

# DESIGN YOUR SYSTEM!

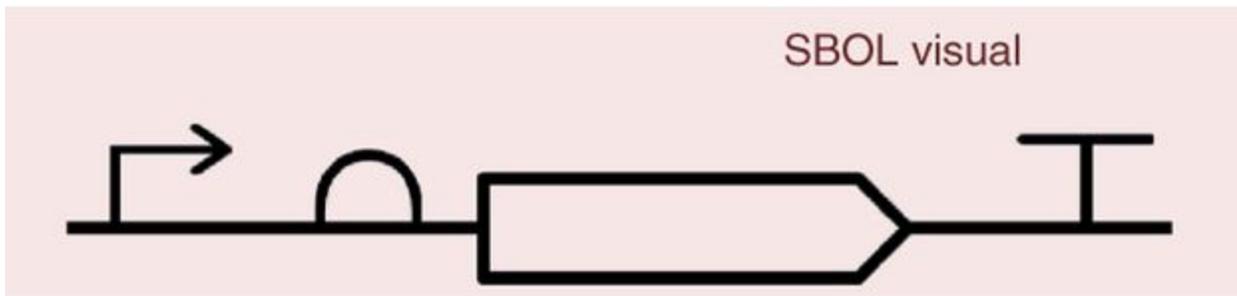
THIS CATALOGUE CONTAINS A SELECTION OF PARTS THAT YOU CAN USE TO DESIGN YOUR VERY OWN BIOLOGICAL SYSTEM.

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

THE SYNTHETIC BIOLOGY OPEN LANGUAGE - SBOL - IS HOW WE 'WRITE' OUR SYSTEMS, VERY SIMILAR TO DRAWING CIRCUIT DIAGRAMS!

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# SECTION 1



## promoters

### 1. BBa\_R0040 - Tet promoter (pressure-inducible promoter)

**Designed by:** Antiquity (2003-01-31)

**Size:** 54 base pairs

**DETAILS:**

Sequence for pTet inverting regulator. Promoter is constitutively ON and repressed by TetR. TetR repression is inhibited by the addition of tetracycline or its analog. Tet promoters are also known as a sensitive ones to pressure.

### 2. BBa\_K190015 - Arsenic induced promoter

**Designed by:** Groningen (2009-07-15)

**Size:** 72 base pairs

**DETAILS:**

Promoter arsRp is associated with the dimer of ArsR for the arsenic induced transcription of genes involved in arsenic efflux (arsR, arsB and arsC, which is present on the genome of Escherichia coli str. K-12 substrain MG1655).

### 3. BBa\_I721001 - Lead Promoter

**Designed by:** Brown (2007-10-26)

**Size:** 94 base pairs

**DETAILS:**

This part is designed to enable Lead Detection in a cell. When Lead (Pb +2) enters the cell, it will couple with the a lead binding protein, forming a dimer. This dimer will then bind to the lead Promoter.

## 4. BBa\_I765001 - UV Promoter

Designed by: Colombia\_Israel (2007-10-26)

Size: 76 base pairs

### DETAILS:

This device is regulated by UV irradiation

## 5. BBa\_J03007 - Maltose specific Promoter

Designed by: iGEM2005 (2005-11-03)

Size: 206 base pairs

### DETAILS:

Binds Maltose and stimulates transcription.

## 6. BBa\_J16101 - BanAp - Banana-induced Promoter

Designed by: iGEM (2006-07-24)

Size: 19 base pairs

### DETAILS:

Taken from no other than Curious George, this promoter is induced by the presence of banana in the metabolism of any mammal. It is very weak however without the presence of the HngR protein. For transcription to reach significant levels both HngR and banana must be present.

## 7. BBa\_J45503 - Cold Shock Promoter

Designed by: igem (2006-06-21)

Size: 393 base pairs

### DETAILS:

This cold shock promoter is only active at temperatures lower than 30 degree Celsius.

## 8. BBa\_K338001- Heat Shock Promoter (HSP)

Designed by: Caltech (2010-10-24)

Size: 98 base pairs

### DETAILS:

promoter activity increases with heat shock temperature.

## 9. BBa\_I760005 - Cu-sensitive promoter

Designed by: Saint\_Petersburg (2007-08-20)

Size: 16 base pairs

### DETAILS:

Promoter from the copper-sensitive CusR/CusS two component signal system. (E.Coli)

## 10. BBa\_I712074 - T7 promoter (strong promoter from T7 bacteriophage)

Designed by: Ljubljana (2007-10-22)

Size: 46 base pairs

### DETAILS:

T7 promoter is very specific promoter which is transcribed only by specific T7 RNA polymerase. Usually this promoter is used in expression systems where T7 promoter is cotransfected with T7 RNA polymerase. That ensures strong transcription of desired genes.

## 11. BBa\_K174015 - Cadmium Sensing promoter

Designed by: Newcastle (2009-10-14)

Size: 205 base pairs

### DETAILS:

The part was built by combining operator binding sites for two metal sensor repressor proteins, ArsR and CzrA [1,2].ArsR can bind to cadmium, silver, copper and arsenic whereas CzrA can bind to zinc, cobalt, nickel and cadmium. Cadmium can bind to both proteins and using a combinatorial approach enables us to filter out sensing any metals other than cadmium.

# SECTION 2



cds

## 1. BBa\_J45002 - Floral Scent

Designed by: MIT (2006-06-07)

Size: 1098 base pairs

### DETAILS:

converts benzoic acid to methyl benzoate (floral odor). encodes SAM benzoic acid carboxyl methyltransferase I derived from BAMT from *Antirrhinum majus* (snapdragon). BAMT catalyzes the conversion of benzoic acid to methyl benzoate. Methyl benzoate has a floral smell.

## 2. BBa\_J45014 - Banana Odor

Designed by: MIT (2006-07-31)

Size: 1581 base pairs

### DETAILS:

encodes alcohol acetyltransferase I derived from ATF1 from *Saccharomyces cerevisiae*. ATF1 catalyzes the conversion of isoamyl alcohol to isoamyl acetate. Isoamyl acetate has a banana smell.

## 3. BBa\_J97003 - Red Fluorescent Protein

Designed by: BioFAB (2014-02-18)

Size: 702 base pairs

### DETAILS:

excitation 550nm, Emission 565nm, Molecular Weight: 25.2kDA, Length: 227aa. TannenRFP appears orange to the naked eye and also appears orange under UV light.

## 4. BBa\_J97001 - JuniperGFP (Green Fluorescent Protein)

Designed by:BioFAB (2014-02-18)

Size: 702 base pairs

### DETAILS:

Excitation 508nm, Emission 521nm. Molecular Weight: 26.6kDa. Length: 237aa. JuniperGFP appears dark yellow to the naked eye, but appears green color under UV light.

## 5. BBa\_K1159001 - NanoLuc Luciferase (Light!!)

Designed by:TU-Munich (2013-05-17)

Size: 510 base pairs

### DETAILS:

NanoLuc Luciferase is engineered ATP-independent luciferase from a deep-sea shrimp which luminescence 2 magnitudes higher than these from *Renilla reniformis* or from *Photinus pyralis* (firefly). Also the molecular weight of NanoLuc luciferase is twice smaller compared to other luciferase (only 19 kDa).

## 6. BBa\_K1033932 - pink chromoprotein

Designed by:Uppsala (2014-04-21)

Size: 678 base pairs

### DETAILS:

This chromoprotein from the coral *Stylophora pistillata*, spisPink (also known as spisCP), naturally exhibits strong color when expressed. The protein has an absorption maximum at 560 nm giving it a pink color visible to the naked eye. The strong color is readily observed in both LB or on agar plates after less than 24 hours of incubation. The protein spisPink has significant sequence homologies with proteins in the GFP family.

## 7. BBa\_K592010 - yellow chromoprotein

Designed by:Uppsala-Sweden (2011-09-18)

Size: 699 base pairs

### DETAILS:

This chromoprotein from the coral *Acropora millepora*, amilGFP, naturally exhibits strong yellow color when expressed. The color is readily visible to

naked eye both in LB-culture and on agar plates. Color development can be seen in less than 24 hours of incubation.

## 8. BBa\_K620000 - DDT Dehydrochlorinase (degrades DDT)

Designed by:Caltech (2011-09-20)      Size: 633 base pairs

### DETAILS:

Also known as Glutathione S-transferase 1-1, this protein is supposed to degrade DDT, an endocrine disruptor and persistent organic pollutant. The protein was identified from the Anopheles dirus mosquito by Prapanthadara et al and the gene was assembled from the protein's amino acid sequence, taken from NCBI's protein database, via PIPE cloning.

## 9. BBa\_K1471000 -MerE. (mercury bioaccumulation)

Designed by:Biosint\_MEXICO (2014-10-08)      Size: 180 base pairs

### DETAILS:

MerE is a gene is part of the mer operon, a collection of bacterial genes specialized on the tolerance to various compounds of mercury including methylmercury. It is naturally found in the transposon Tn21 from the plasmid NR1 Shigella flexneri or MB1 in the case of Bacillus megaterium.

## 10. BBa\_K1438000 - Bacterioferritin (BFR)

Designed by:Berlin (2014-09-13)      Size: 513 base pairs

### DETAILS:

Bacterioferritins are the E. coli cells natural iron storage proteins. These hollow nearly spherical protein shells detoxify the cell by sequestering excessive iron and forming Iron(III)hydroxid-oxide particles. Bacterioferritin is an heam containing bacterial ferritin. Each heme is bound in a pocket formed by the interface between a pair of symmetry-related subunits [1]. However, it was investigated that these heme groups may be involved in the release of iron out of the ferritin iron core by forming an heme-mediated electron transfer to reduce immobilized Fe<sup>3+</sup> to more soluble Fe<sup>2+</sup>.Bacterioferritins reveal to have the highest increase in iron capacity when compared to other ferritin species.

## 11. BBa\_K1015010 - Ampicillin resistance gene

Designed by:TMU-Tokyo (2013-09-16)

Size: 983 base pairs

### DETAILS:

Ampicillin acts as an irreversible inhibitor of the enzyme transpeptidase, which is needed by bacteria to make their cell walls. It inhibits the third and final stage of bacterial cell wall synthesis in binary fission, which ultimately leads to cell lysis. This part provides a resistance to the action of the antibiotic.

## 12. BBa\_K117000- Cell death

Designed by:NTU-Singapore (2008-10-07)

Size: 144 base pairs

### DETAILS:

This lysis gene encodes for the lysis protein in colicin-producing strains of bacteria. Once activated, it causes the host cell to lyse. It also removes the immunity protein out of colicin, and hence, activates the endonuclease activity of the colicin.

# SECTION 3



## 1. BBa\_K590025 - The PetroBrick: Diesel Producing Device

Designed by: iGEM11\_Washington (2011-09-15)

Size: 2392 bp

### DETAILS:

This part encodes both Acyl-ACP Reductase (AAR) and Aldehyde Decarbonylase (ADC) from *Synechococcus elongatus* behind a strong constitutive expression cassette. Transforming this part into *E. coli* will result in the production of alkanes, the primary component of diesel, without the need for any inducing agents.

## 2. BBa\_I737009 - Light sensing device

Designed by: iGEM07\_Calgary (2007-07-16)

Size: 5332 bp

### DETAILS:

This part senses for red light and produces green fluorescent protein as a result. We can replace the GFP coding sequence with any other.

## 3. BBa\_K844017 - Spider Silk Generator

Designed by: Utah\_State (2012-10-25)

Size: 2385 bp

### DETAILS:

Protein generator part for Spider Silk. Protein is a 10x fusion of spider silk "F" subunits (1x BBa\_K844007 followed by 9x BBa\_K844003), which were codon optimized to use a minimal set of tRNA codons (1 codon per amino acid). Contains a lactose/IPTG inducible promoter, RBS, and a 10x-His tag (BBa\_K844000) for purification of protein

## 4. BBa\_K843001 - Carbon Monoxide Dehydrogenase generator

Designed by: METU (2012-09-26)

Size: 3819 bp

### DETAILS:

Carbon Monoxide Dehydrogenase enzyme from Mycobacterium bovis strain BCG, containing medium small and large chains. This enzyme is able to convert carbon dioxide into carbon monoxide and vice versa depending on their concentrations. The coding region is ligated to BBa\_J23116 constitutive promoter for expression.

## 5. BBa\_K1312000 - Magnetosome (bacterial magnets) generator

Designed by: Kyoto (2014-09-30)

Size: 2142 bp

### DETAILS:

Magnetosomes are intracellular structures that consist of magnetic, iron-mineral crystals enveloped by a membrane vesicle known as the magnetosome membrane. Simply, magnetosomes are tiny magnets inside bacteria that are organized in one or more straight chains, parallel to the long axis of the cell, which function act in concert as a compass needle by orienting the cell in the magnetic field. This device generates magnetotactic bacteria AMB-1's magnetosome proteins mamL, mamQ, mamB.

## 6. BBa\_K1622001 - Polyethylene terephthalate degrading device

Designed by: iGEM11\_Washington (2011-09-15)

Size: 2392 bp

### DETAILS:

This part encodes both Acyl-ACP Reductase (AAR) and Aldehyde Decarbonylase (ADC) from Synechococcus elongatus behind a strong constitutive expression cassette. Transforming this part into E. coli will result in the production of alkanes, the primary component of diesel, without the need for any inducing agents.

# SECTION 3

## T terminators

### 1. BBa\_B0010 - T1 from E. coli

Designed by: Antiquity (2003-11-19)

Size: 80 base pairs

**DETAILS:**

Transcriptional terminator consisting of a 64 bp stem-loop. Its analog Tet promoters are also known as a sensitive ones to pressure.

### 2. BBa\_B0012 - TE from coliphage T7

Designed by: Antiquity (2003-07-17)

Size: 41 base pairs

**DETAILS:**

Transcription terminator for the E.coli RNA polymerase.

### 3. BBa\_B0015 - double terminator (B0010-B0012)

Designed by: Antiquity (2003-07-17)

Size: 129 base pairs

**DETAILS:**

Double terminator consisting of BBa\_B0010 and BBa\_B0012.



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