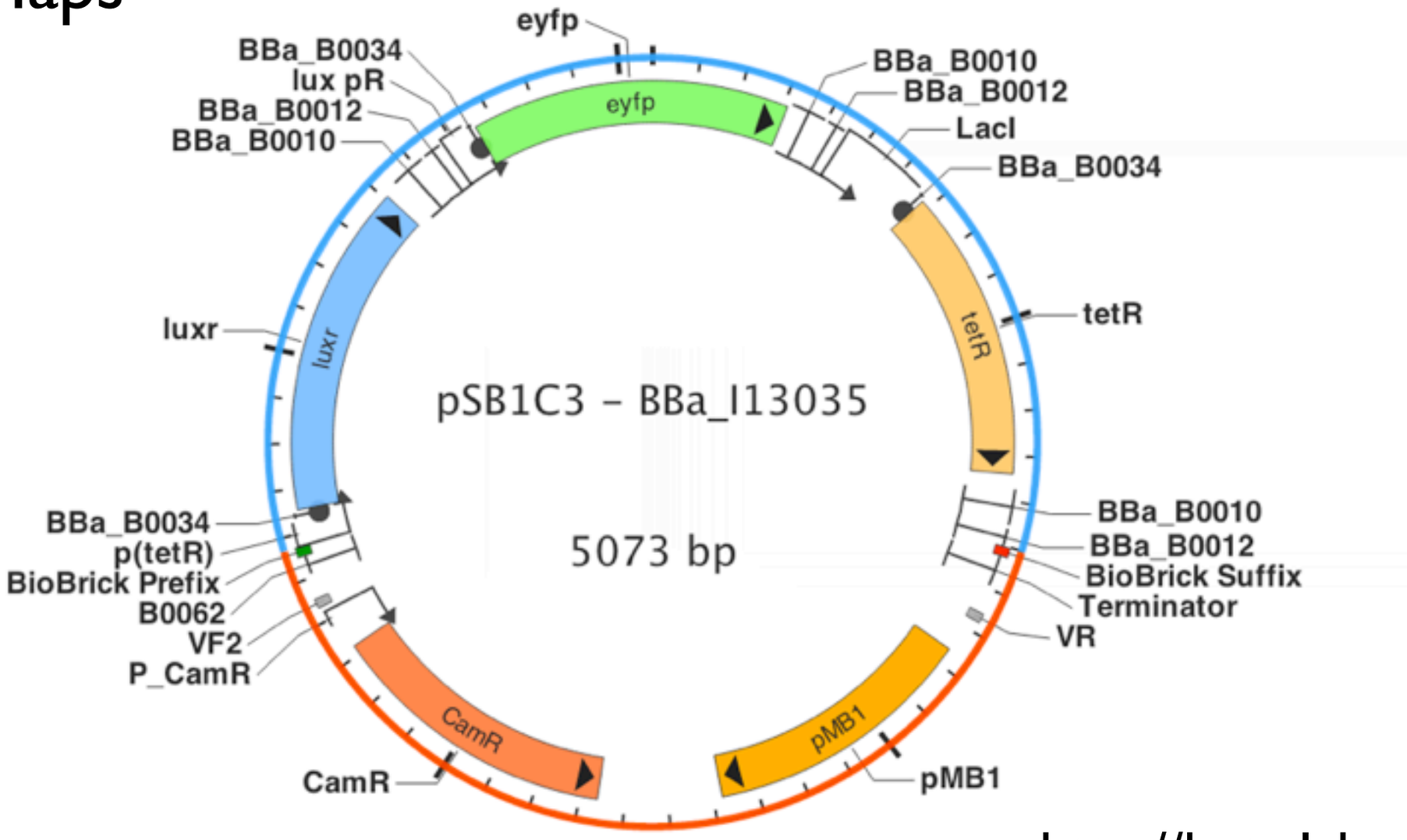
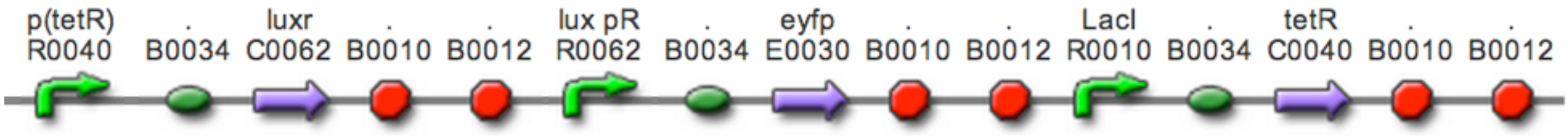
Bio-Ontologies Flash Update
20 July 2013

Plasmid Maps



http://beta.labgeni.us/

Parts Abstraction



http://parts.igem.org/

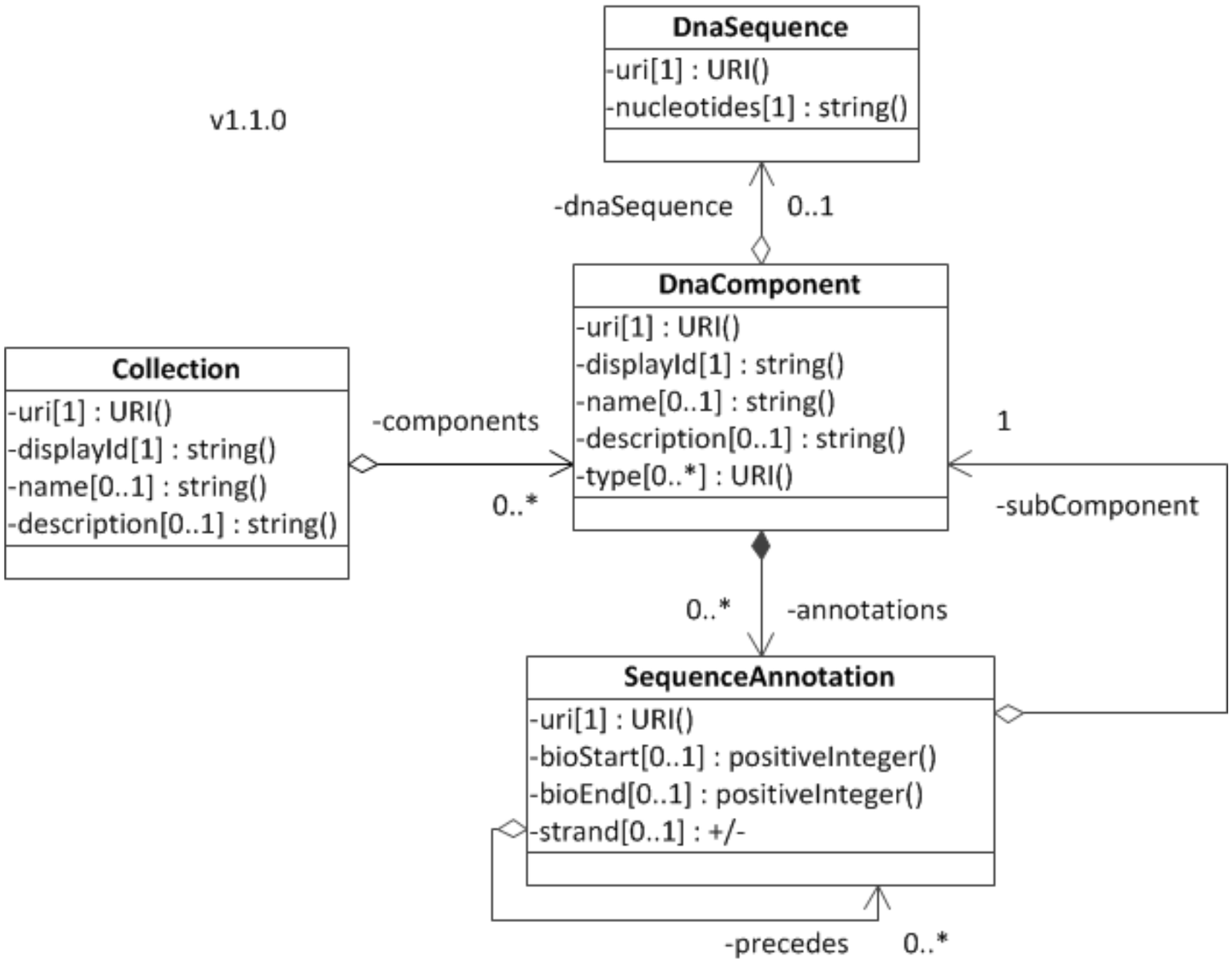
promoter	origin of replication
cds	primer binding site
ribosome entry site	blunt restriction site
terminator	sticky restriction site
operator	5’ overhang
insulator	3’ overhang
ribonuclease site	assembly scar
rna stability element	signature
protease site	user defined
protein stability element	

standardized symbol set

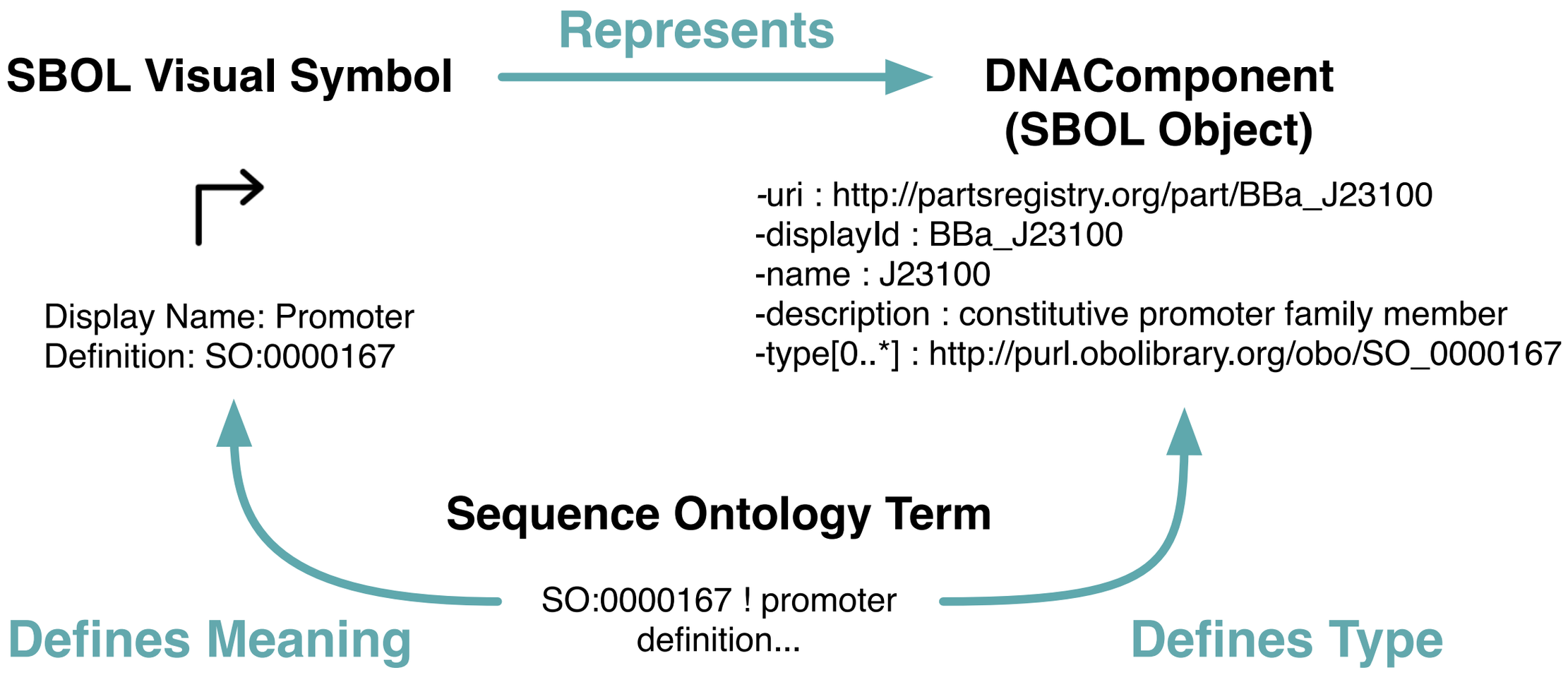
7. The SBOL Visual Symbol Set

Shape	Display Name	Definition
	Promoter	SO:0000167
	Operator	SO:0000057
	CDS	SO:0000316
	Ribosome Entry Site	SO:0000139

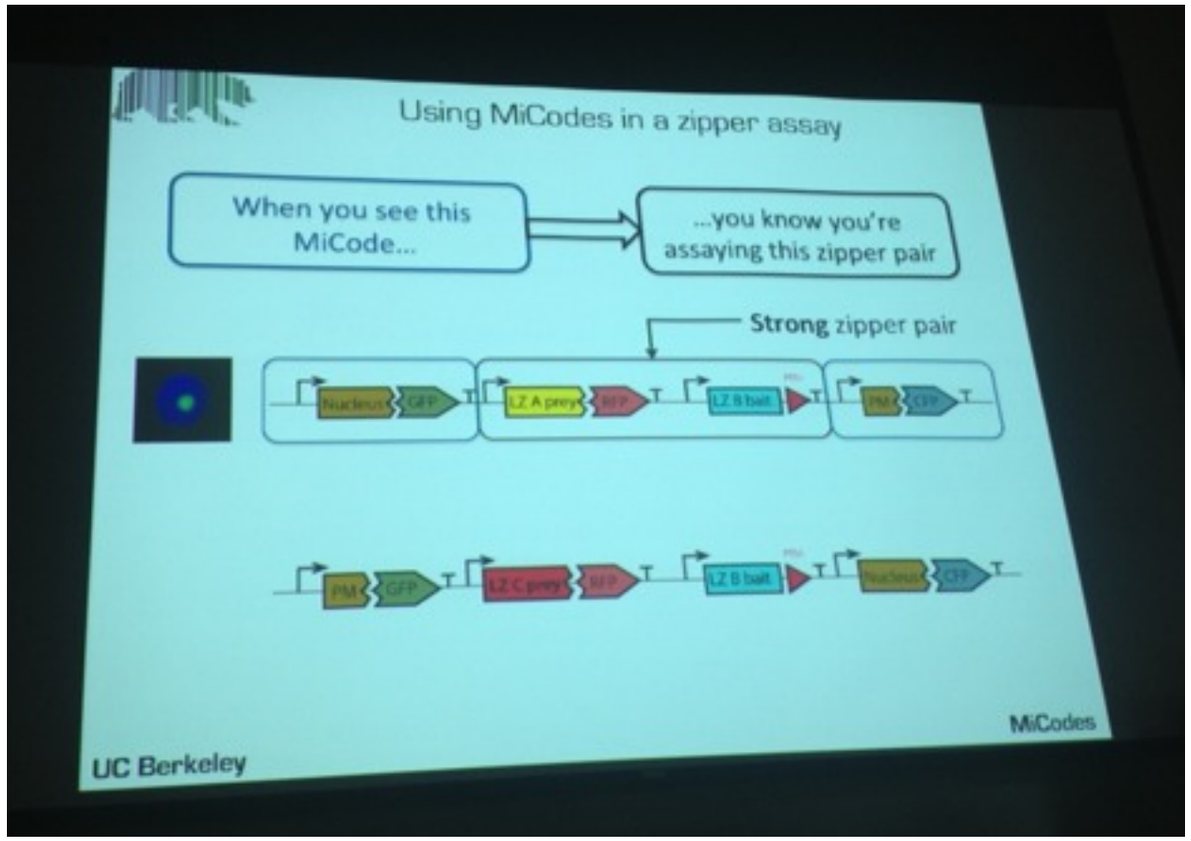
v1.1.0



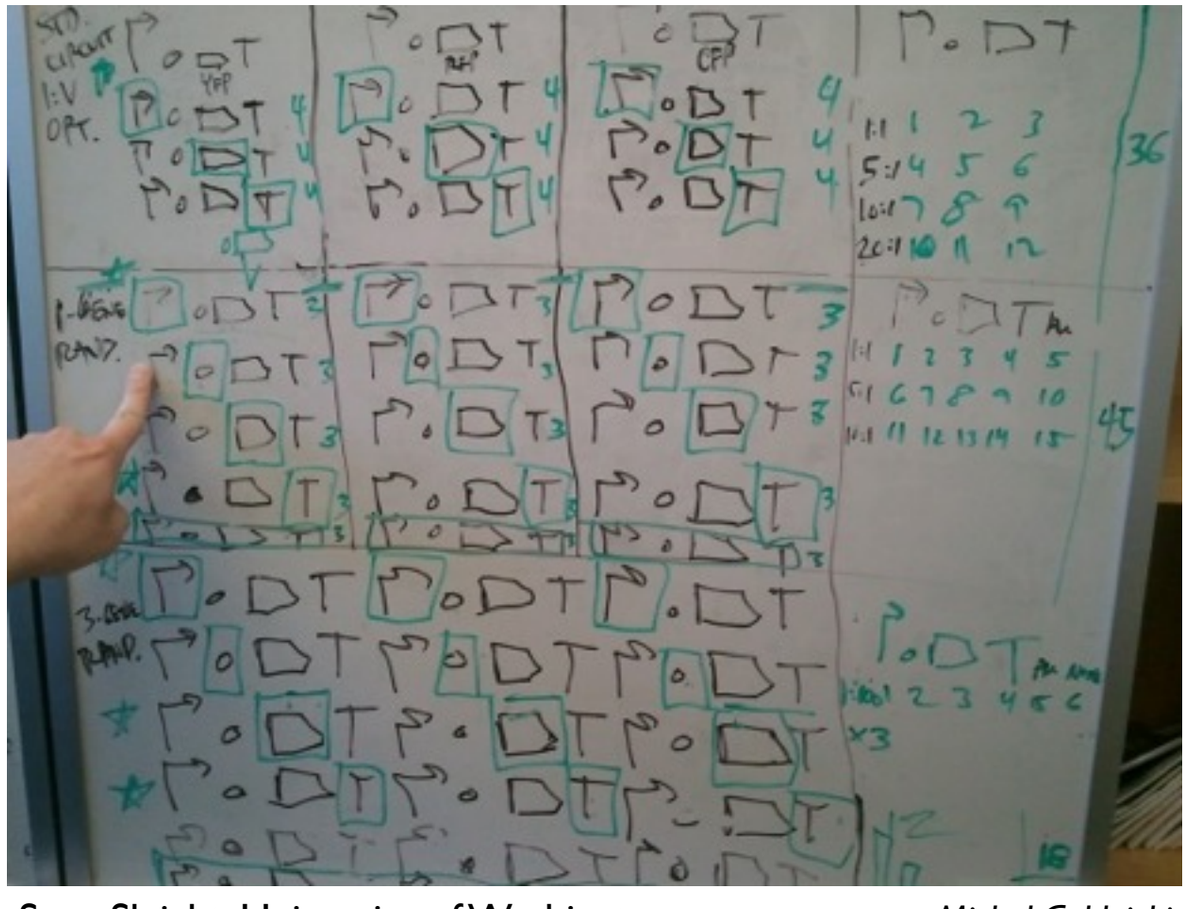
SBOL data model



SBOL Visual's relationship to SBOL and SO



iGEM Americas West Regional 2012 *Cesar Rodriguez*



Sean Sleight, University of Washington *Michal Galdzicki*

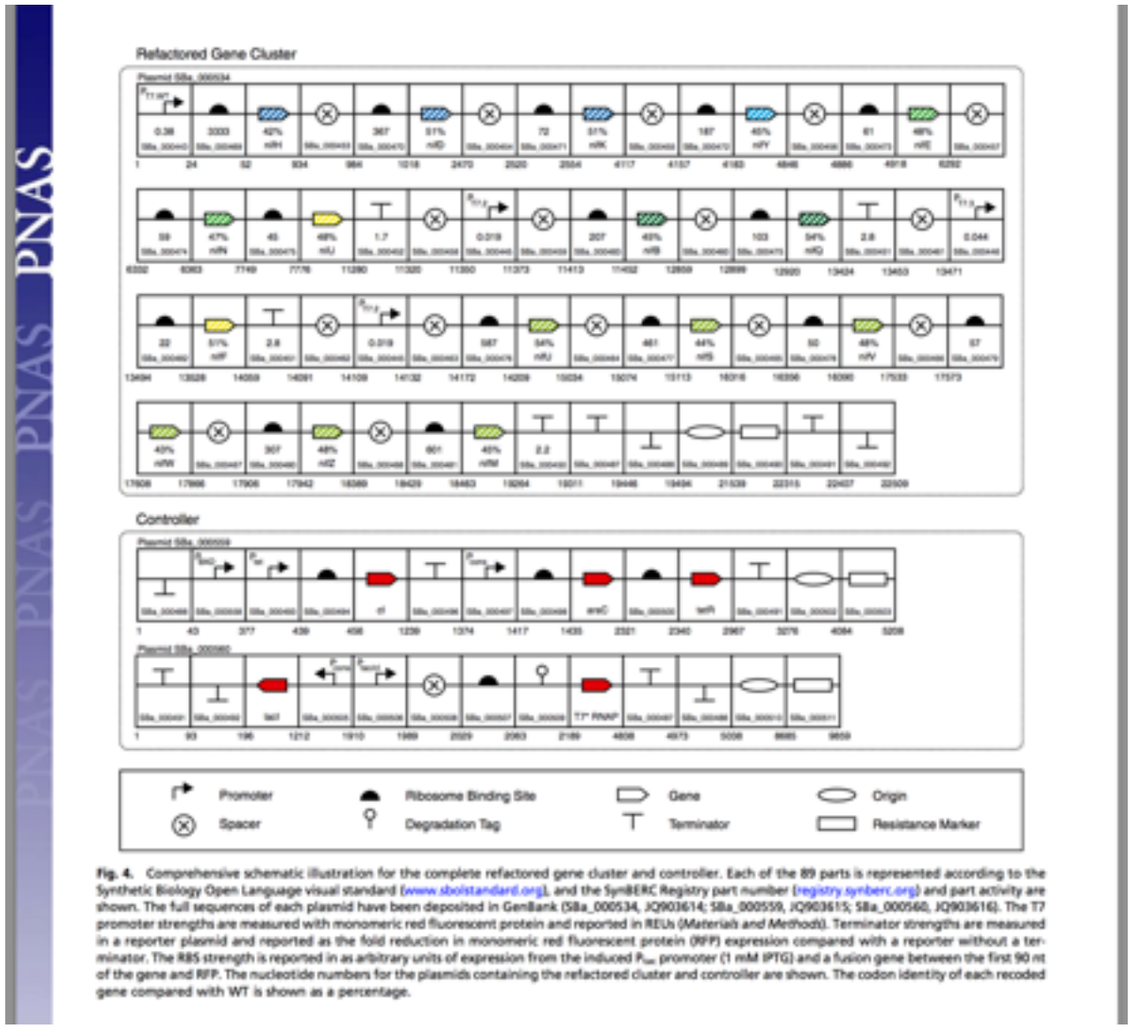
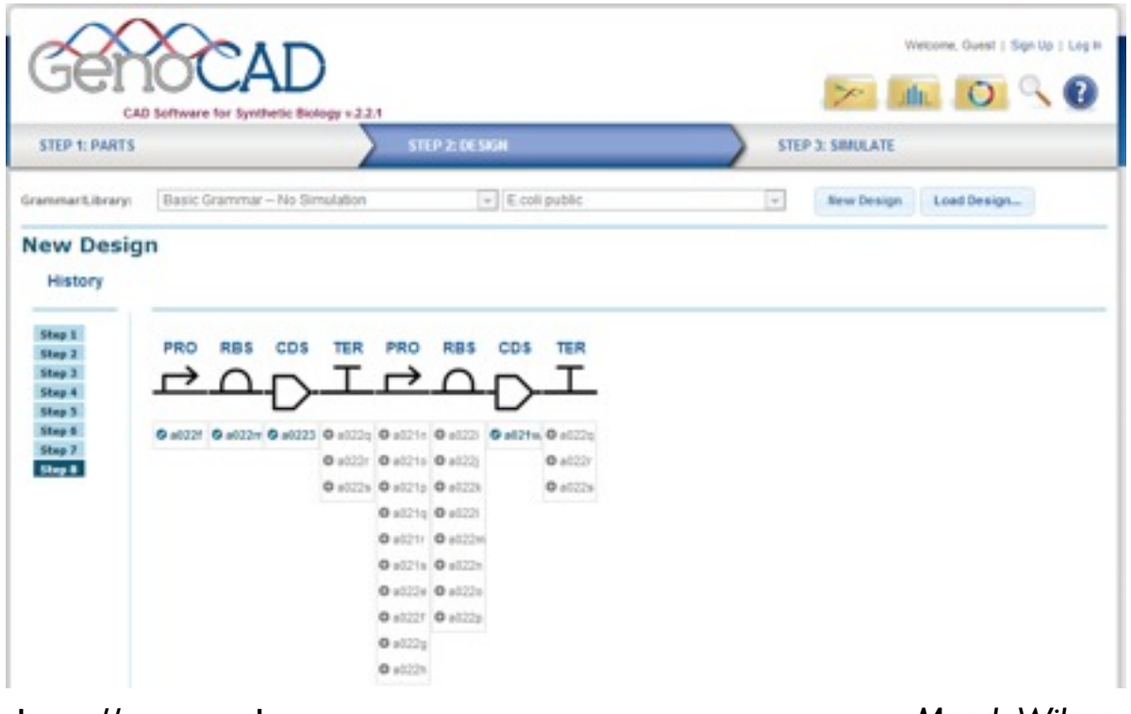


Fig. 4. Comprehensive schematic illustration for the complete refactored gene cluster and controller. Each of the 89 parts is represented according to the Synthetic Biology Open Language visual standard (www.sbolstandard.org), and the SynBERC Registry part number (registry.synberc.org) and part activity 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 REUs (*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 reporter 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.

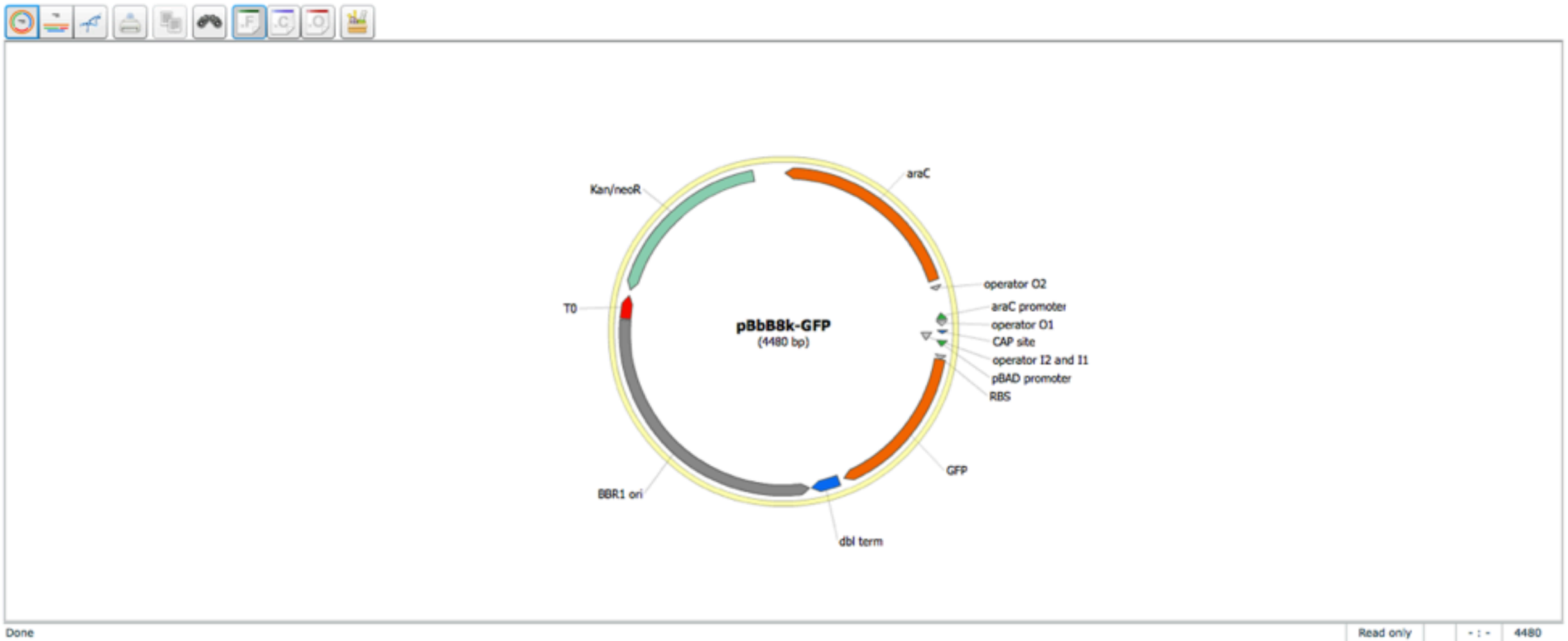
Temme, Zhao & Voigt, PNAS 2012 *10.1073/pnas.1120788109*



http://genocad.org *Mandy Wilson*

SEQUENCE

Delete | Open | Download | Hide Pigeon Image



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JBEI-ICE and PigeonCAD

public-registry.jbei.org, pigeoncad.org

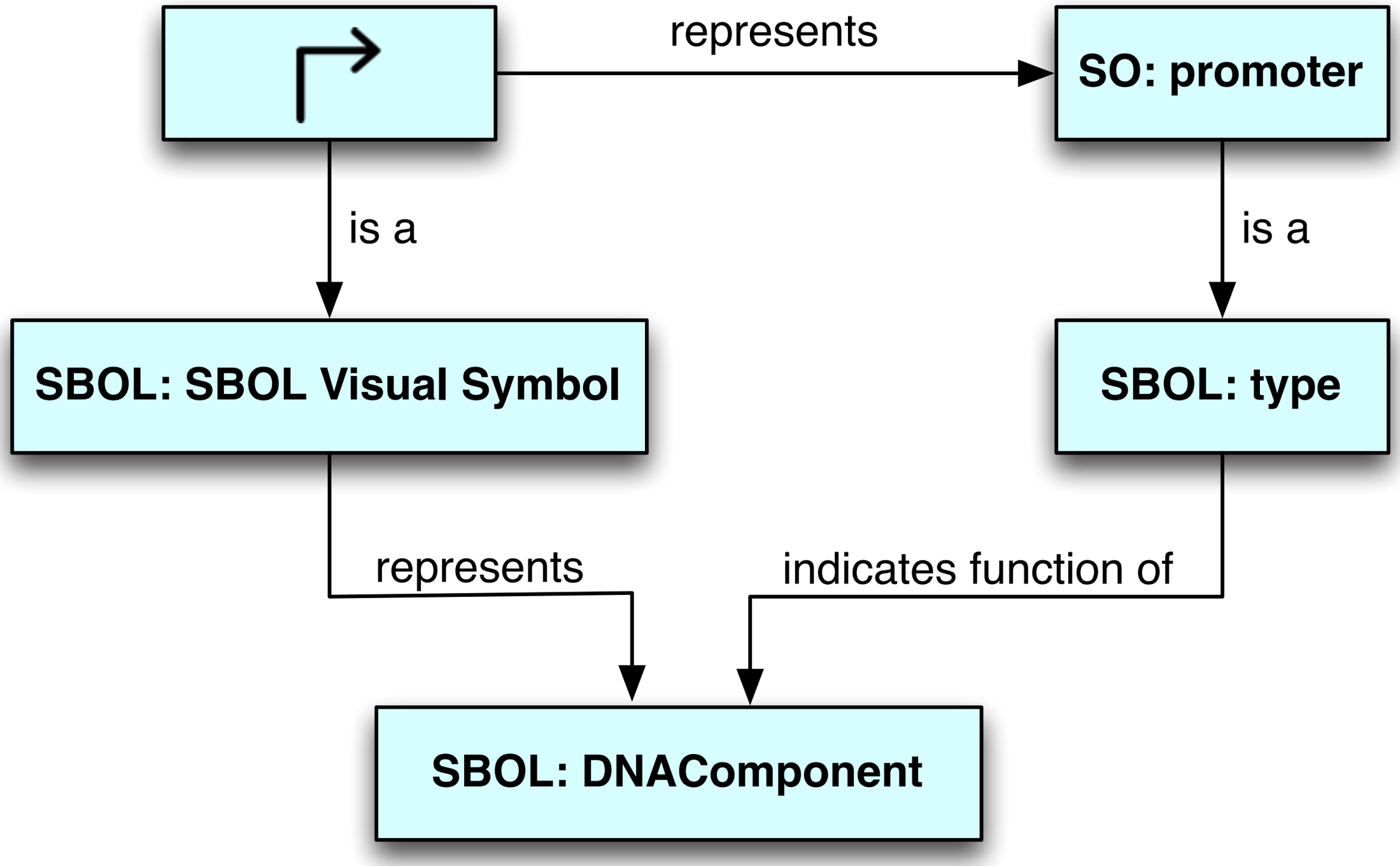
Table 1. SO type <-> GenBank feature type <-> SBOL Visual type <-> Pigeon type

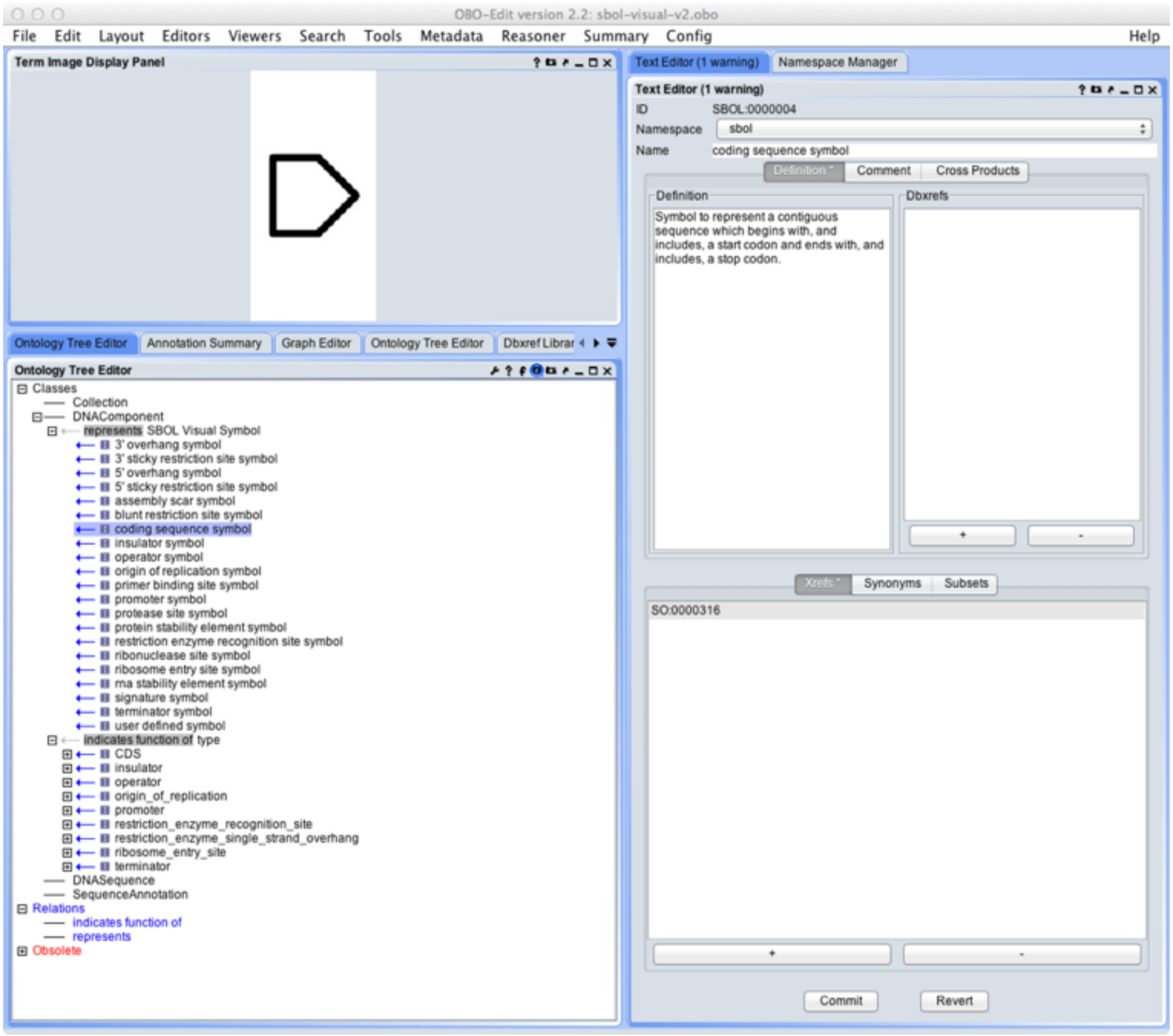
SO type	GenBank feature type	SBOL Visual type	Pigeon type (ICE color)
SO_0000001	***misc_feature***	***User Defined***	***s (2)***
SO_0000001	*misc_feature*	*User Defined*	- (13)
SO_0000001	*misc_feature*	*User Defined*	> (1)
SO_0000001	*misc_feature*	3' Sticky Restriction Site	*s (2)*
SO_0000001	*misc_feature*	5' Sticky Restriction Site	*s (2)*
SO_0000001	*misc_feature*	Ribonuclease Site	*s (2)*
SO_0000001	*misc_feature*	Signature	*s (2)*
SO_0000002	misc_structure	*User Defined*	*s (2)*
SO_0000005	satellite	*User Defined*	*s (2)*
SO_0000013	scRNA	*User Defined*	*s (2)*
SO_0000019	*stem_loop*	*User Defined*	*s (2)*
SO_0000057	operator	Operator	o (13)
SO_0000104	protein	*User Defined*	*s (2)*
SO_0000109	*variation*	*User Defined*	*s (2)*
SO_0000110	*misc_feature*	*User Defined*	*s (2)*
SO_0000112	primer	*User Defined*	*s (2)*
SO_0000139	RBS	Ribosome Entry Site	r (13)
SO_0000140	attenuator	*User Defined*	*s (2)*
SO_0000141	*terminator*	*Terminator*	**t (6)**
SO_0000141	*terminator*	*Terminator*	T (6)

SBOL Visual *is* an ontology

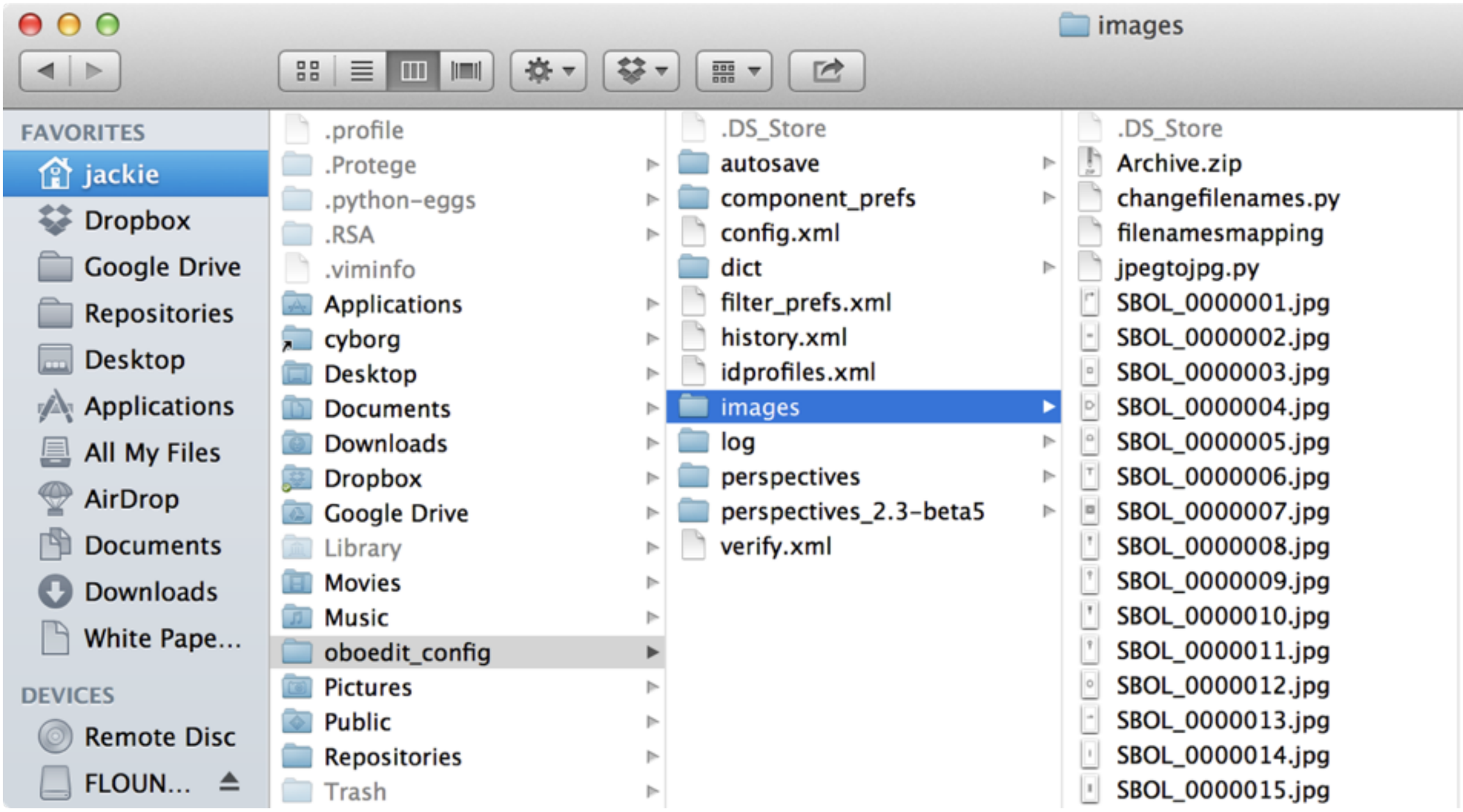
Using standard ontological format would aid in:

- Software Integration
- Version Control
- Distribution


represents
SO: promoter
is a
is a
SBOL: SBOL Visual Symbol
SBOL: type
represents
indicates function of
SBOL: DNAComponent



http://oboedit.org/


images
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.python-eggs
.RSA
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SBOL_0000010.jpg
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SBOL_0000012.jpg
SBOL_0000013.jpg
SBOL_0000014.jpg
SBOL_0000015.jpg

www.essepuntato.it/lode/

www.essepuntato.it/lode/http://www.essepuntato.it/tmp/1374255973-ontology

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Table of Content

Classes

3' overhang symbol[C]

back to ToC or Class ToC

IRI: http://purl.obolibrary.org/obo/SBOL_0000019

has super-classes

SBOL Visual Symbol[C]

:represents[OP] **some** restriction_enzyme_single_strand_overhang[C]

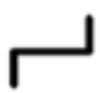
3' sticky restriction site symbol[C]

back to ToC or Class ToC

IRI: http://purl.obolibrary.org/obo/SBOL_0000017

has super-classes

SBOL Visual Symbol[C]



5' overhang symbol[C]

back to ToC or Class ToC

http://www.essepuntato.it/lode

Could visual symbols be applied to other ontologies?

If so, the community might consider developing:

- Standards for associating images with classes
- Support for image browsing within:
  - BioPortal
  - Ontology Editors (OBO-Edit, Protege)

SBOL Visual Working Group

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Alan Villalobos
Mandy Wilson

Thank You!

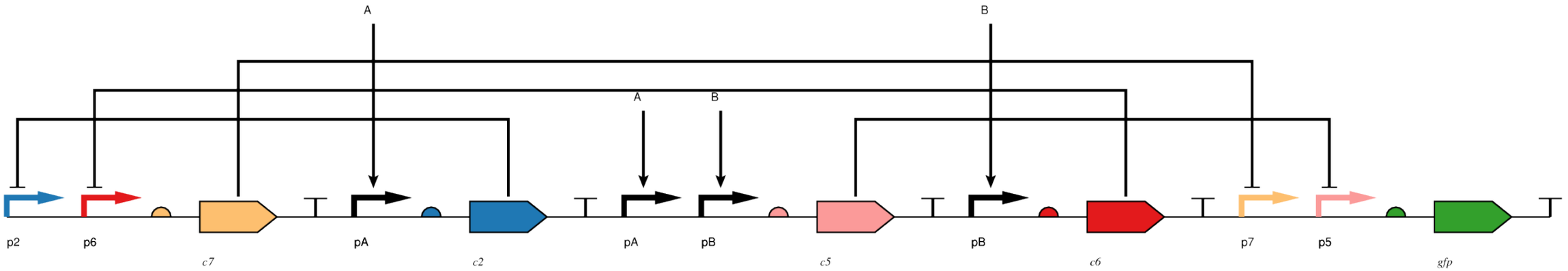
visual@sbolstandard.org

www.sbolstandard.org/visual

purl.bioontology.org/ontology/SBOL

Strategies for SBOL/SO Integration

- SBOL ontology with dbxref to SO terms
- SBOL ontology with relationships to terms imported from SO
- SO with added images and SBOL Visual subset




```
p p2 2
p p6 6
r r 7 nl
c c7 7
t
```

```
p pA
r r 2 nl
c c2 2
t
```

```
p pA
p pB
r r 5 nl
c c5 5
t
```

```
p pB
r r 6 nl
c c6 6
t
```

```
p p7 7
p p5 5
r r 4 nl
c gfp 4
t
```

```
# Arcs
c2 rep p2
c5 rep p5
c6 rep p6
c7 rep p7
A ind pA
B ind pB
```

PigeonCAD
pigeoncad.org