

Gene-O-Matic

- **Genetic network modelling and simulation tool**
- **Graphical user interface to design networks**
- **Discrete model: Boolean network/ matrix multiplication**
- **Written in Java**

Gene-O-Matic - /home/ute/CellOlab/celegans/blast/eizelle-7e.xnet

File Actions GeneNet Options Help

The main window displays a gene regulatory network diagram with nodes such as `mom1_mRNA posterior`, `pop1_mRNA`, `PIE1 posterior`, `pal1_mRNA`, `MOM1`, `MOM2`, `POP1`, `SKN1`, `Mediator Threshold: 1.0`, `Delta`, `APX1 posterior`, `GLP1`, `GLP_star Threshold: 1.0`, `ELT2`, `GES1`, `TL2`, `MTL1`, `N2`, `SEM5`, `fateP12`, `HMP2`, and `fusion`. Interactions are shown with blue arrows (positive) and red lines with bars (negative). Numerical weights are provided for many interactions.

Properties Dialog Box:

- BIC:** MOM2
- Description:** Wnt, acts in P2 (signaling cell) blastomere identity gene external
- Protein Type:** unspecified
- Function:**
- Threshold:** 0.0
- Internal gene:** external
- Location:**
- Process:** unknown
- Origin:** maternal
- Reference:**

Cells Panel:

- Name:** AB
- Radius:** 10.0
- Position:** {0.0,0.0,0.0}
- Division axis:** {4.0,0.0,0.0}

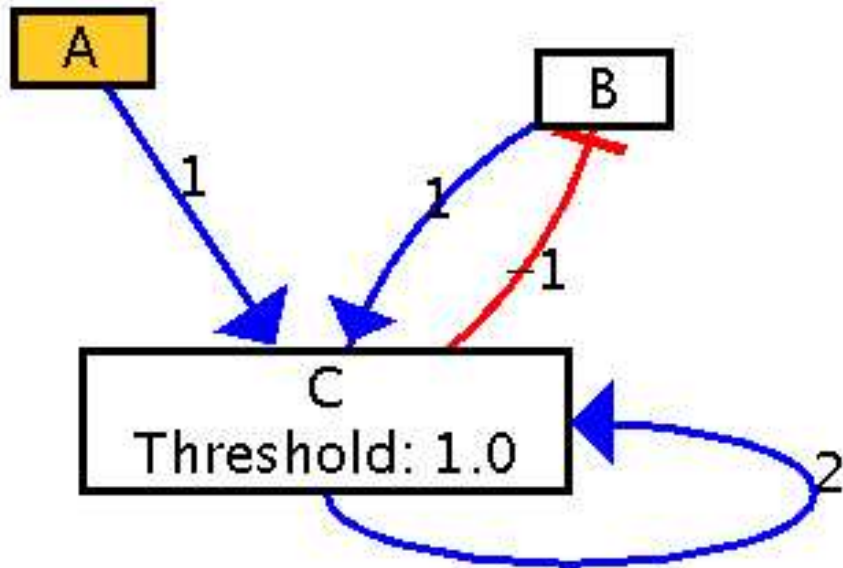
Customize Genetic State Dialog Box:

<input checked="" type="checkbox"/> APX1	<input type="checkbox"/> Delta	<input type="checkbox"/> GLP1	<input type="checkbox"/> GLP_star
<input type="checkbox"/> Mediator	<input type="checkbox"/> MOM1	<input checked="" type="checkbox"/> mom1_mRNA	<input type="checkbox"/> MOM2
<input type="checkbox"/> PAL1	<input checked="" type="checkbox"/> pal1_mRNA	<input checked="" type="checkbox"/> PIE1	<input type="checkbox"/> POP1
<input checked="" type="checkbox"/> pop1_mRNA	<input checked="" type="checkbox"/> SKN1		

WormBase

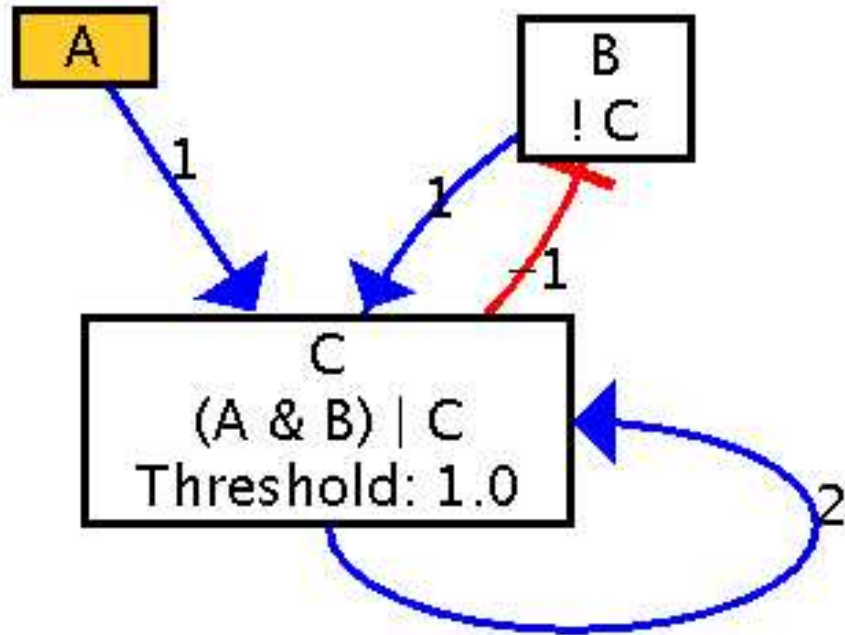
<http://gen-o.org>

Matrix and Boolean Network



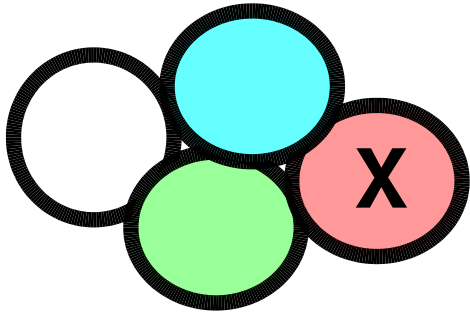
	A	B	C
A	0	0	0
B	0	0	-1
C	1	1	2

Matrix and Boolean Network



	A	B	C
A	0	0	0
B	0	0	-1
C	1	1	2

Calculation

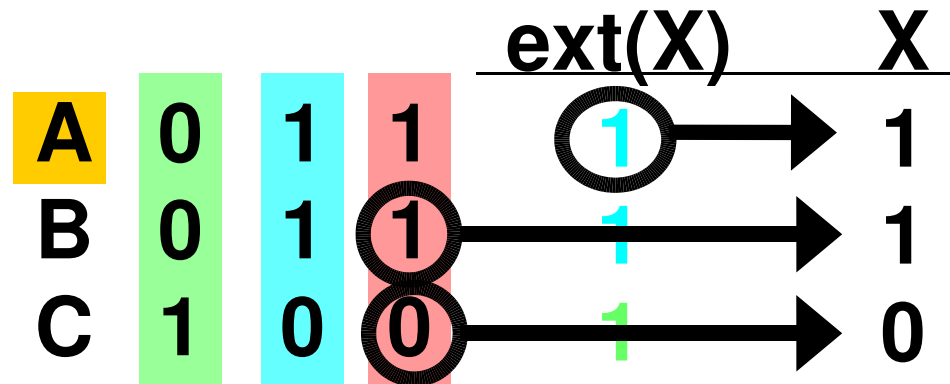
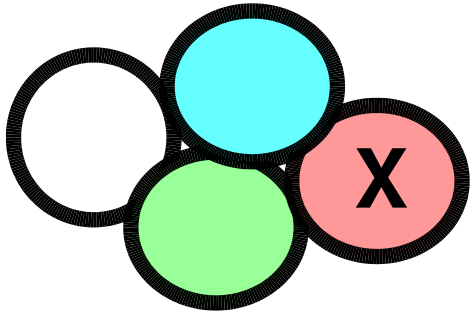


		<u>ext(X)</u>		<u>X</u>
A	0	1	1	1
B	0	1	1	1
C	1	0	0	0

$$\begin{matrix} A \\ B \\ C \end{matrix} \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & -1 \\ 1 & 1 & 2 \end{pmatrix} * \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 1+1=2 \end{pmatrix} \begin{matrix} \text{greater} \\ ? \end{matrix} \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \rightarrow \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$$

thresholds

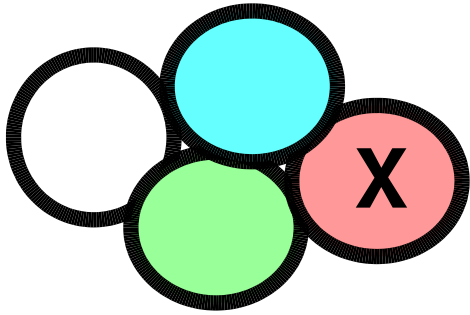
Calculation



$$\begin{matrix} A \\ B \\ C \end{matrix} \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & -1 \\ 1 & 1 & 2 \end{pmatrix} * \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 1+1=2 \end{pmatrix} \begin{matrix} \text{greater} \\ ? \end{matrix} \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \rightarrow \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$$

thresholds

Calculation



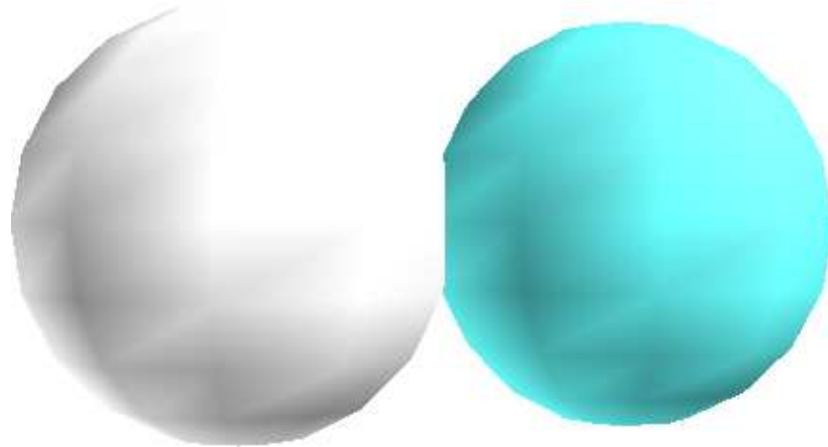
		$\text{ext}(X)$		X
A	0	1	1	1
B	0	1	1	1
C	1	0	0	0

Arrows indicate the calculation of $\text{ext}(X)$ for each row: Row A: 1 + 1 = 2 > 1; Row B: 1 + 1 = 2 > 1; Row C: 0 + 0 = 0 < 1.

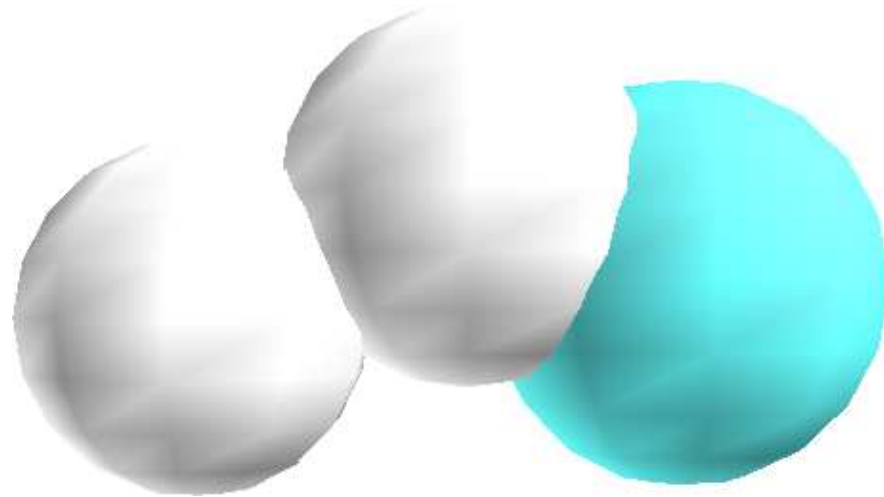
$$\begin{matrix} A \\ B \\ C \end{matrix} \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & -1 \\ 1 & 1 & 2 \end{pmatrix} * \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 1+1=2 \end{pmatrix} \begin{matrix} \text{greater} \\ ? \end{matrix} \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \rightarrow \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$$

thresholds

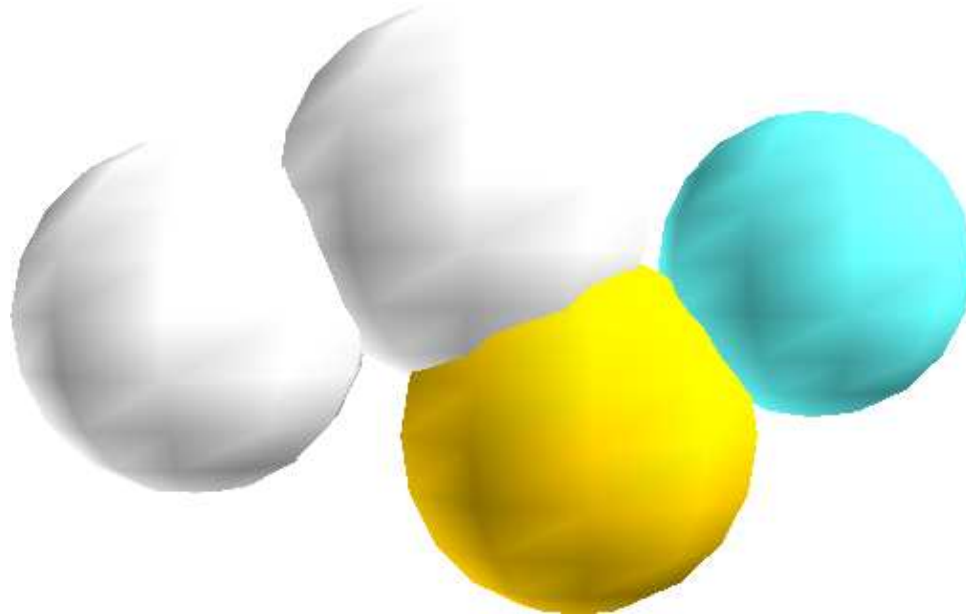
Example: *C. elegans* embryo



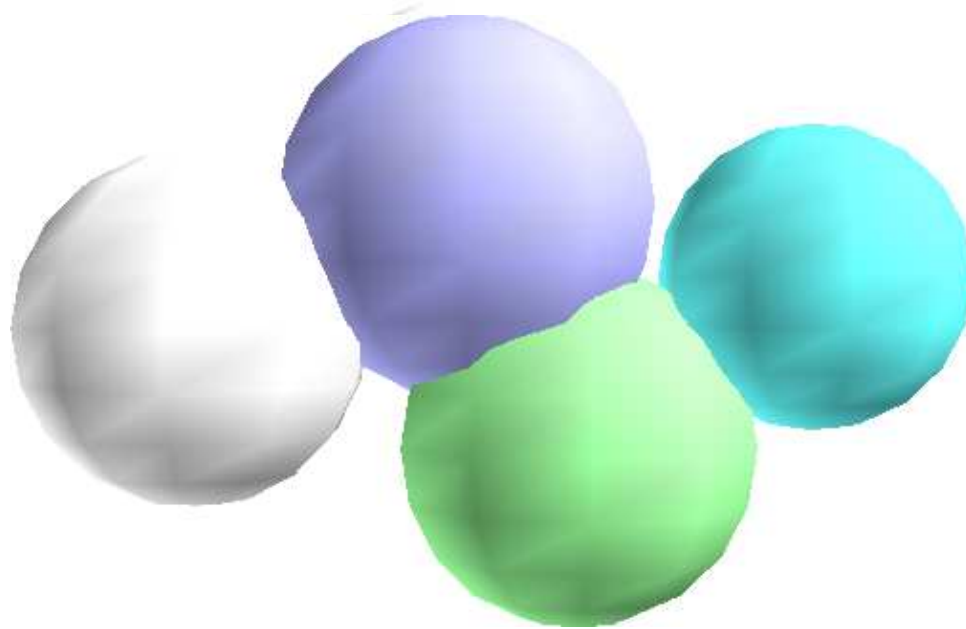
Example: *C. elegans* embryo



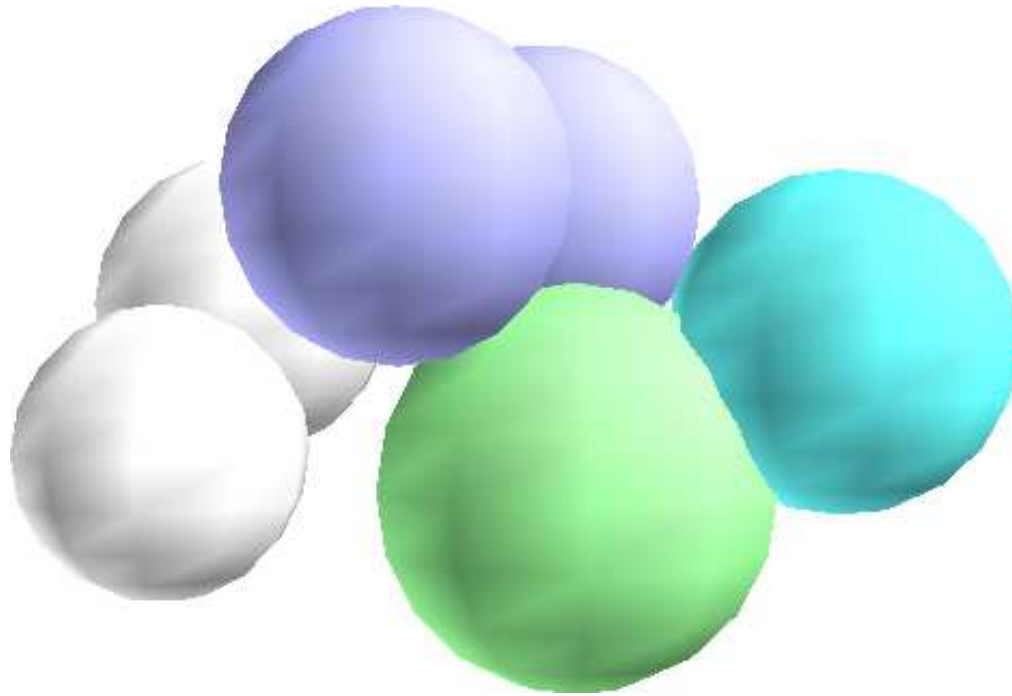
Example: *C. elegans* embryo



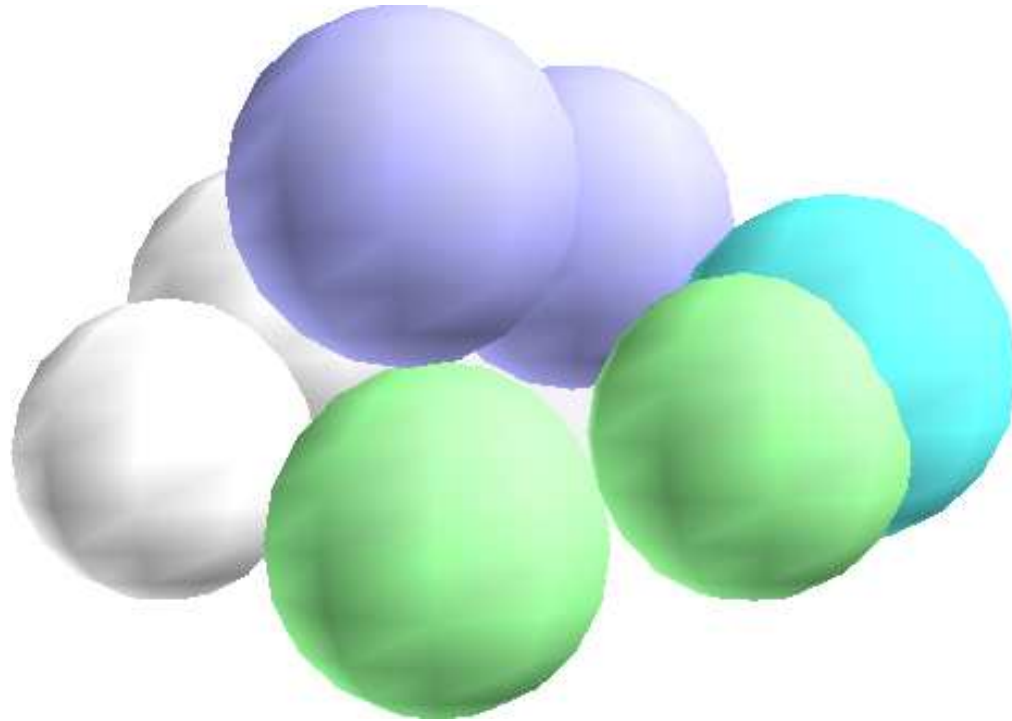
Example: *C. elegans* embryo



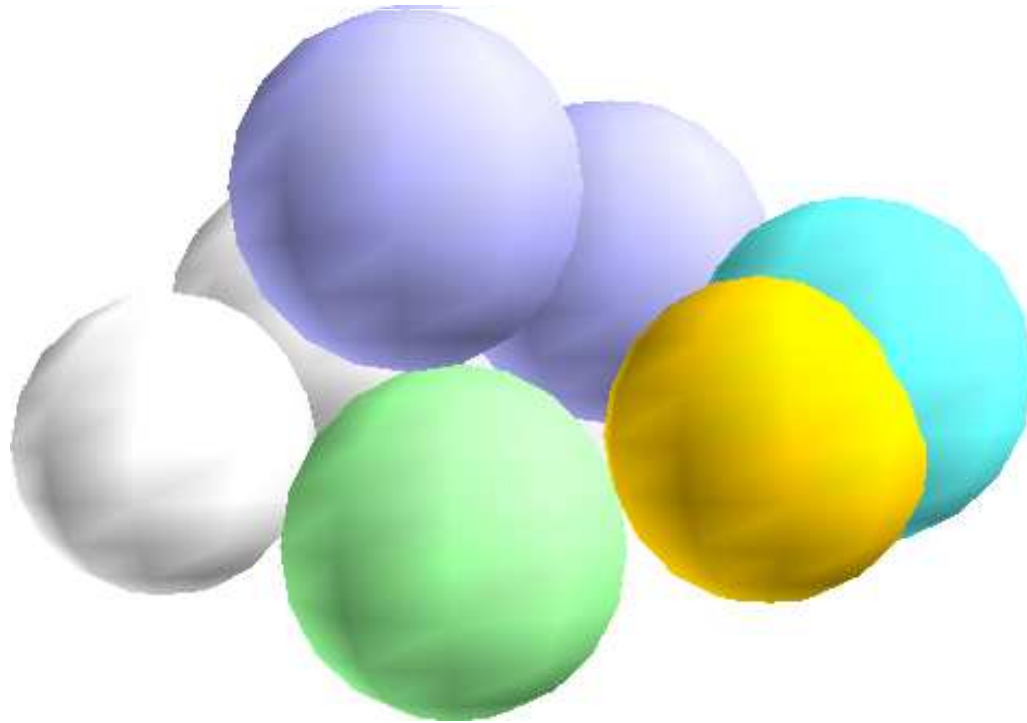
Example: *C. elegans* embryo



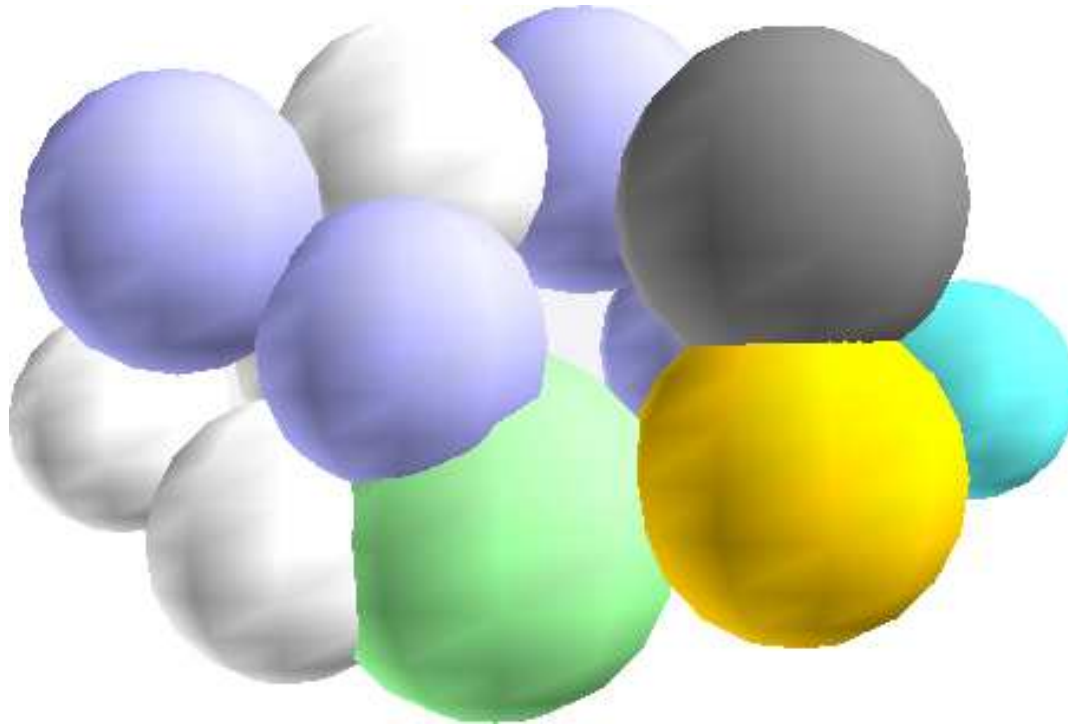
Example: *C. elegans* embryo



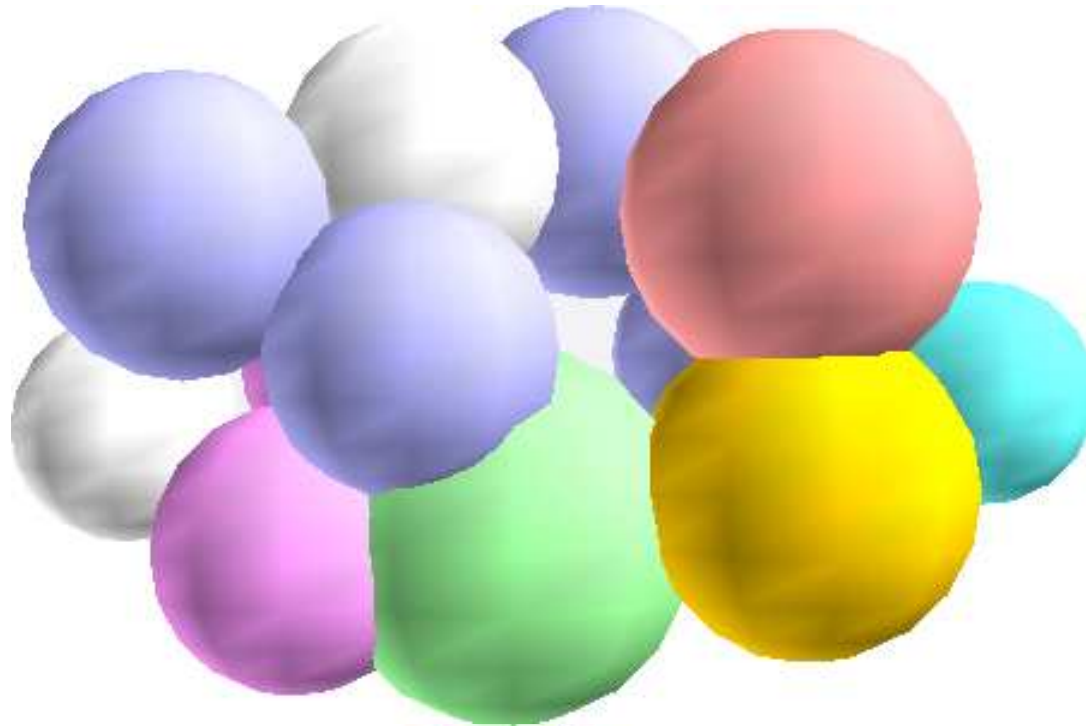
Example: *C. elegans* embryo



Example: *C. elegans* embryo



Example: *C. elegans* embryo



Information

- **Species names**
- **Interaction strengths or Boolean formulas**
- **Cell positions (x,y,z), radius**
- **[Cell division info]**
- **Initial state for all species in every cell**
- **[Species location]**