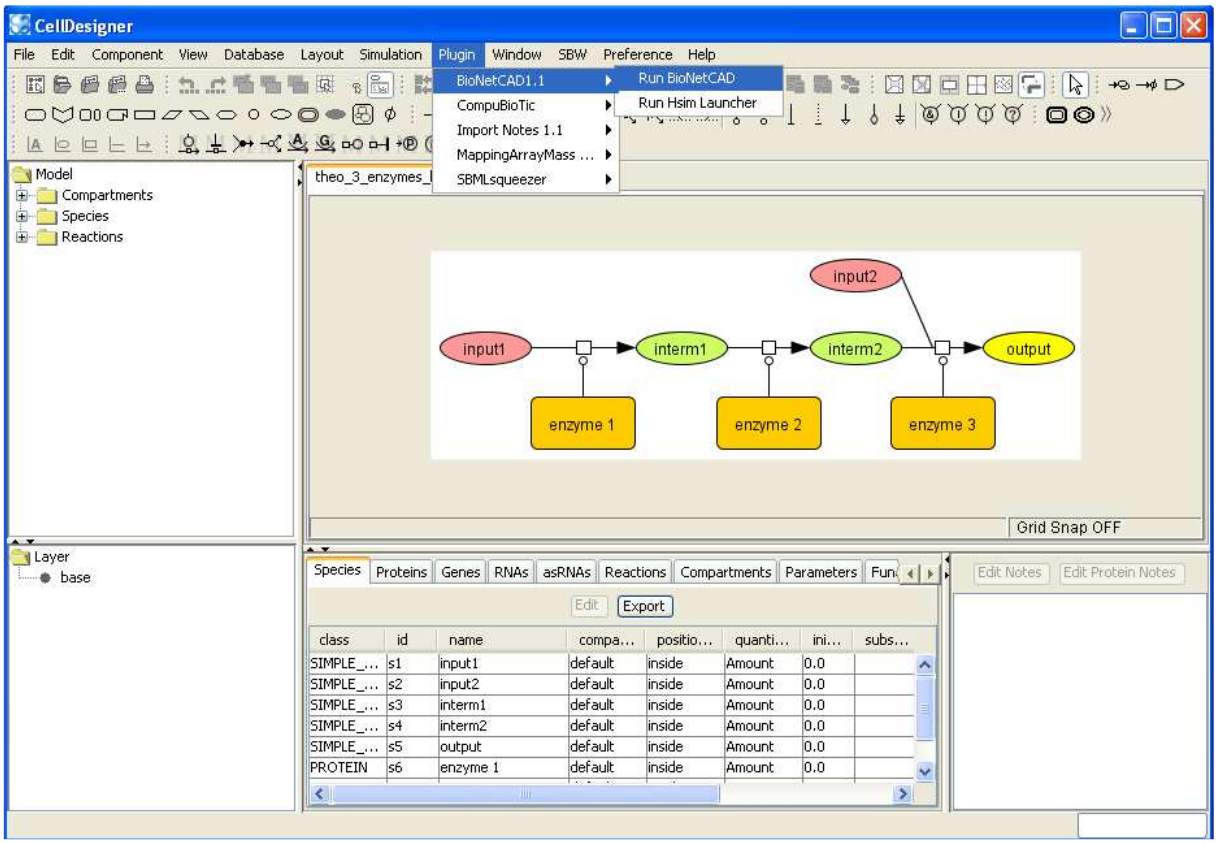
BioNetCAD1.1 tutorial

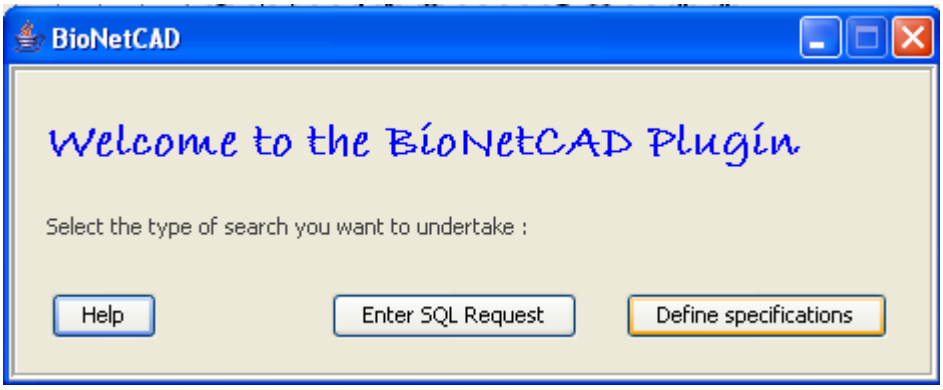
1. IMPLEMENTATION OF BIOCHEMICAL NETWORKS

A Logic "AND" gate

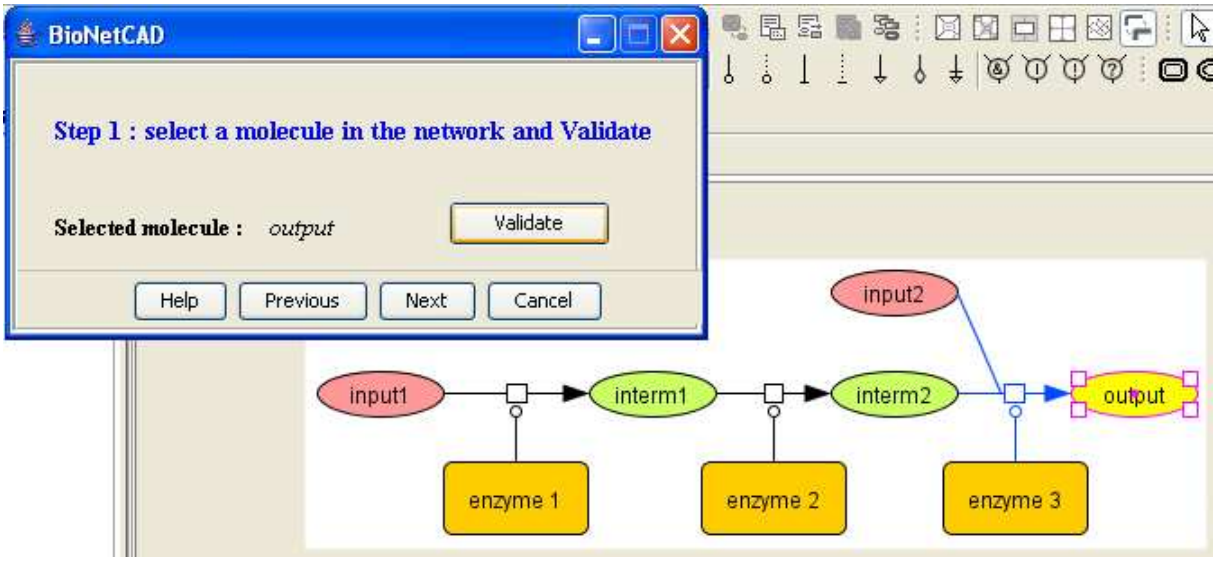
1. Open file in *CellDesigner*: theo_3_enzymes_logic_gate.xml
2. Once a model is opened in *CellDesigner*, go to menu Plugin and choose BioNetCAD1.1, and click on "Run BioNetCAD".



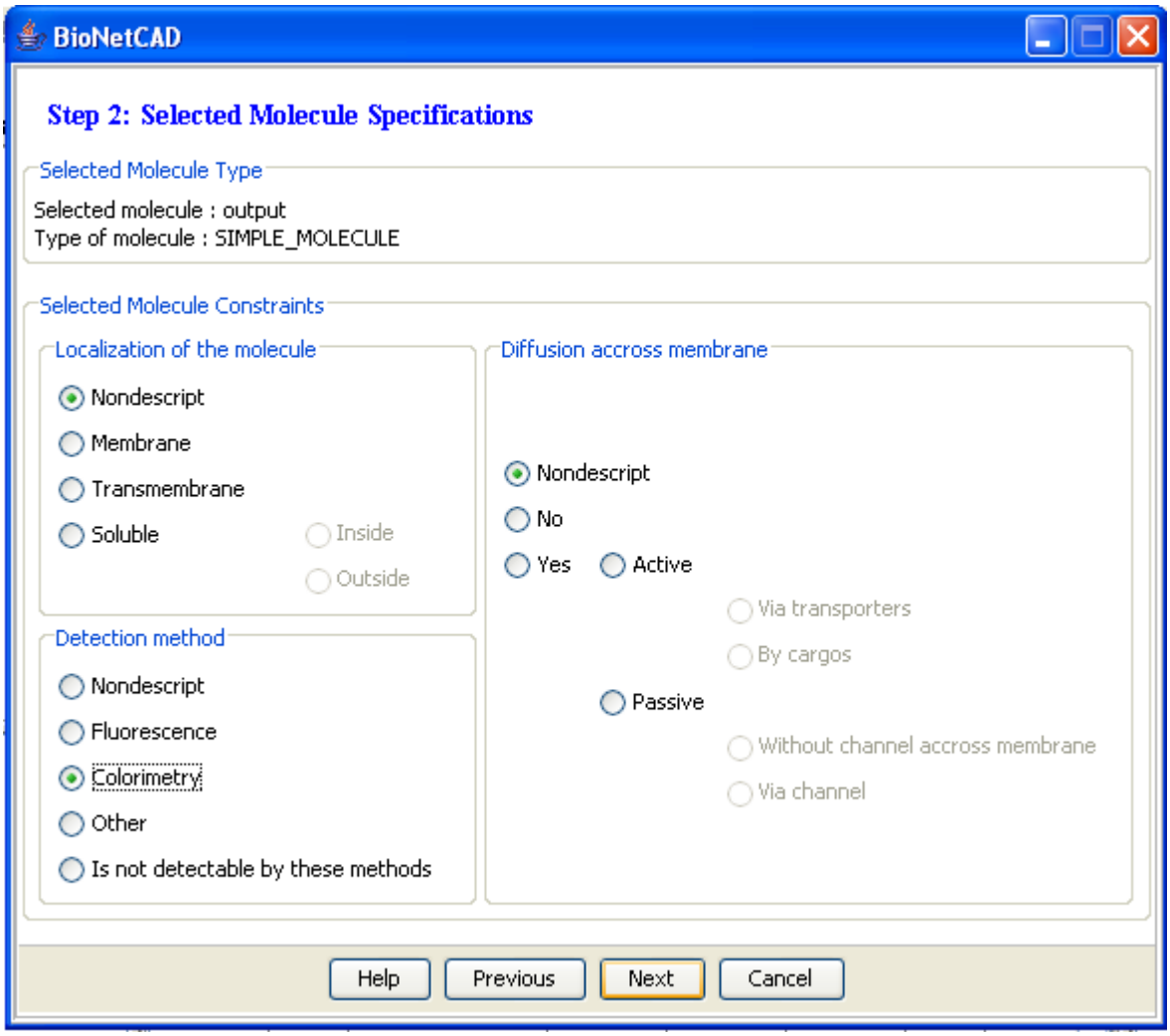
3. The BioNetCAD interface opens and asks you to choose between writing an SQL query and defining specifications about the network.
   Choose "Define specifications".



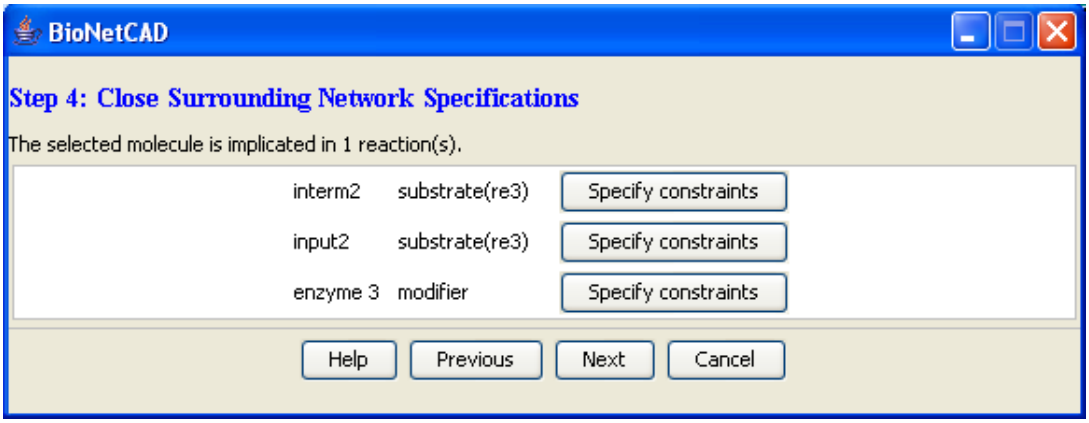
4. Click on the schema of “output” in the *CellDesigner* model in order to select it and then click on button “Validate” in the BioNetCAD interface to validate your choice. Then click on button “Next”.



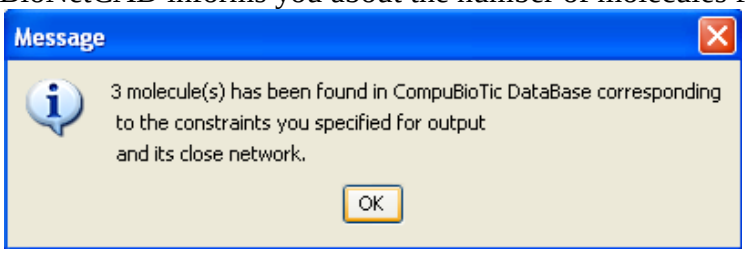
5. Next interface allows you to specify constraints about the molecule you have selected (“output” in this case).
   Choose “Colorimetry” in the “Detection method” section.
   Then click on button “Next”.



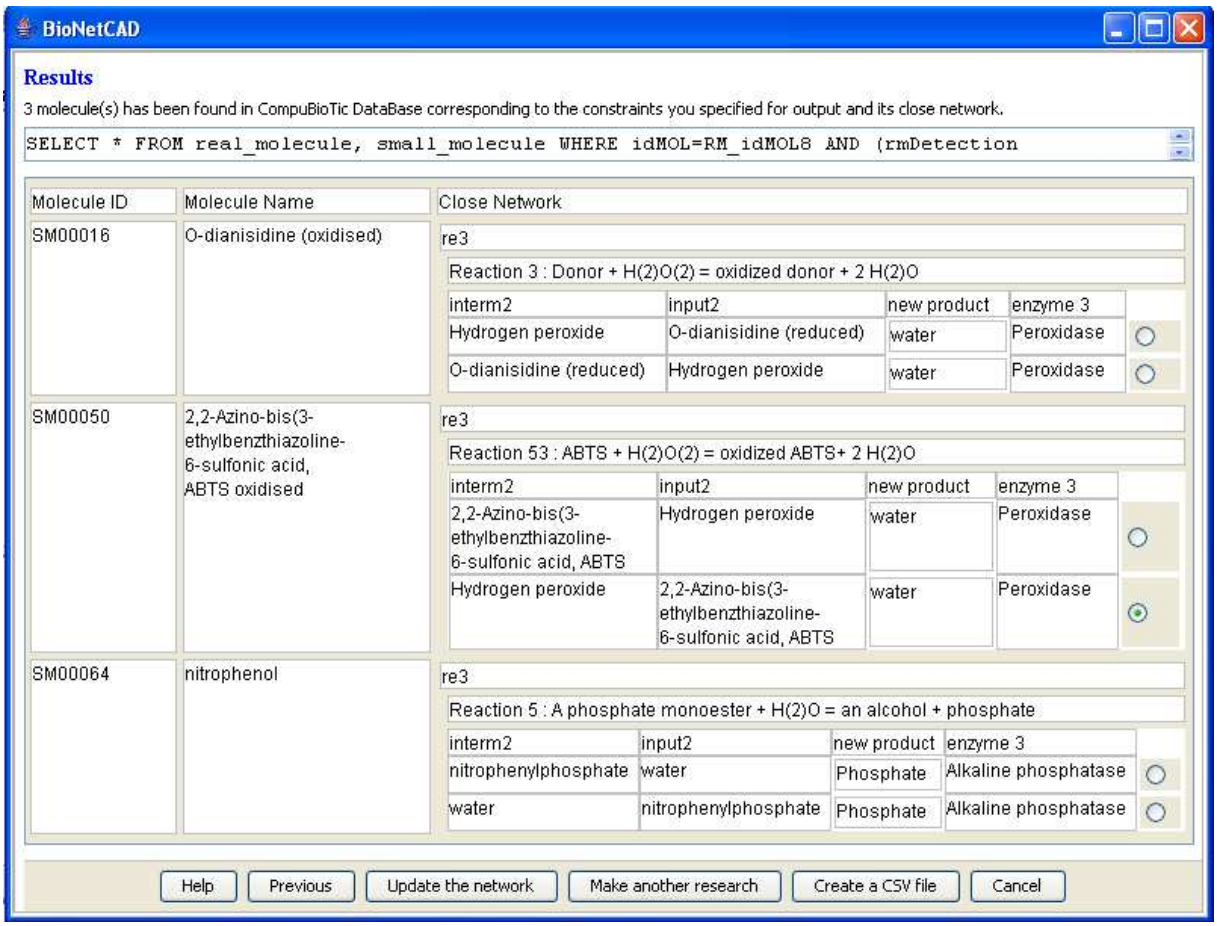
6. BioNetCAD proposes you to specify constraints about molecules directly linked to the selected molecule by reactions.
   Here, no constraints will be specified. Thus, click on “Next”.



7. Now BioNetCAD performs a research on the database taking into account the constraints you specified for the selected molecule, the constraints about the network’s molecules, and the topology of the network drawn under *CellDesigner*.
   After the research, BioNetCAD informs you about the number of molecules found. Click “Ok”.

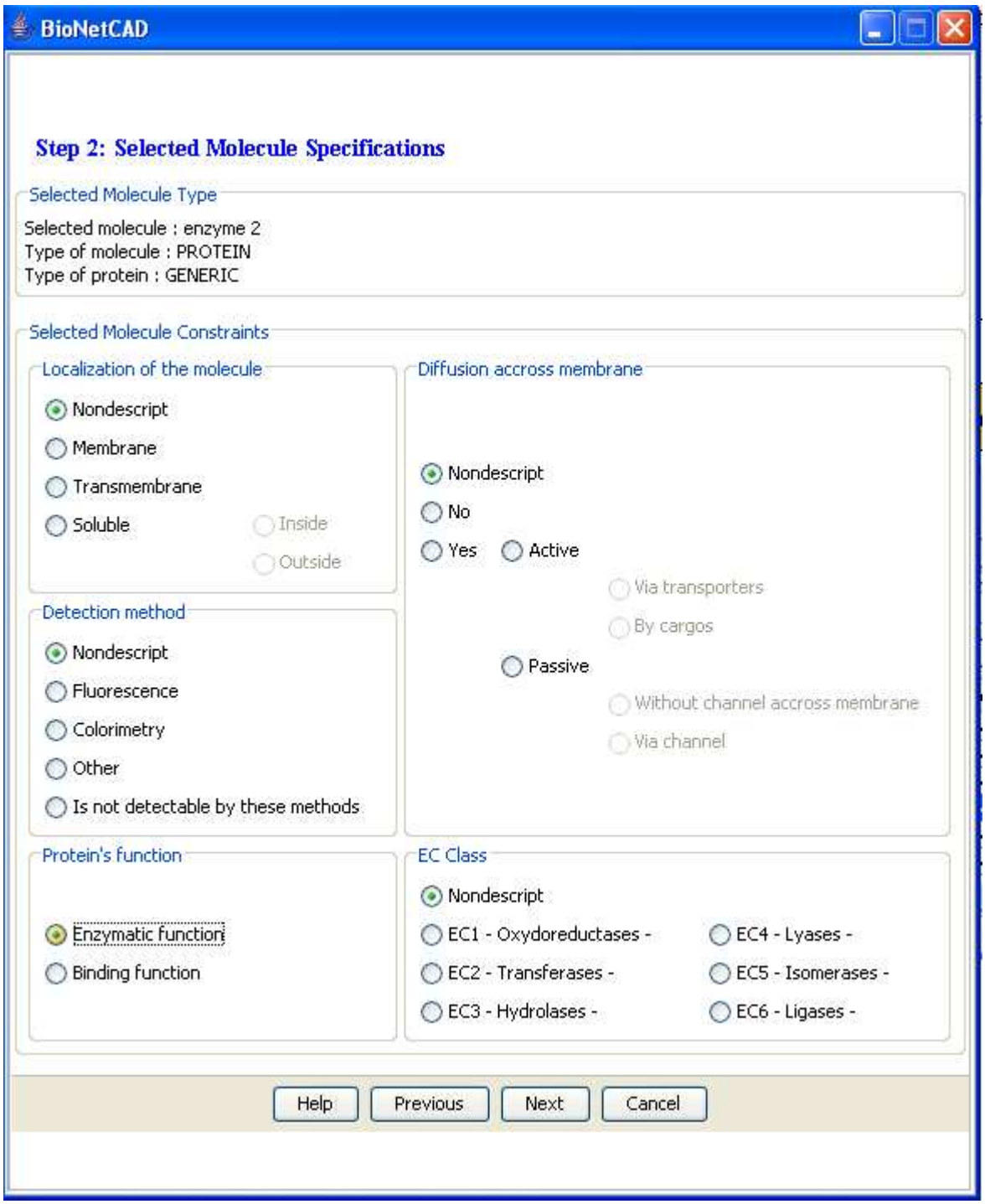


8. The results of the research on CompuBioTicDB are displayed. Choose one combination by *CellDesigner* reaction, by selecting a radio button: for instance, select SM00050 with hydrogen peroxide as implementation of “interm2”. Once your choice is made, click on “Update the network”.

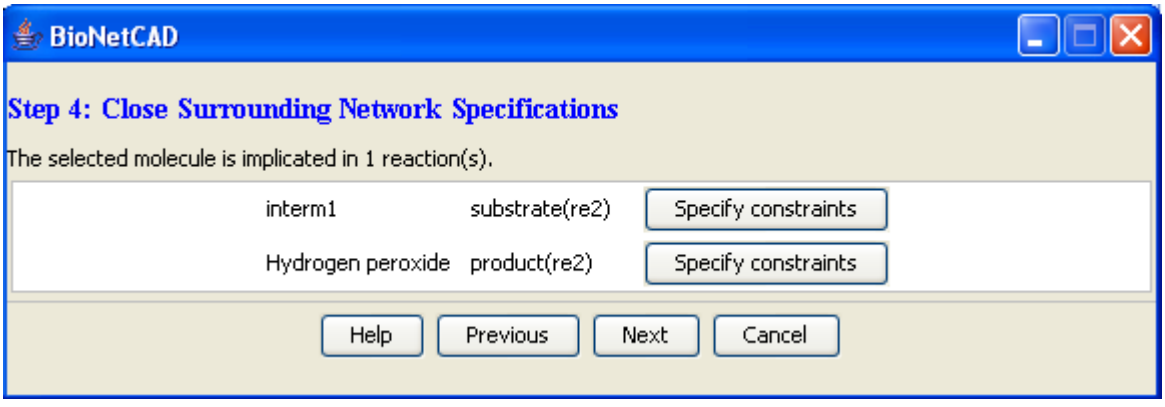


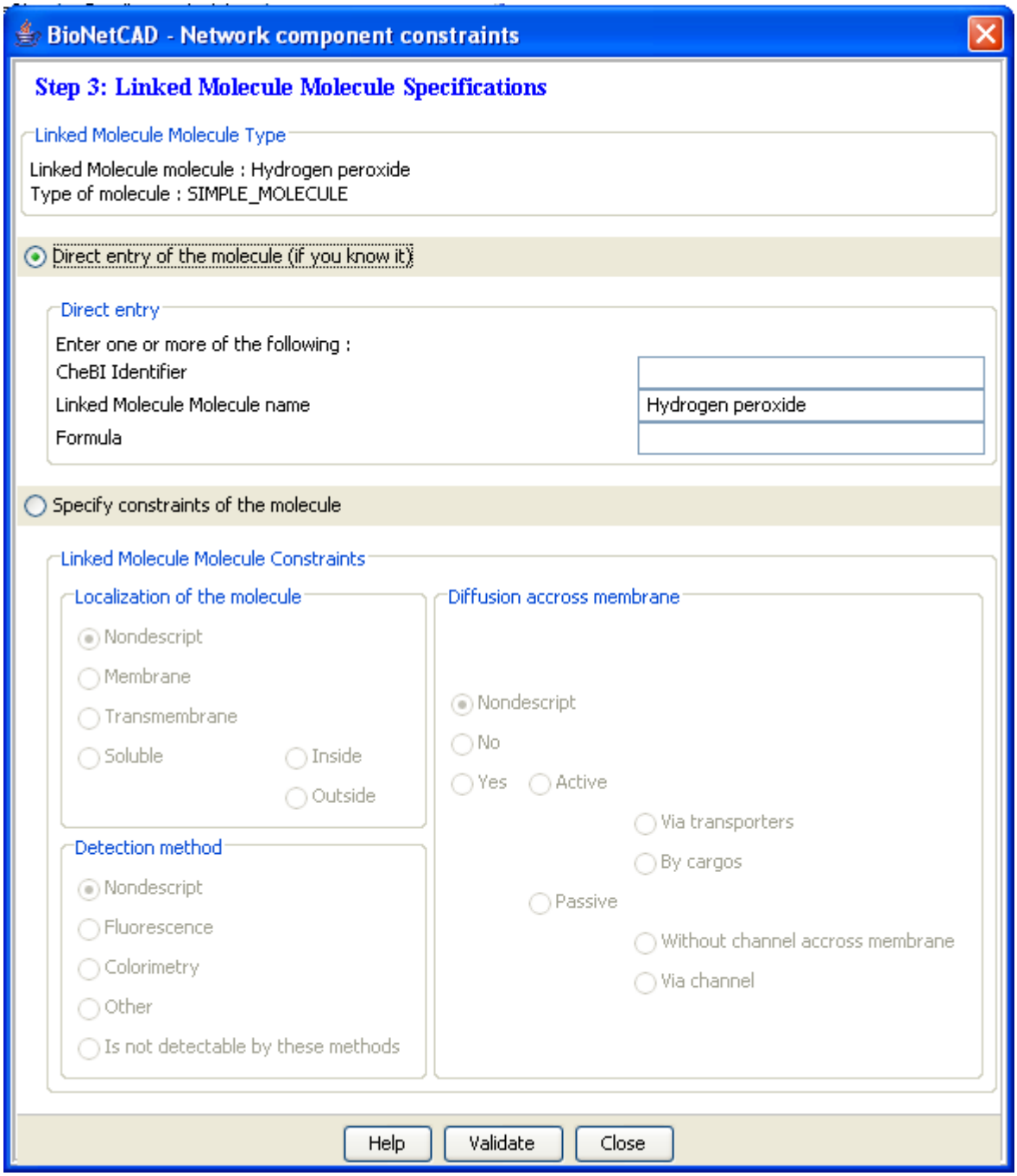
9. The network is implemented with the choice of molecules you have made.
   Click on “Make another research” to search implementations for the molecule “enzyme 2”.

10. Repeat steps 3 and 4 of the tutorial with selection of “enzyme 2”. In the “Step 2: Selected Molecule Specifications” interface, select “Enzymatic function” in the “Protein’s function” section. Then click “Next”.



11. Click on “Specify constraints” for the molecule “Hydrogen peroxide”. Click “Validate” on the next interface.

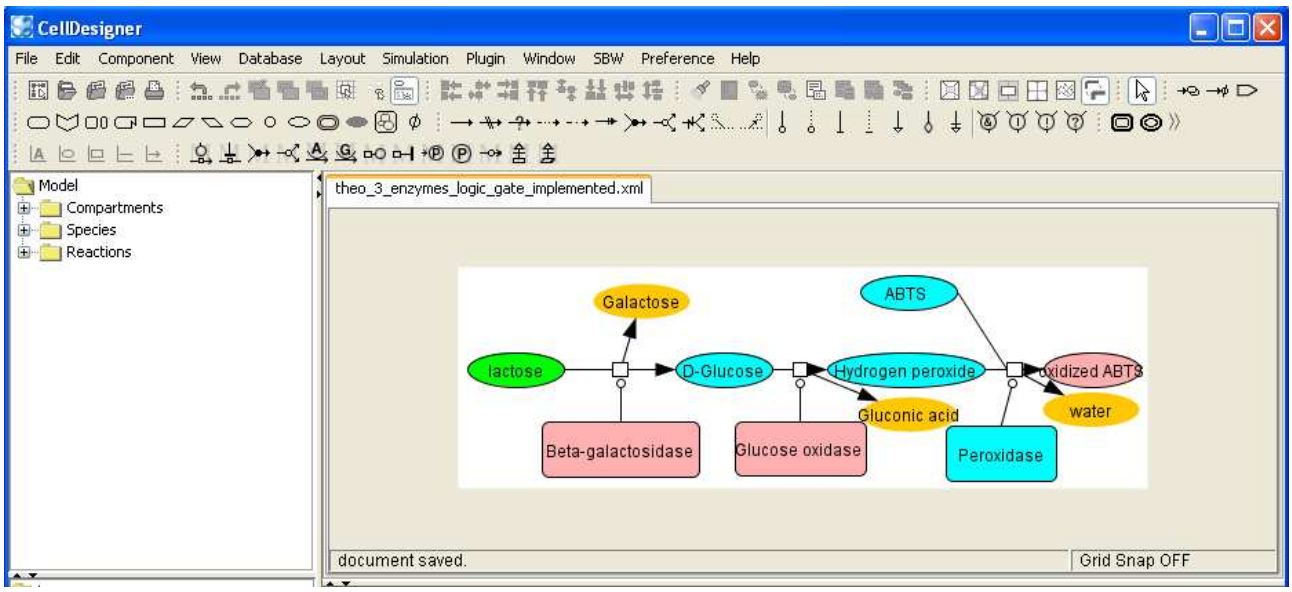




BioNetCAD will search for enzymes having hydrogen peroxide as product.

12. Again, results are displayed. Choose “glucose oxidase” with D-glucose as implementation of interm1. Repeat tutorial steps 9 to 11. For the last search, choose “enzyme 1” as firstly selected molecule and specify constraints about the D-glucose in the close network.

13. Finally, an implemented network is obtained.



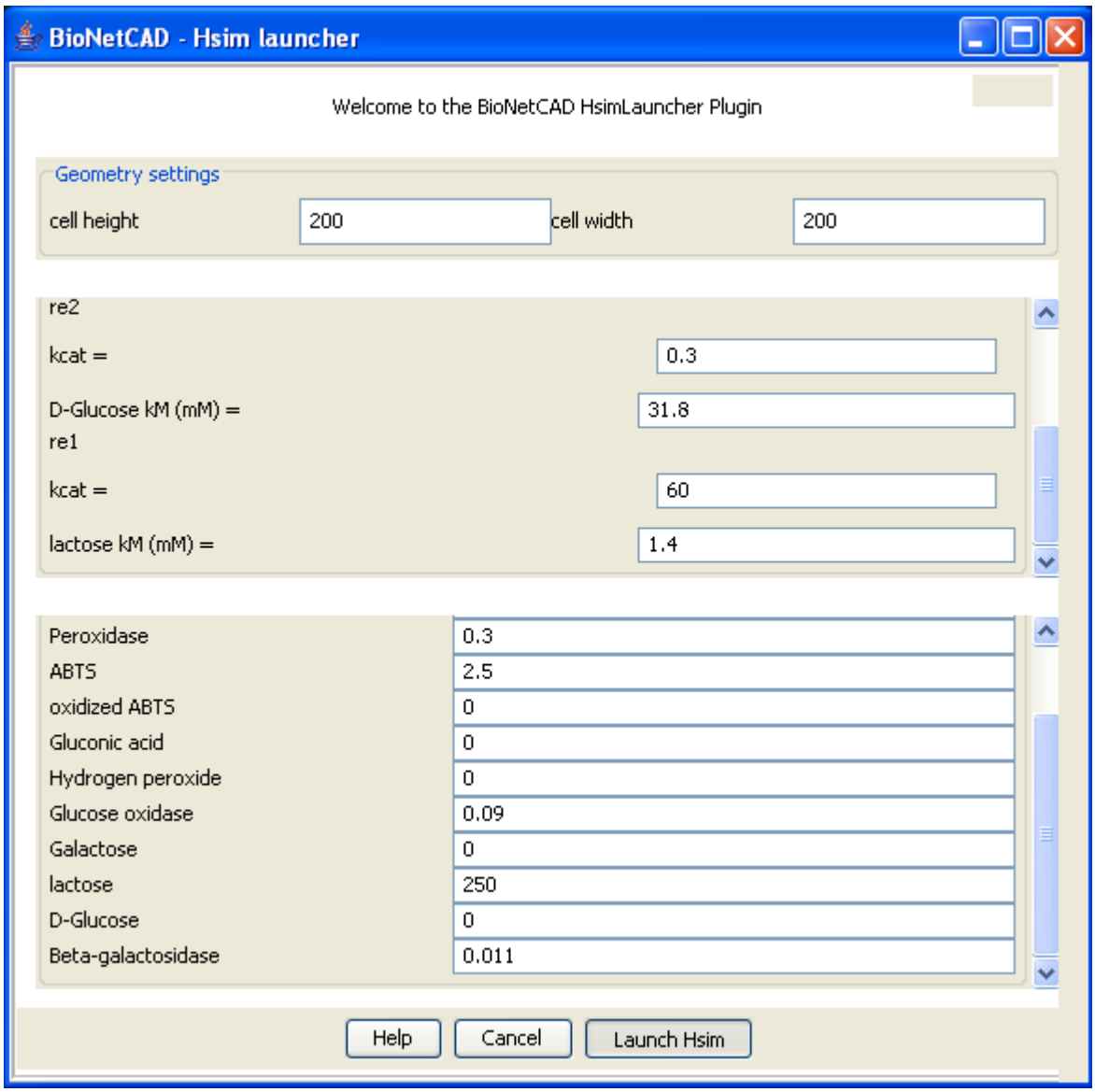
2. HSIM SIMULATIONS

1. Open theo_3_enzymes_logic_gate_implemented.xml or theo_3_enzymes_logic_gate.xml after implementation in Section 1 of the present tutorial.
2. In the Plugin menu of CellDesigner and choose BioNetCAD1.1, and click on “Run Hsim launcher”.
3. Hsim launcher interface asks for several parameters needed for the Hsim configuration file.
   As an example, enter the following parameters:
   Geometry settings: cell height:200; cell width: 200
   Reactions parameters settings:
   - Re3
     - kcat=736
     - Hydrogen peroxide kM=0.005
     - ABTS kM=0.18
   - Re2
     - Kcat=0.3
     - D-glucose kM=31.8
   - Re3
     - Kcat=60
     - Lactose kM=1.4

   Initial quantities settings:

Water	0
Peroxidase	0.3
ABTS	2.5
Oxidized ABTS	0
Gluconic acid	0
Hydrogen peroxide	0
Glucose oxidase	0.09
Galactose	0
Lactose	250
D-glucose	0
Beta-galactosidase	0.011

When all the parameters are specified, click on “Launch Hsim”.


BioNetCAD - Hsim launcher
Welcome to the BioNetCAD HsimLauncher Plugin
Geometry settings
cell height
200
cell width
200
re2
kcat =
0.3
D-Glucose kM (mM) =
31.8
re1
kcat =
60
lactose kM (mM) =
1.4
Peroxidase
0.3
ABTS
2.5
oxidized ABTS
0
Gluconic acid
0
Hydrogen peroxide
0
Glucose oxidase
0.09
Galactose
0
lactose
250
D-Glucose
0
Beta-galactosidase
0.011
Help
Cancel
Launch Hsim