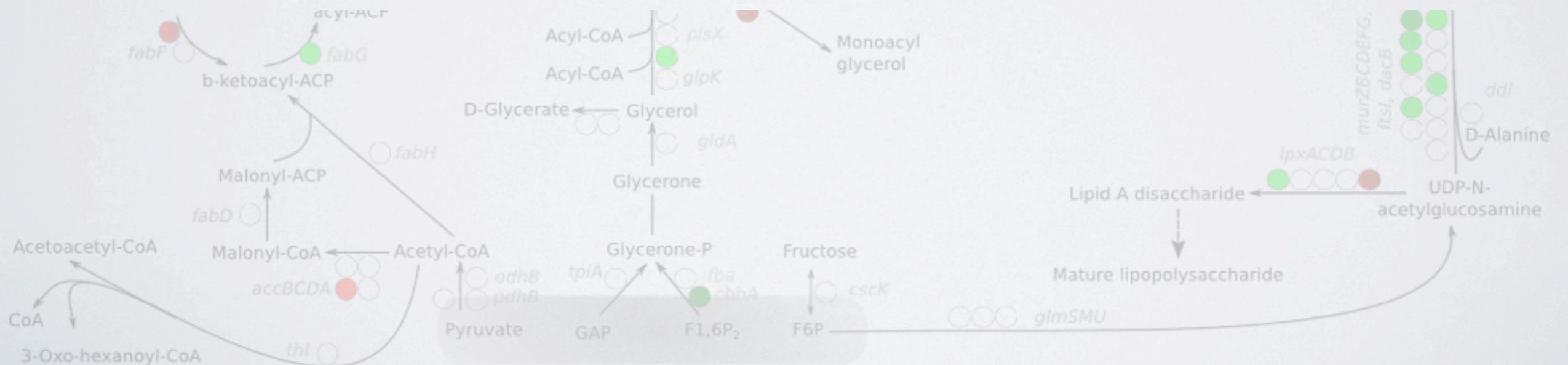


SVGMAPPING 2

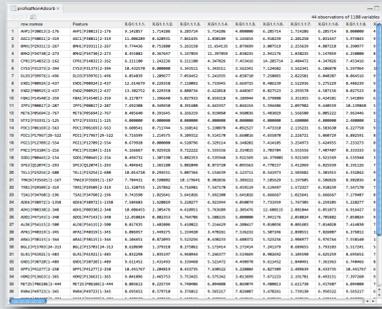
AN **R** PACKAGE TO MAP OMIC DATA SETS ONTO PATHWAYS TEMPLATES

Jean-Christophe Aude, CEA



Context & Motivation

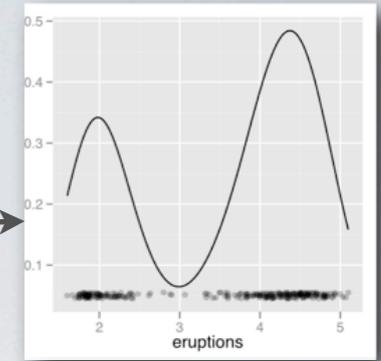
data



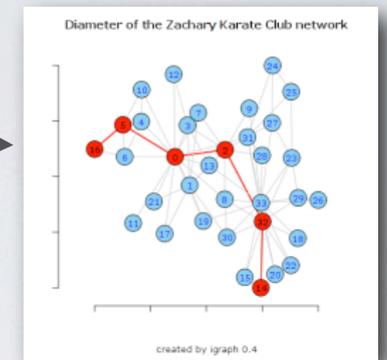
time	eruptions	height	volume	temp	...
1	1.6	133.7	3.169	1984	...
2	3.3	133.7	3.169	1984	...
3	4.7	133.7	3.169	1984	...
4	8.0	133.7	3.169	1984	...
5	13.0	133.7	3.169	1984	...

undirected
visualization*

plot,ggplot2,lattice...

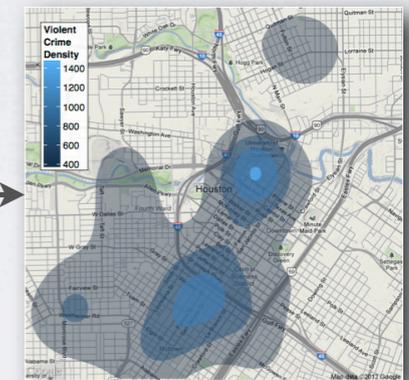


igraph...



directed
visualization*

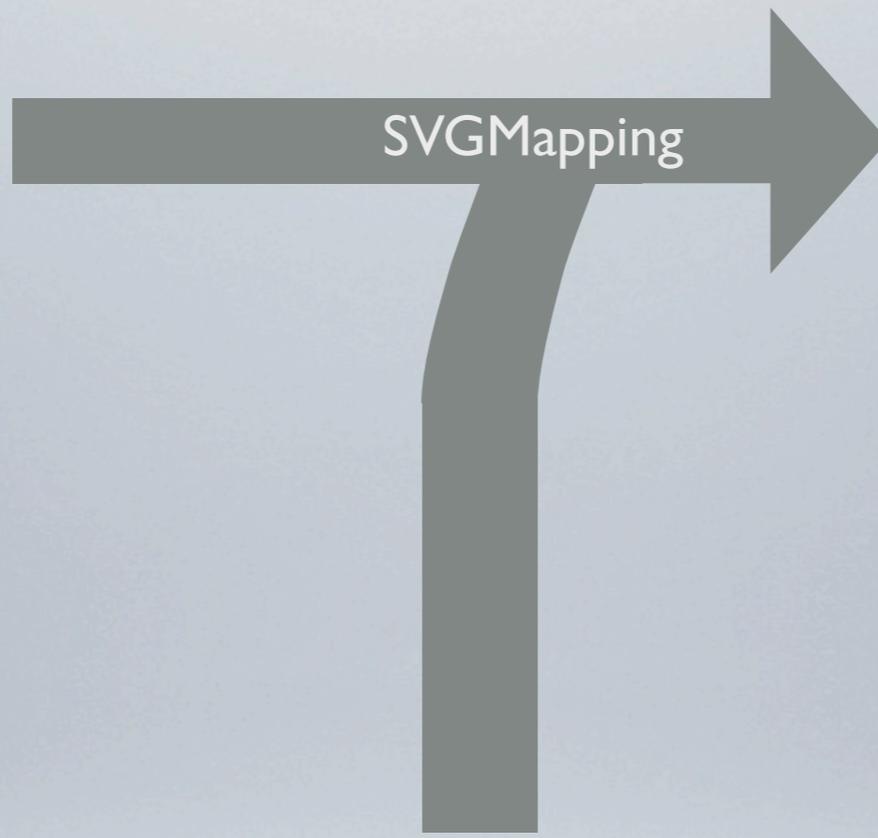
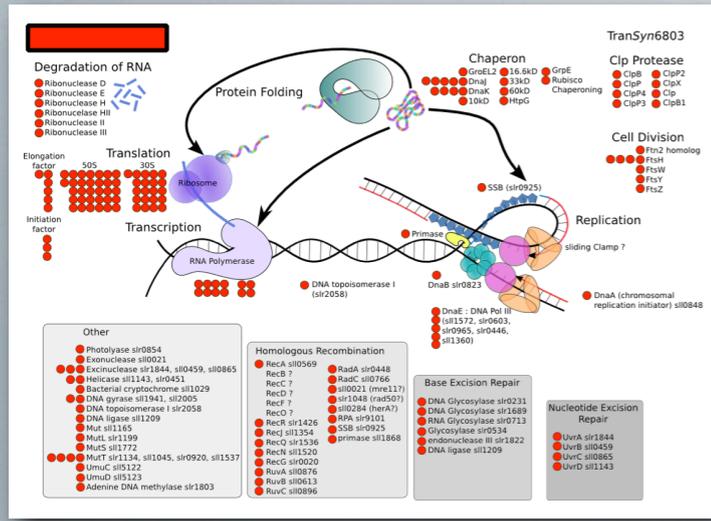
ggmap...



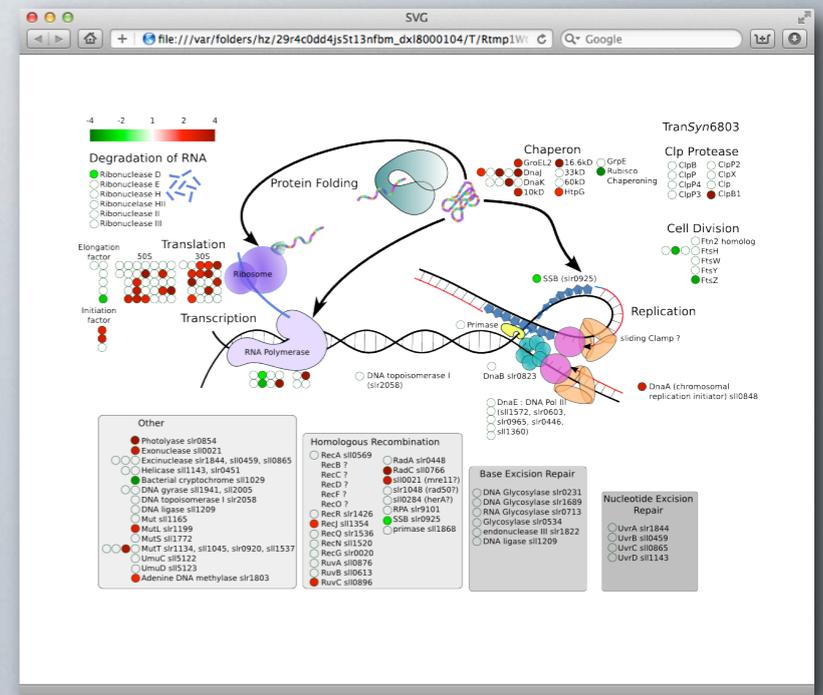
prior knowledge

*Keim, D. A., Mansmann, F., Schneidewind, J., and Ziegler, H. (2006). *Challenges in Visual Data Analysis*. In Tenth International Conference on Information Visualisation (IV'06), pages 9–16, University of Konstanz, Germany.

Pathway Template



SVGMapping

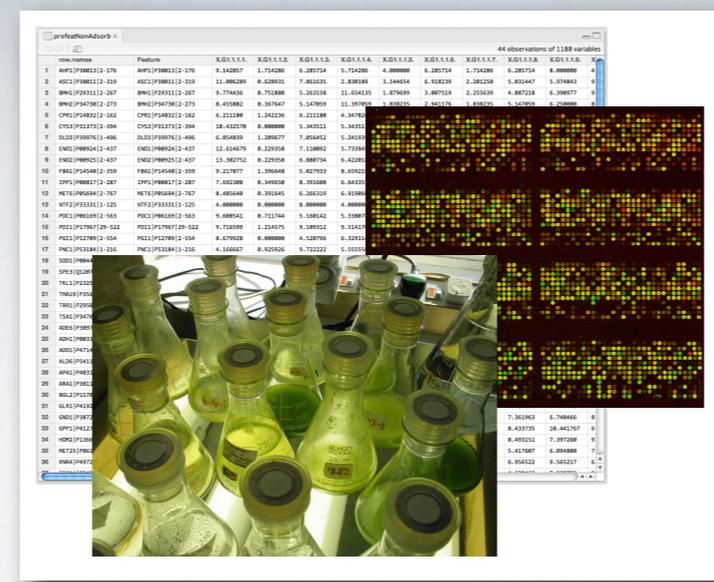


Pathway Experiment Map
(dots are colored according to a gene expression measurement)

design



conduct



Experimental data:
(microarrays, ngs, ...)

Template Editing using Inkscape

File Edit View Layer Object Path Text Filters Extensions Help

SYNY3_17_Detoxification.svg - Inkscape

Detoxification System

H^+ O_2^- H_2O_2 H_2O

sodB (slr1516)

katG (slr1987)

Arsenate

arsI1 (slr5104)

arsI2 (slr6037)

arsC (slr0946)

Arsenite

Glutar

Glutaredox

H_2O

gpx1 (slr1171)

gpx2 (slr1992) 2 GST

Object Properties (Shift+Ctrl+O)

Id: slr1987

Label: []

Title: []

Description: []

Hide Lock

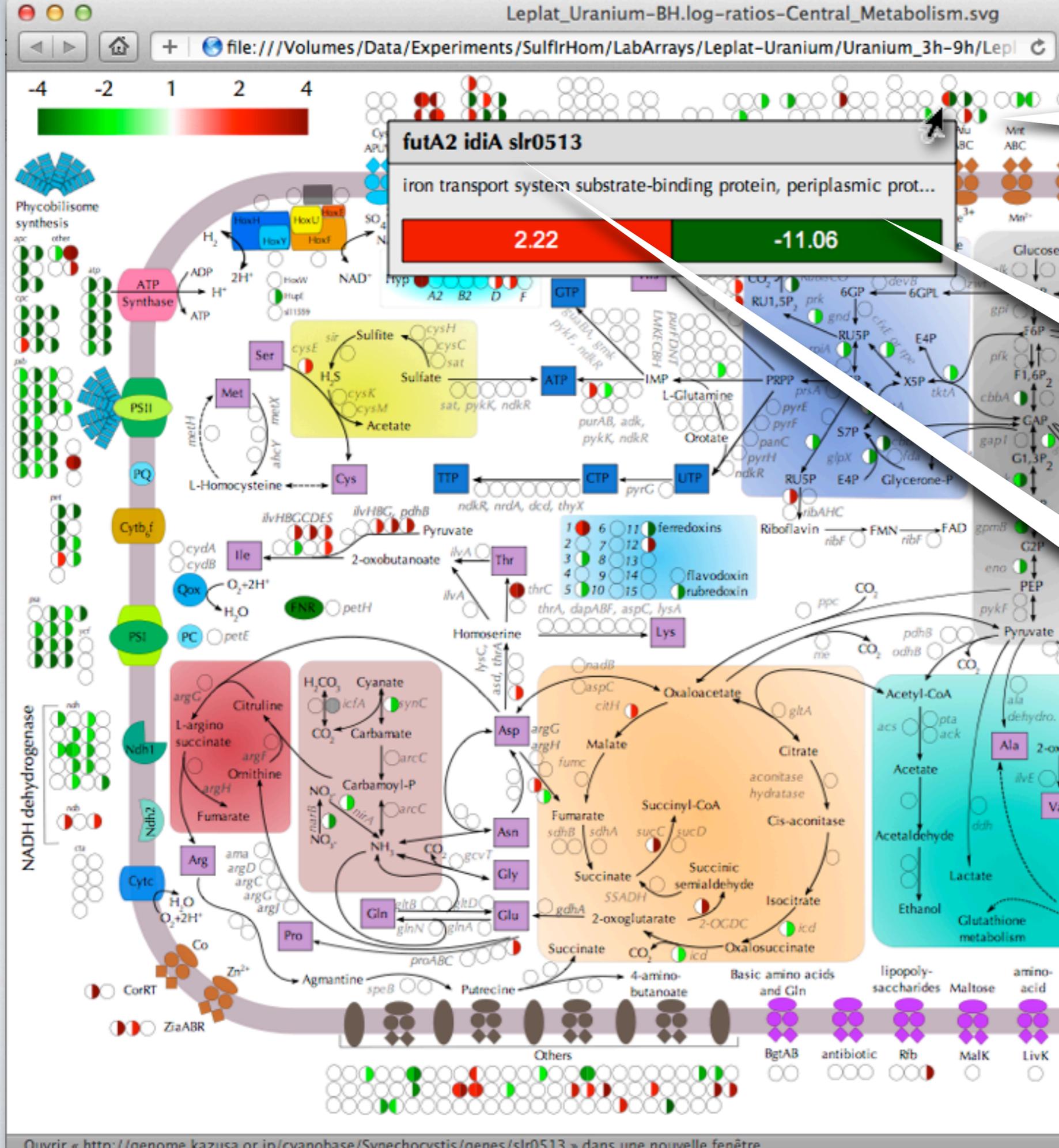
Interactivity

Fill: [] Stroke: 0,314

•Calque 1 Ellipse in layer Calque 1. Click selection to toggle scale/rotation handles.

X: 377,18 Y: 735,05 Z: 274%

ID (or Label) are used to identify visual shapes that will be modified (colors, stroke, ...)



expression values \rightarrow colors

3h 9h experiment comparison

values \rightarrow tooltips

gene annotations, expression values

values \rightarrow hyperlinks

locus ID for reference database hyperlinks

experiment: *Synechocystis sp.* cells are exposed to an uranium pulse. mRNA are extracted 3h and 9h after this treatment.

SVG MAPPING = SVG + MAPPING

- **SVG** key features

- easy to use getter/setter
- pseudo-devices
- (basic) grid layout

- **Mapping** key features

- **Data = Values + Targets**
- **Transformation** function applied on values, before the mapping operation
- **Operations** used transformed values to alter target shapes or document

(basic) grid-layout

- Creates **fixed** and **variable** grids one the whole document or within a rectangle:

```
>blank <- SVG.factory(dims="a4", landscape=TRUE)
```

```
>vgrid <- VarGrid.factory(cols=c(0,0.25,0.28,1.0),opacity=1.0,prefix="Grid")
```

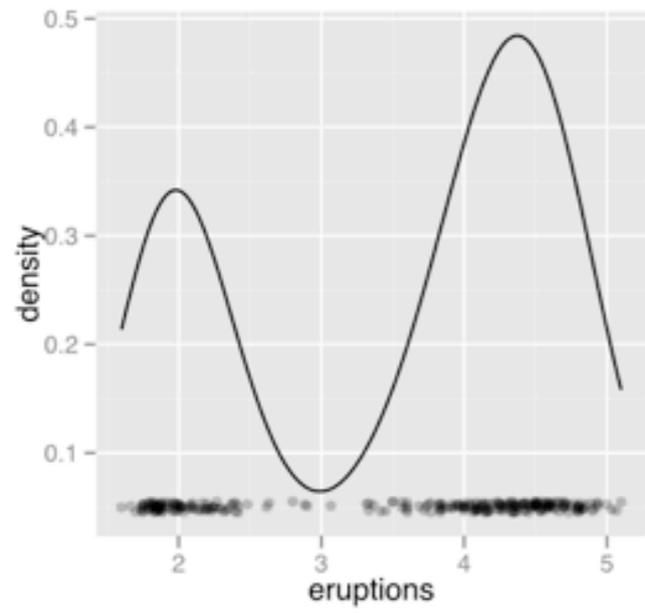
```
>layout(blank) <- vgrid
```

```
>lgrid <- FixGrid.factory(nrows=3,opacity=1.0,prefix="leftGrid")
```

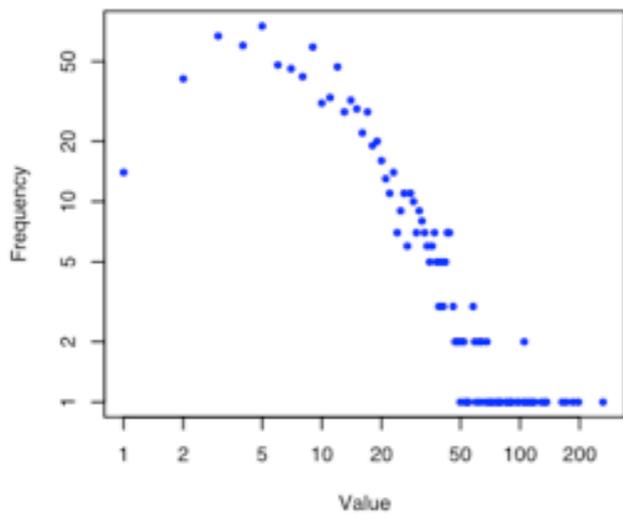
```
>layout(blank,blank["Grid.grid.1.1"][[1]]) <- lgrid
```



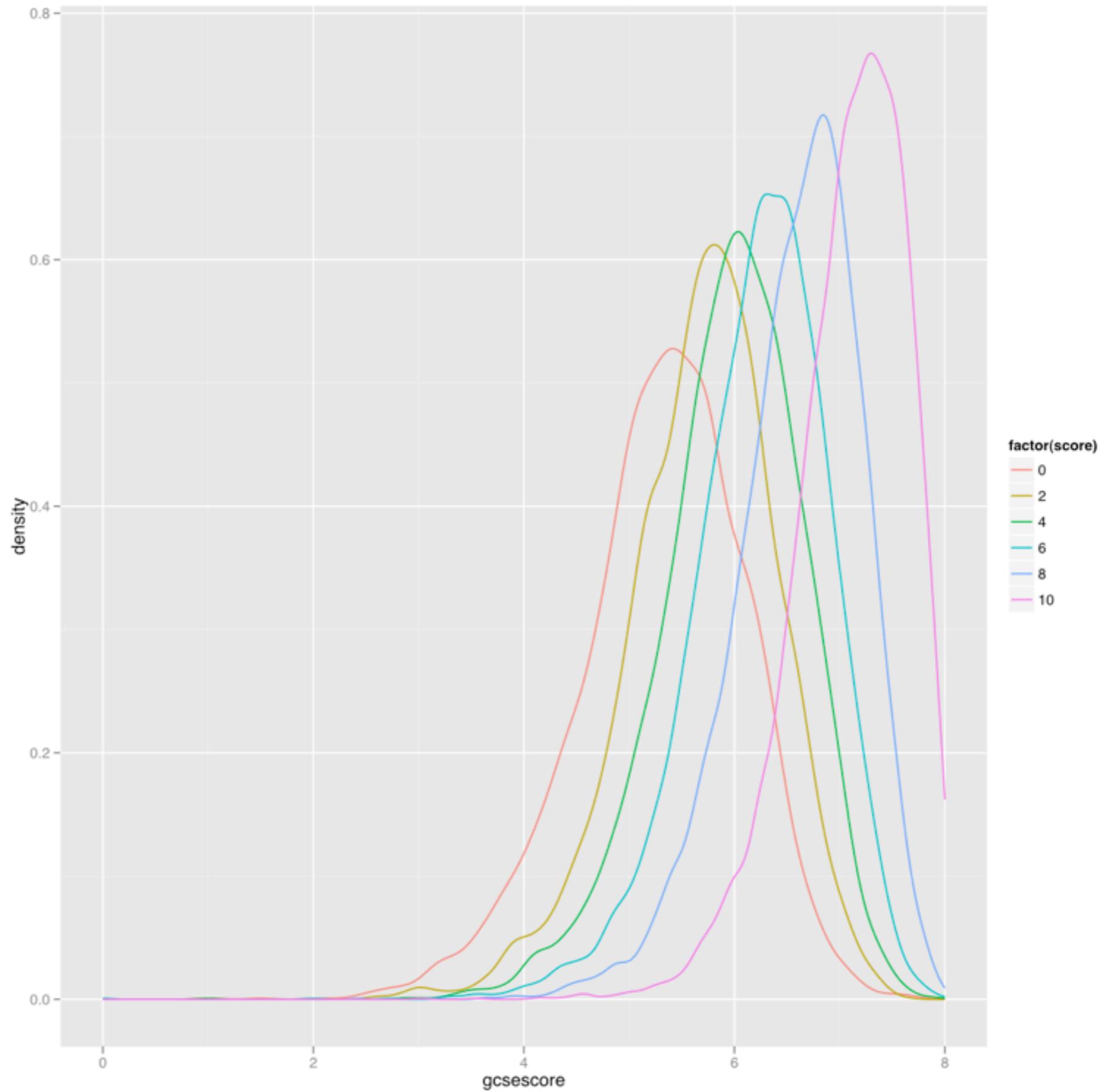
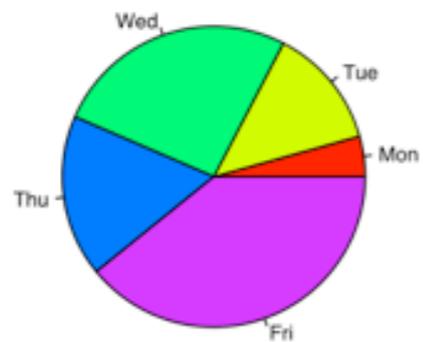
(basic) grid-layout



Log-normal distribution



Cars



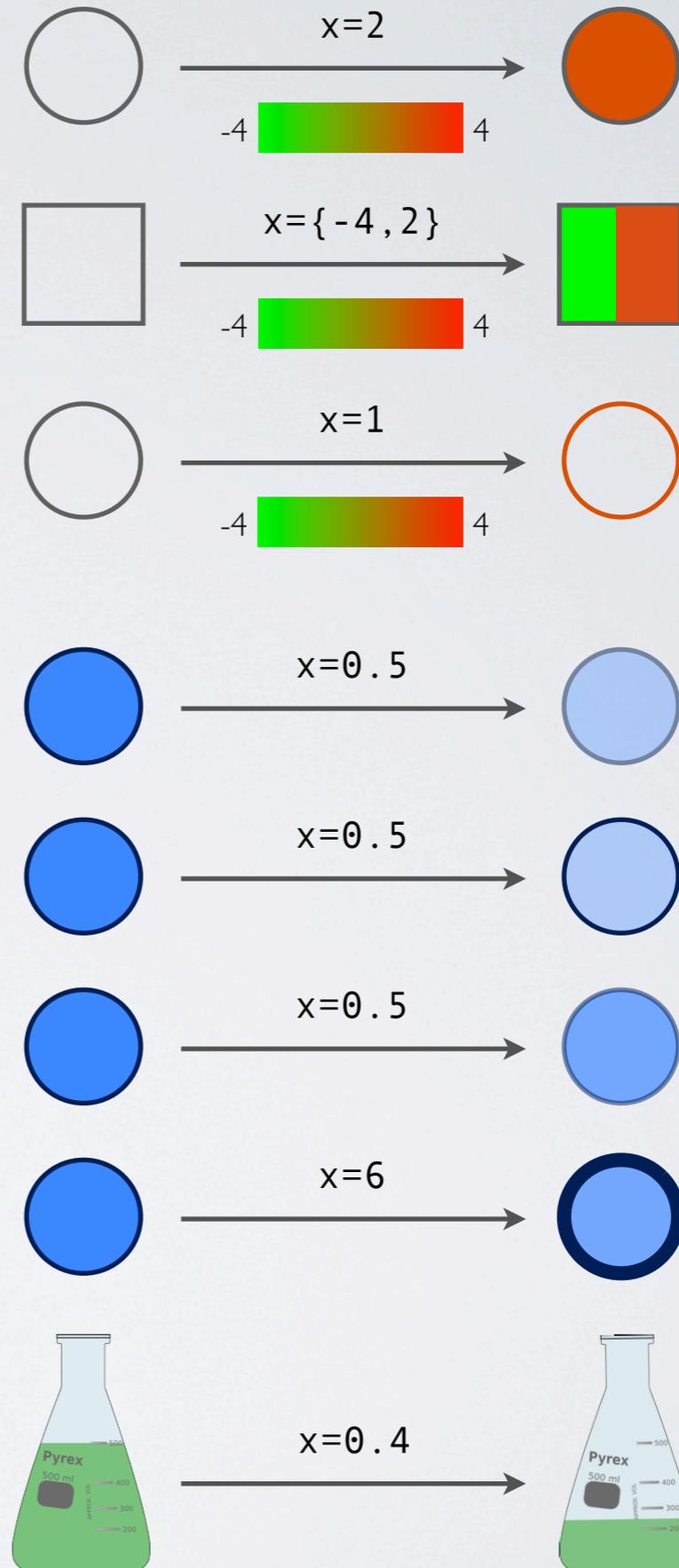
Transformations

- Transformations are R function with the following prototype `function(x,p)`
 - `x` is a single data row (of a data-frame or vector) argument
 - `p` is the function parameter argument
- We provide a set of built-in functions:
 - `random(x,p={min,max})`, `identity(x)`,
 - `linear(x,p={a,b})`, `range-linear(x,p={a,b,min,max})`
 - `logistic(x,p={K,a,r})`, `sigmoid(x,p={r})`
 - `log2FC(x)` for microarrays log₂ ratios to fold-change conversions
- One can also used its own function:

```
id2url ← function(x,params) {  
  return(paste('http://uniprot.org/query.pl?geneid=',x,sep=' '))  
}
```

Operations

- **MappingFillColor**s: convert a numeric value to a fill color given a list of colors or a gradient
 - it also works with vectors....
- **MappingStrokeColor**s: same as above for the stroke color
- **MappingOpacity**: set global shape opacity (input is in the range $[0,1]$)
- **MappingFillOpacity**: set the fill opacity
- **MappingStrokeOpacity**: set the stroke opacity
- **MappingStrokeWidth**: convert numeric values to a stroke width
- **MappingMasks**: apply a mask to partially hide a shape. The hidden fraction of the shape depends on the input value



TITLE

88:88

30.0 C
25.0 C
20.0 C
15.0 C
10.0 C
5.0 C
0.0 C
-5.0 C
-10.0 C
-15.0 C
-20.0 C

TEMP

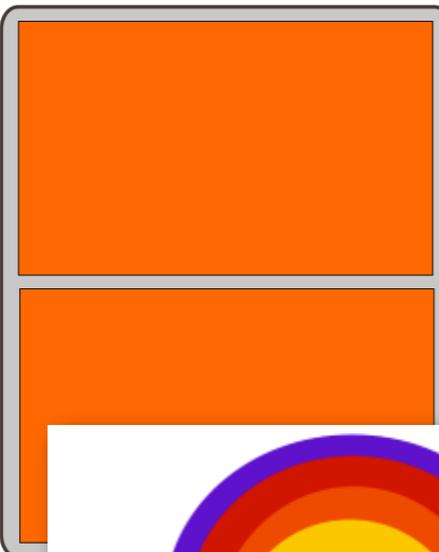
WIND

GAUGE

GAUGE

VALUE

VALUE



We can map other data as well...

Template

Weather in Orsay Today..

16:22

30.0 C
25.0 C
20.0 C
15.0 C
10.0 C
5.0 C
0.0 C
-5.0 C
-10.0 C
-15.0 C
-20.0 C

16.8 °C

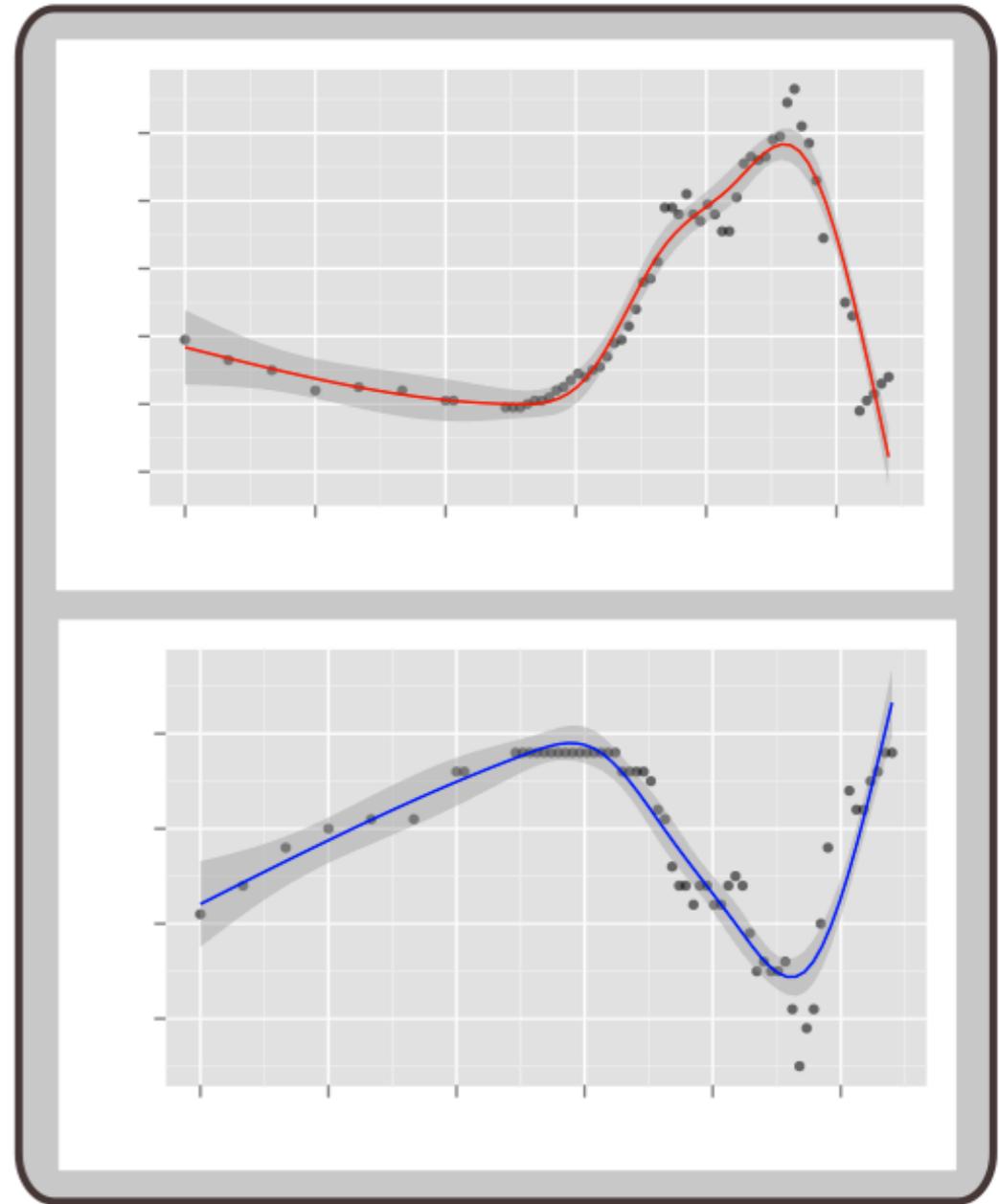
9.3 Km/h

ATM. Pressure

1007.3 hPa

Rel. Humidity

98 %



CONCLUSION

- SVGMapping aims to map *omic* experimental data onto SVG template for visualization purposes
- What I have not talked about:
 - Geometric transformations (rotation, scaling ...)
 - Animations
- Complementary/Alternative packages:
 - SVGAnnotation (omegahat), RSVGTipsDevice, gridSVG
- Contributors:
 - Raphaël Champeimont, version 1.x main contributor
 - Christophe Leplat, *synechocystis sp.* pathway designer
 - Franck Chauvat, for the financial support
- Project hosted here <https://github.com/jcaude/SVGMapping/tree/V2> , please contact me before at jean-christophe.aude@cea.fr