VisBOL

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SBOL & SBOL Visual

- SBOL provides the exchange format for designs, but it's a non-visual language intended for machines

- Need a way to communicate features of genetic circuit designs to humans

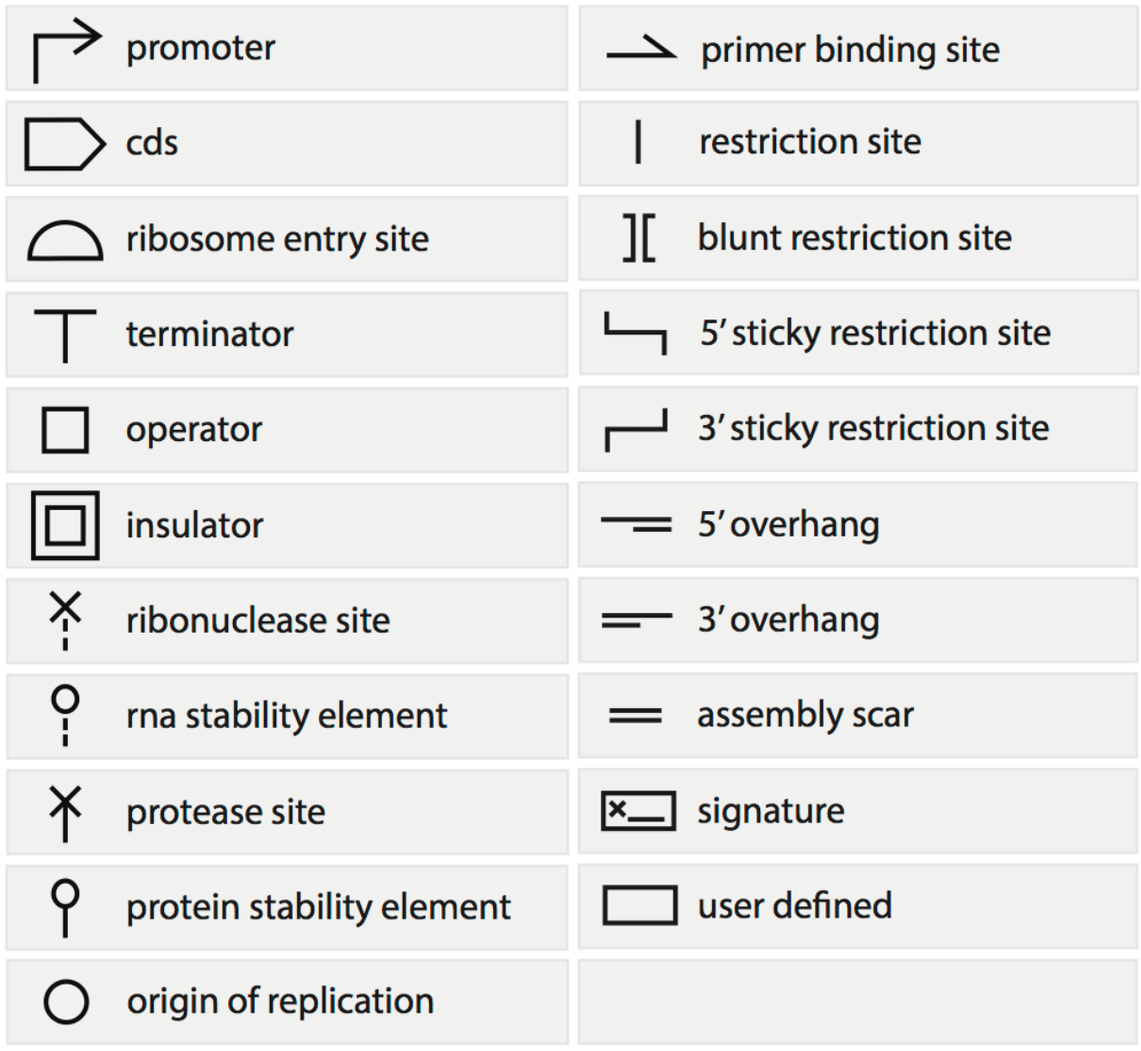
- Graphical representations have always been widely used in genomics

SBOL & SBOL Visual

- SBOL Visual defines an open set of glyphs to convey genetic features

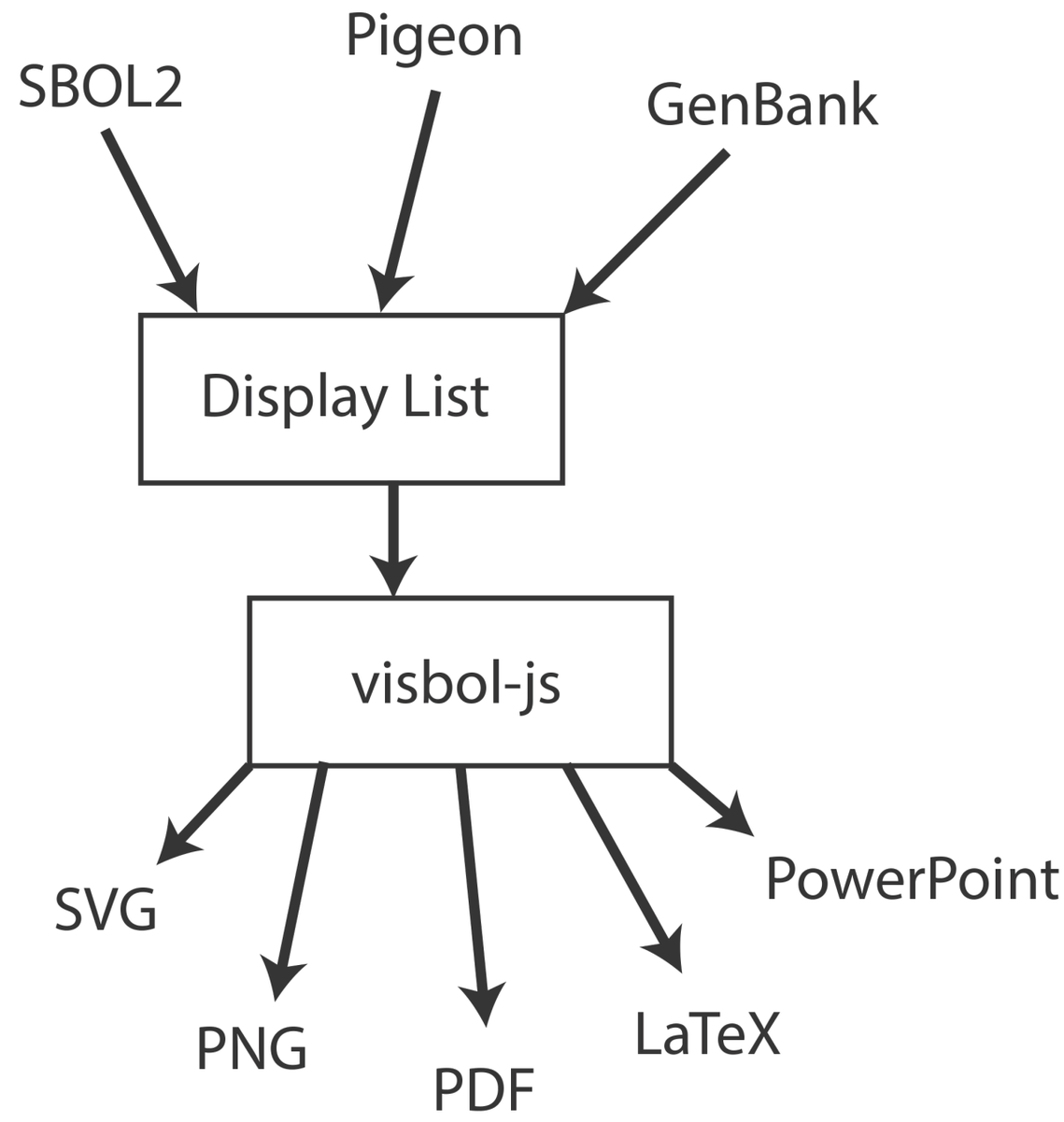
- Software such as PigeonCAD and SBOL Designer enable construction of visual designs using SBOL Visual glyphs

- But we can't yet automatically generate a visualisation from an SBOL2 document



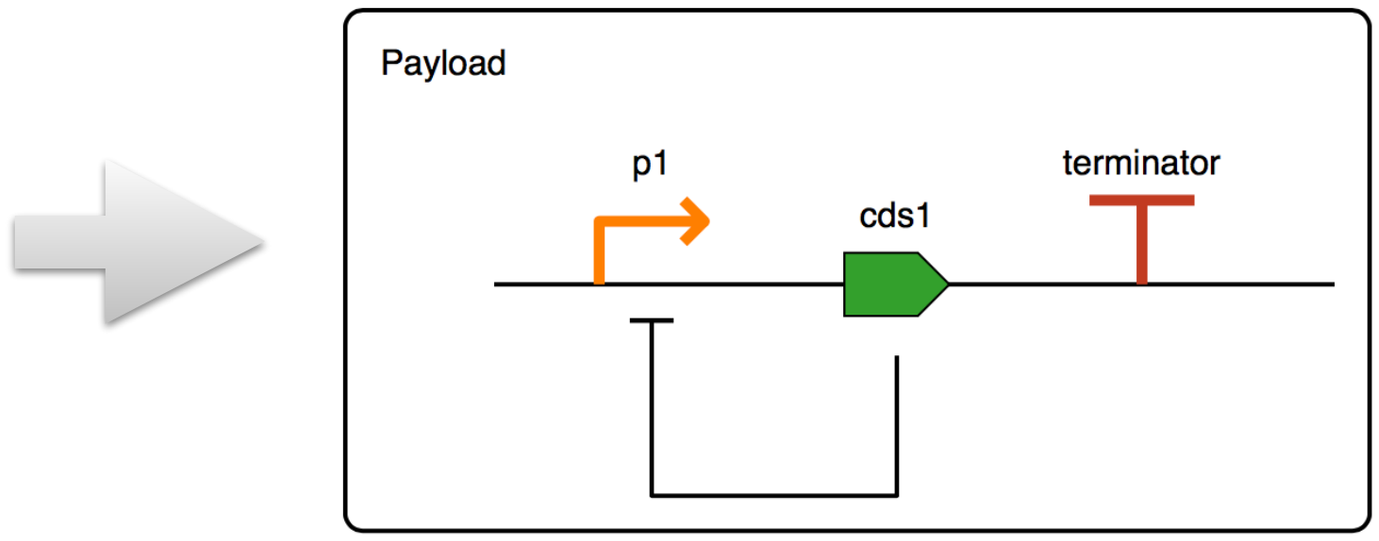
Display Lists

- An intermediate format to describe visual genetic circuit designs
- Specified in JSON
- Display list generators are available for SBOL2, PigeonCAD notation, and GenBank



Display Lists


```
{
  "version": 1,
  "components": [
    {
      "segments": [
        {
          "id": "payload",
          "name": "Payload",
          "sequence": [
            {
              "strand": "positive",
              "type": "promoter",
              "id": "p1",
              "name": "p1",
              "color": "#ff7f00"
            },
            {
              "strand": "positive",
              "type": "cds",
              "id": "cds1",
              "name": "cds1",
              "color": "#33a02c"
            },
            {
              "strand": "positive",
              "type": "terminator",
              "id": "terminator",
              "name": "terminator"
            }
          ]
        }
      ],
      "entities": [],
      "joins": []
    }
  ],
  "interactions": [
    {
      "id": "cds1-p1",
      "type": "repression",
      "origin": "cds1",
      "target": "p1"
    }
  ]
}
```

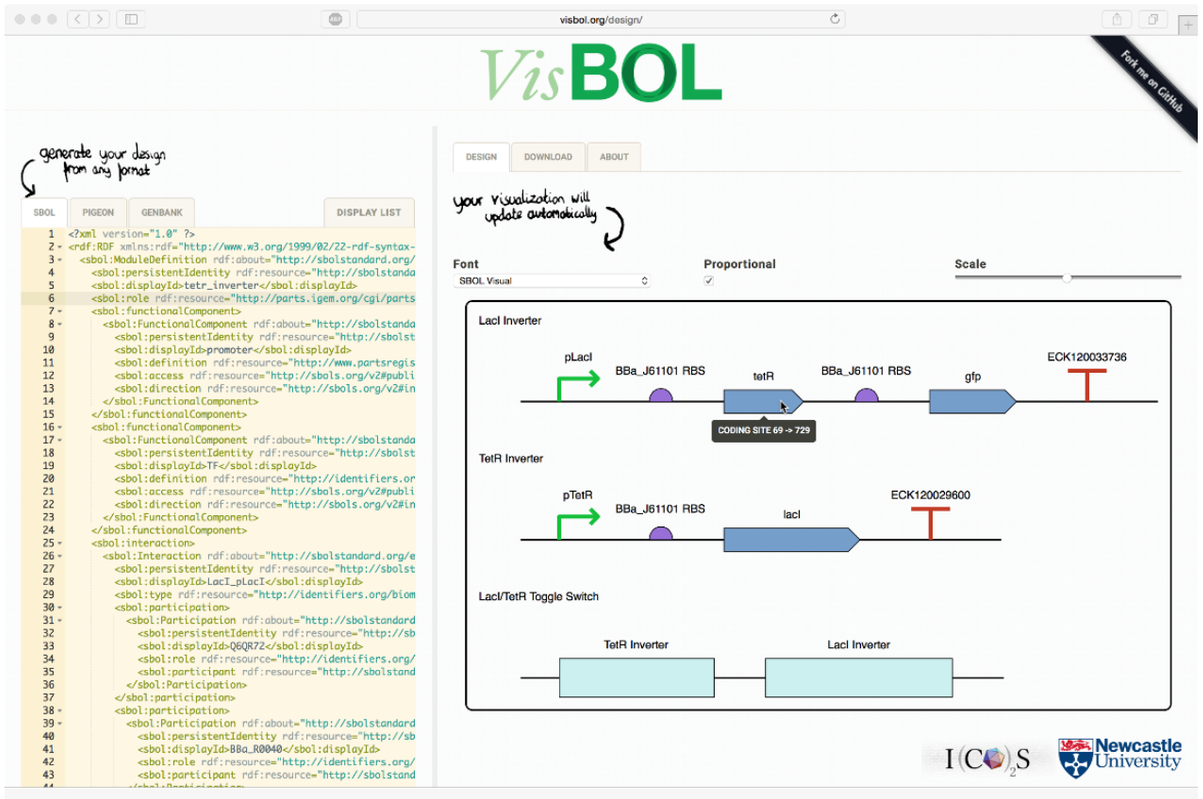



VisBOL

- VisBOL is an open source design visualization framework written in JavaScript

- Generates designs from display lists

- Renders visualization to SVG directly in the browser; export to SVG or PNG



visbol.org/design/

VisBOL

Fork me on GitHub

generate your design from any format

SBOL | PIGEON | GENBANK | DISPLAY LIST

```
1  <?xml version="1.0" ?>
2  <rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-
3    <sbol:ModuleDefinition rdf:about="http://sbolstandard.org/
4      <sbol:persistentIdentity rdf:resource="http://sbolstanda
5      <sbol:displayId>tetr_inverter</sbol:displayId>
6      <sbol:role rdf:resource="http://parts.igem.org/cgi/parts
7      <sbol:functionalComponent>
8        <sbol:FunctionalComponent rdf:about="http://sbolstanda
9          <sbol:persistentIdentity rdf:resource="http://sbolst
10         <sbol:displayId>promoter</sbol:displayId>
11         <sbol:definition rdf:resource="http://www.partsregis
12         <sbol:access rdf:resource="http://sbols.org/v2#publi
13         <sbol:direction rdf:resource="http://sbols.org/v2#in
14       </sbol:FunctionalComponent>
15     </sbol:functionalComponent>
16     <sbol:functionalComponent>
17       <sbol:FunctionalComponent rdf:about="http://sbolstanda
18         <sbol:persistentIdentity rdf:resource="http://sbolst
19         <sbol:displayId>TF</sbol:displayId>
20         <sbol:definition rdf:resource="http://identifiers.or
21         <sbol:access rdf:resource="http://sbols.org/v2#publi
22         <sbol:direction rdf:resource="http://sbols.org/v2#in
23       </sbol:FunctionalComponent>
24     </sbol:functionalComponent>
25     <sbol:interaction>
26       <sbol:Interaction rdf:about="http://sbolstandard.org/e
27         <sbol:persistentIdentity rdf:resource="http://sbolst
28         <sbol:displayId>LacI_pLacI</sbol:displayId>
29         <sbol:type rdf:resource="http://identifiers.org/biom
30         <sbol:participation>
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33             <sbol:displayId>Q6QR72</sbol:displayId>
34             <sbol:role rdf:resource="http://identifiers.org/
35             <sbol:participant rdf:resource="http://sbolstand
36           </sbol:Participation>
37         </sbol:participation>
38         <sbol:participation>
39           <sbol:Participation rdf:about="http://sbolstandard
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42             <sbol:role rdf:resource="http://identifiers.org/
43             <sbol:participant rdf:resource="http://sbolstand
```

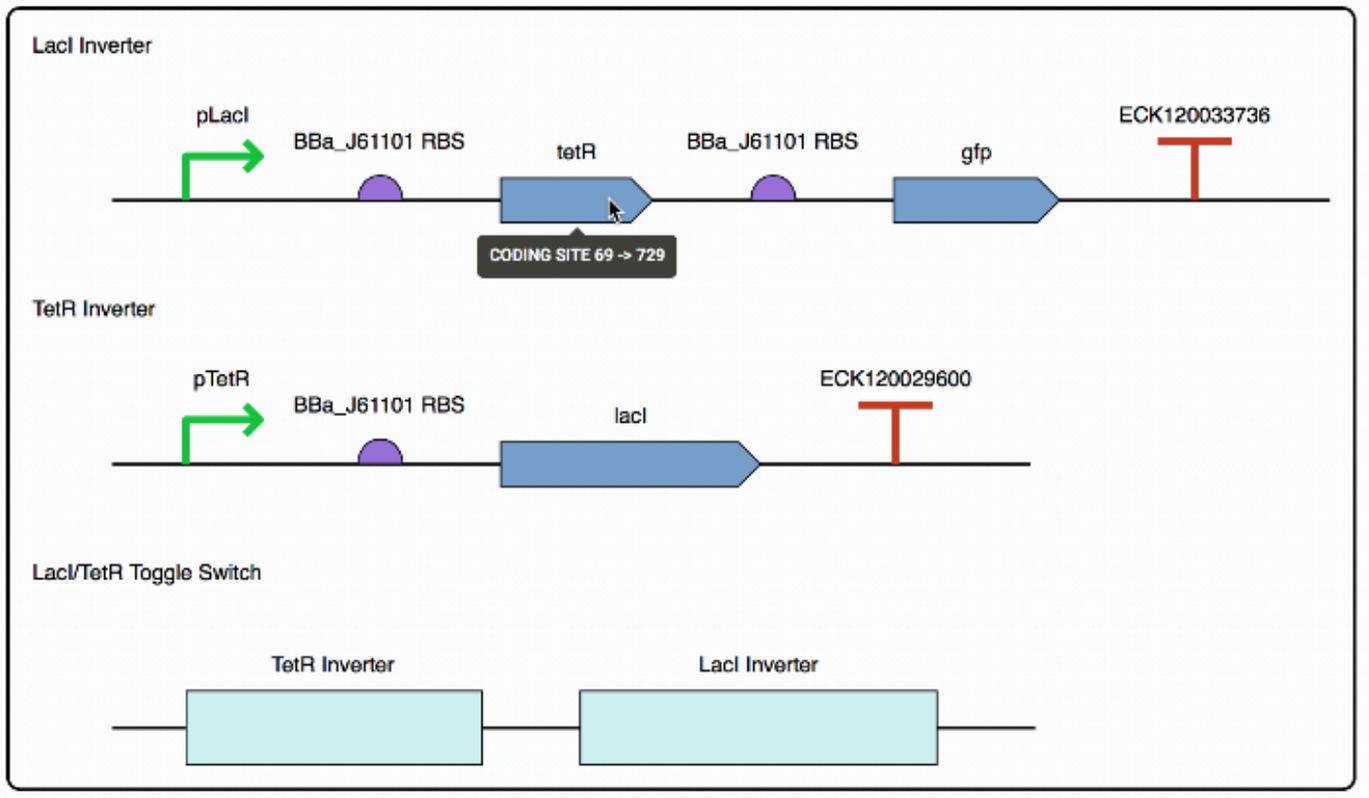
DESIGN | DOWNLOAD | ABOUT

your visualization will update automatically

Font SBOL Visual

Proportional ☑

Scale



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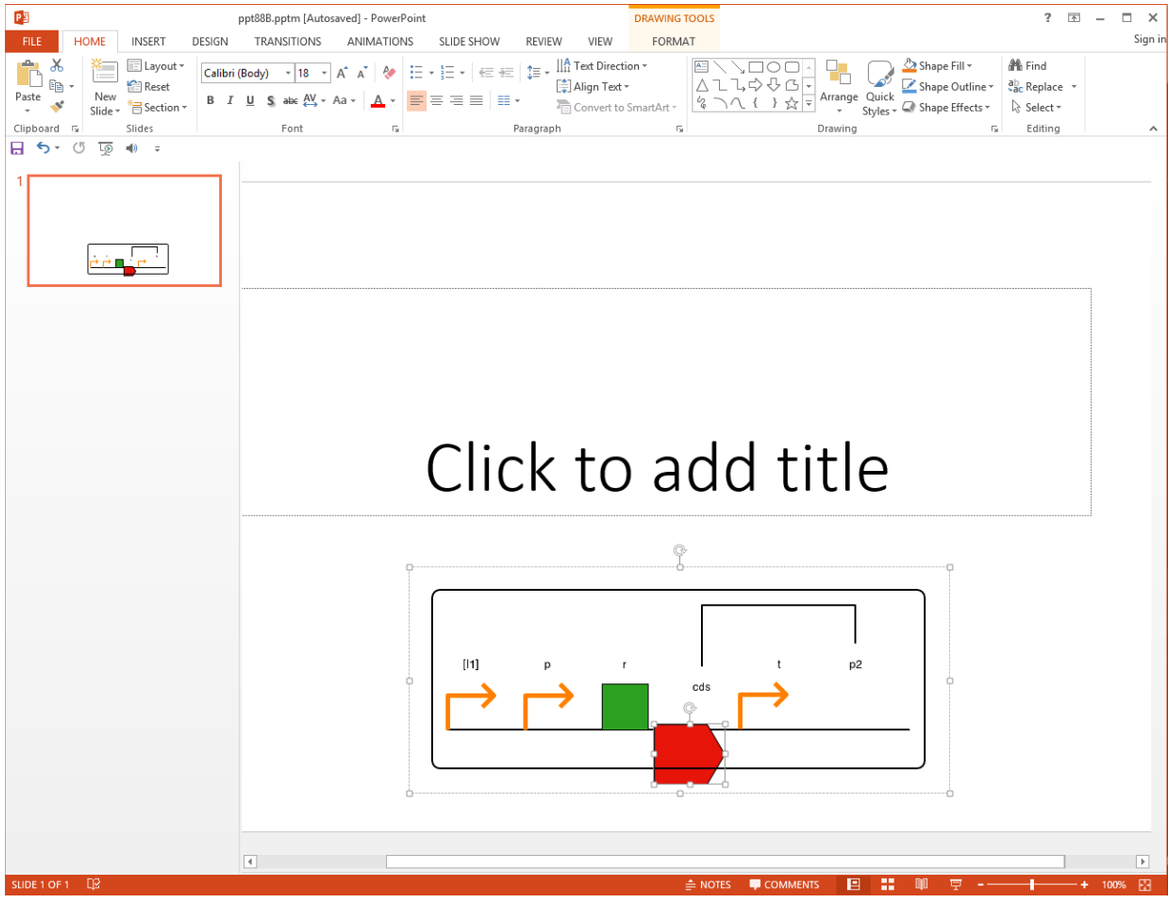
VisBOL

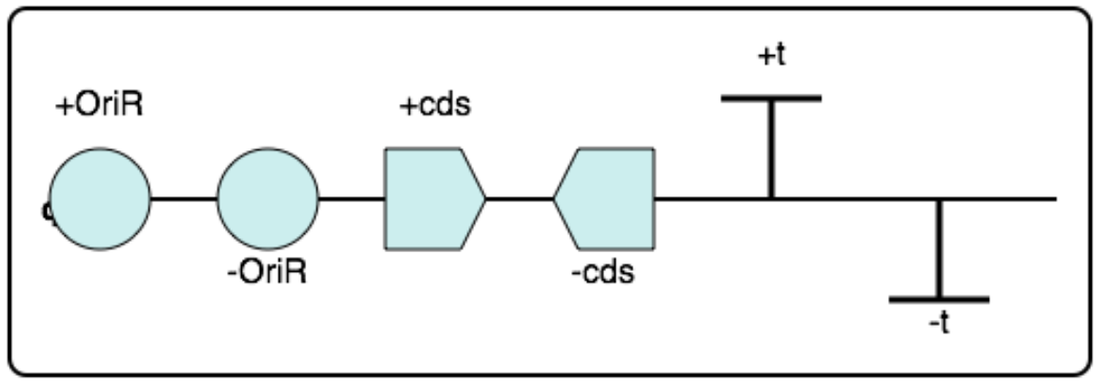
- SVG images can be embedded in websites, publications and presentations

- Further edit visualizations using widely available software such as Inkscape, Illustrator, PowerPoint

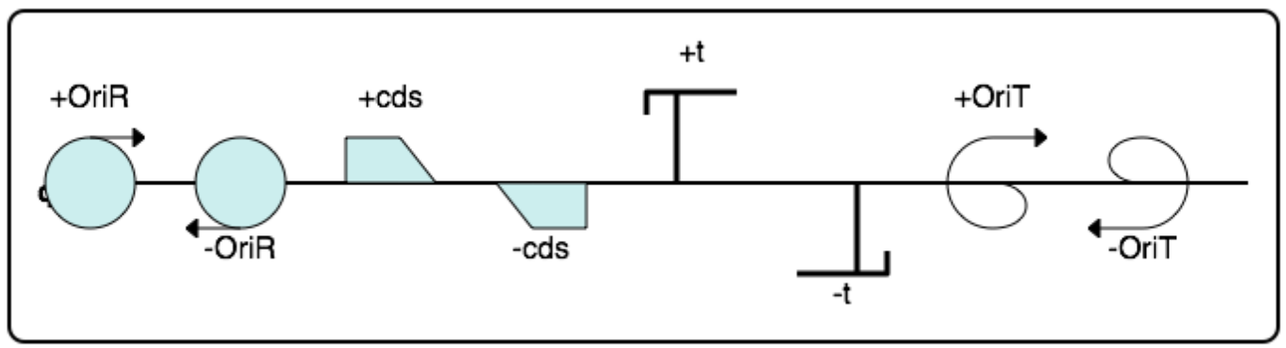


Fonts

- Glyph sets are defined by fonts
- Easily extendable with new glyphs and alternative renderings



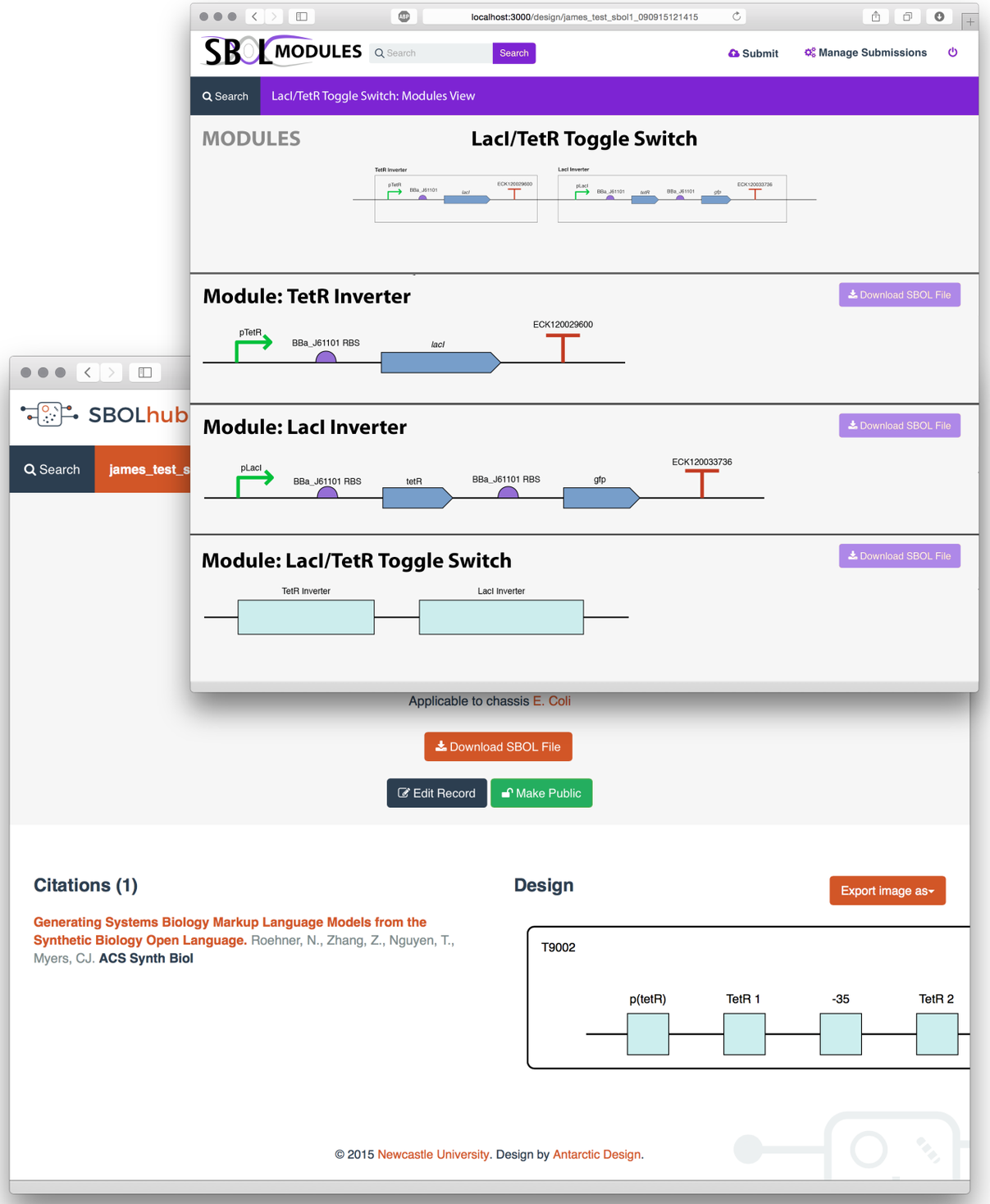
- Base font is SBOL Visual; experimenting at Newcastle with a set of glyphs with improved directionality



Integration

- VisBOL can be embedded directly into Web content to provide visualization capabilities

- Newcastle projects: visbol.org, SynBioModules, SBOLhub, Virtual Parts Repository

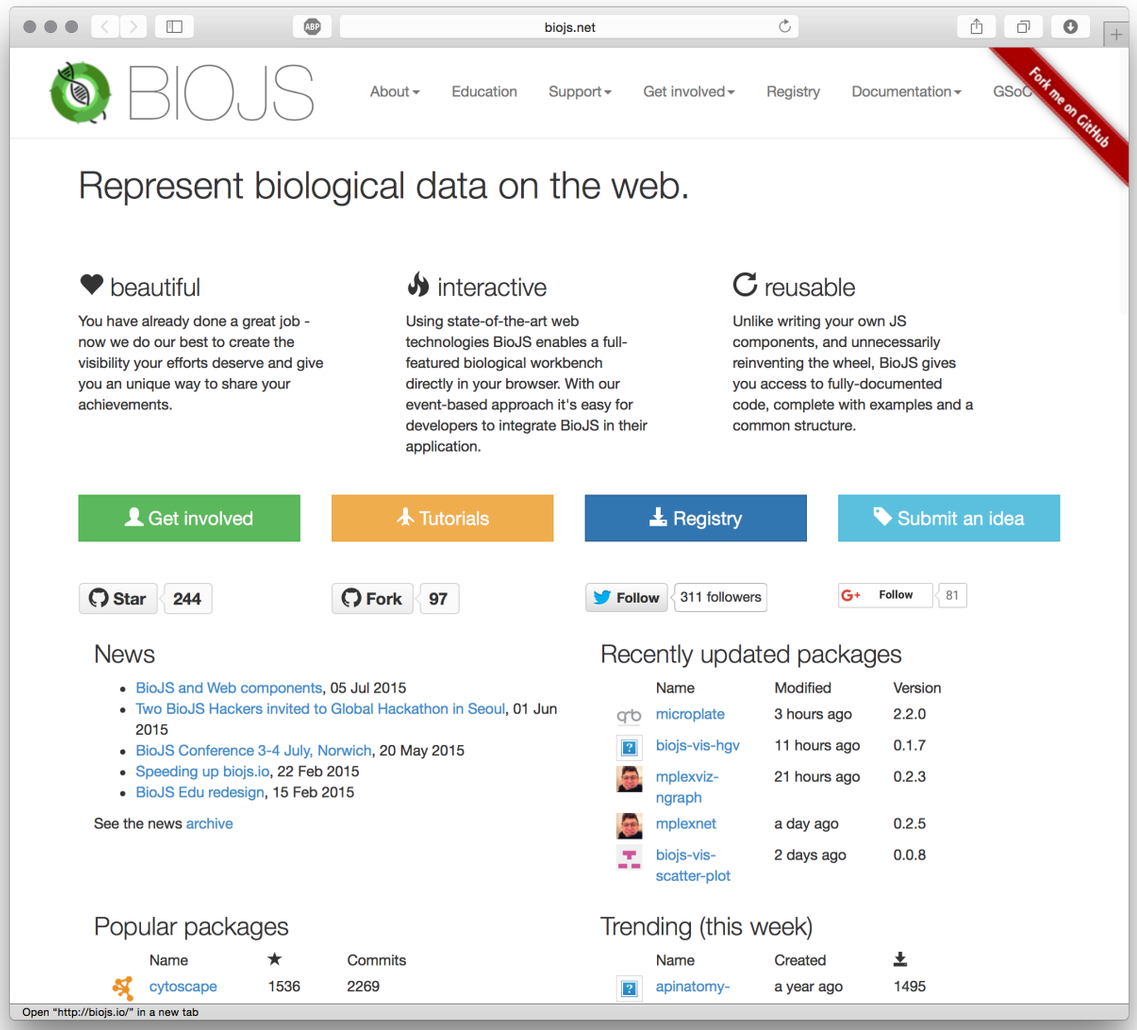


Integration

```
<svg id="sbol-design"></svg>

<script type="text/javascript">
    require.config({
        packages: [
            {
                name: 'visbol',
                location: 'js/visbol/lib'
            },
            {
                name: 'visbol-font',
                location: 'js/visbol/font'
            }
        ],
        baseUrl: 'http://visbol.org/design'
    });

    require([
        'visbol',
        'visbol-font',
        'visbol-font!http://visbol.org/design/js/visbol/font/sbolv',
        'visbol-font!http://visbol.org/design/js/visbol/font/sbolv-improved-directionality'
    ], function (visbol, visbolFont, sbolv, sbolvImprovedDirectionality) {

        var design = new visbol.Design({
            element: document.getElementById('sbol-design'),
            font: visbolFont.get('sbolv')
        });

        design.setDisplayList(displayList);
    });
</script>
```

Integration

- Part of a growing ecosystem of JavaScript bioinformatics tooling
- > 100 packages already available in the registry at biojs.net
- npm has ~200,000 JavaScript packages available: largest module repository of any language



VisBOL

http://visbol.org/design

http://github.com/visbol

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