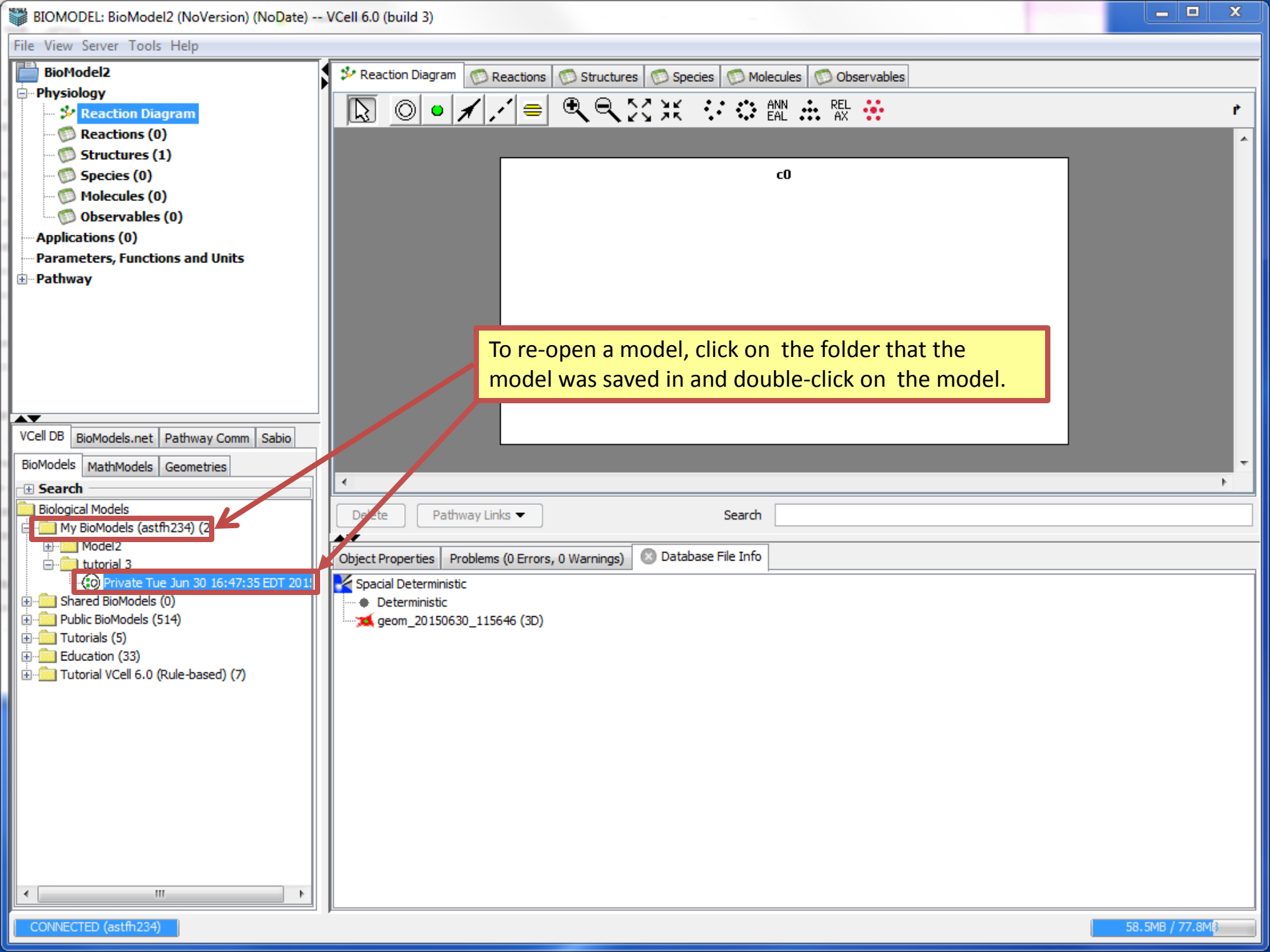
VCell Tutorial

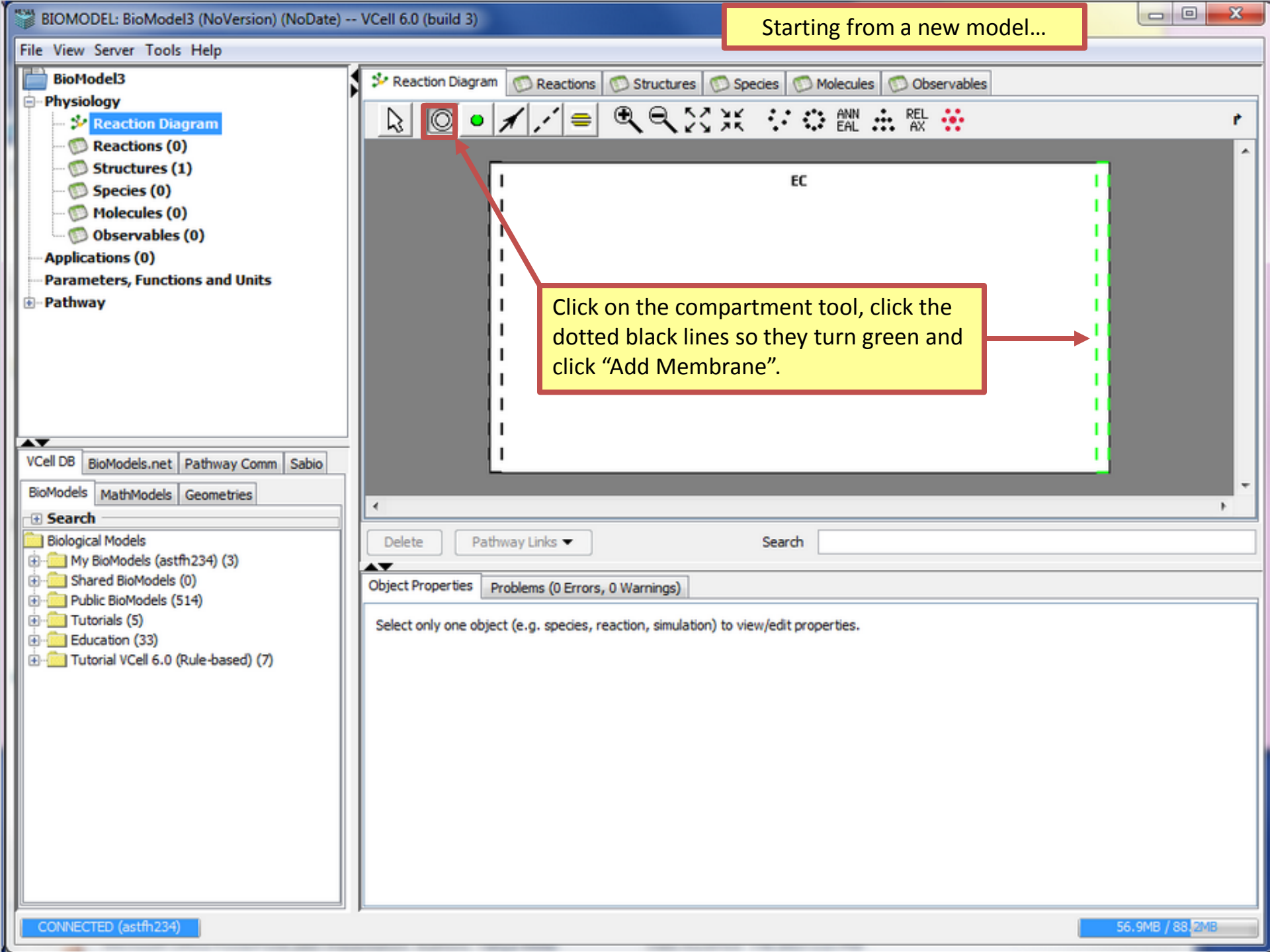
FRAP with binding

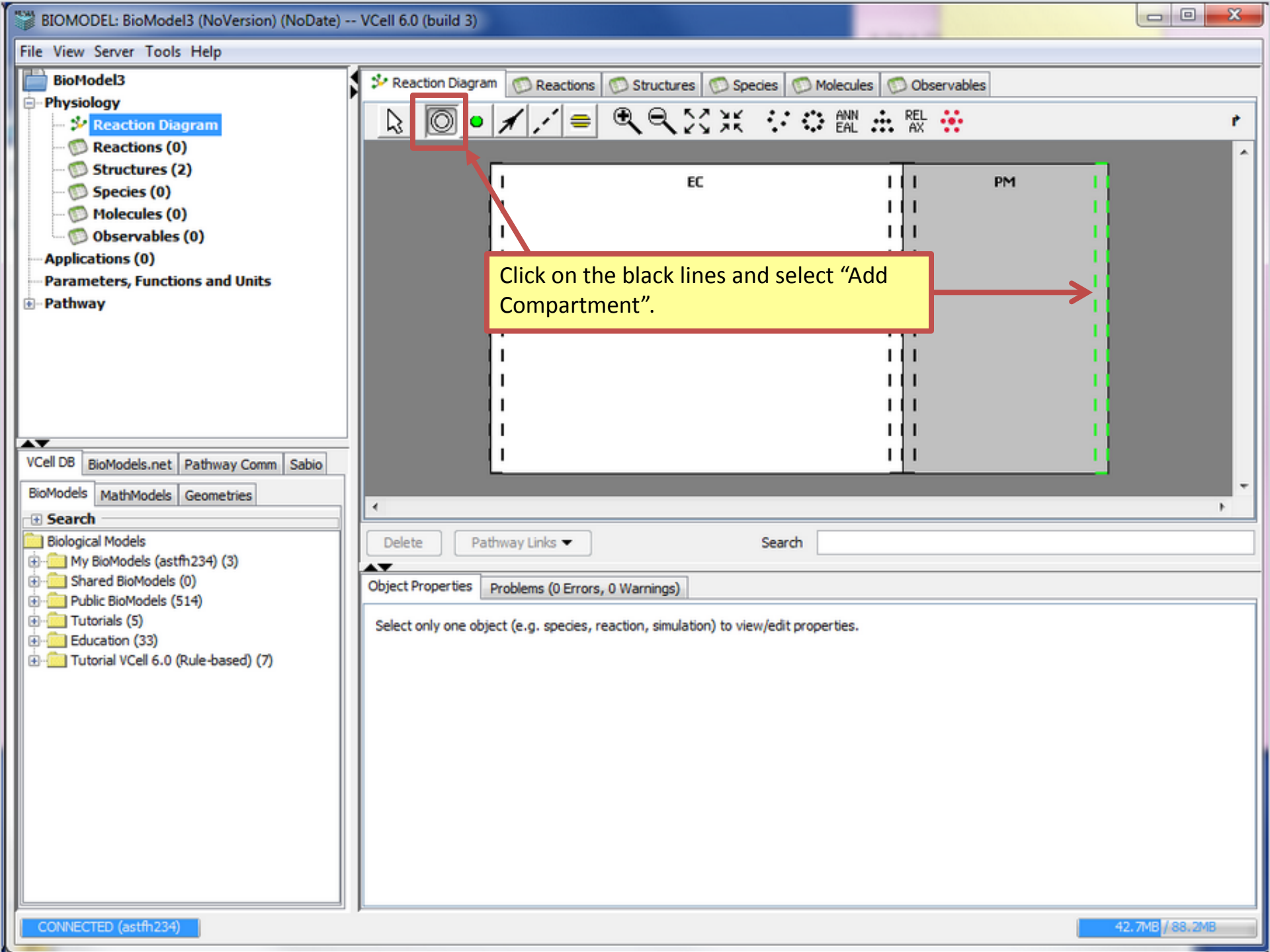
Create a simple biomodel and spatial (PDE) application to simulate a photobleaching experiment with both diffusion and binding.

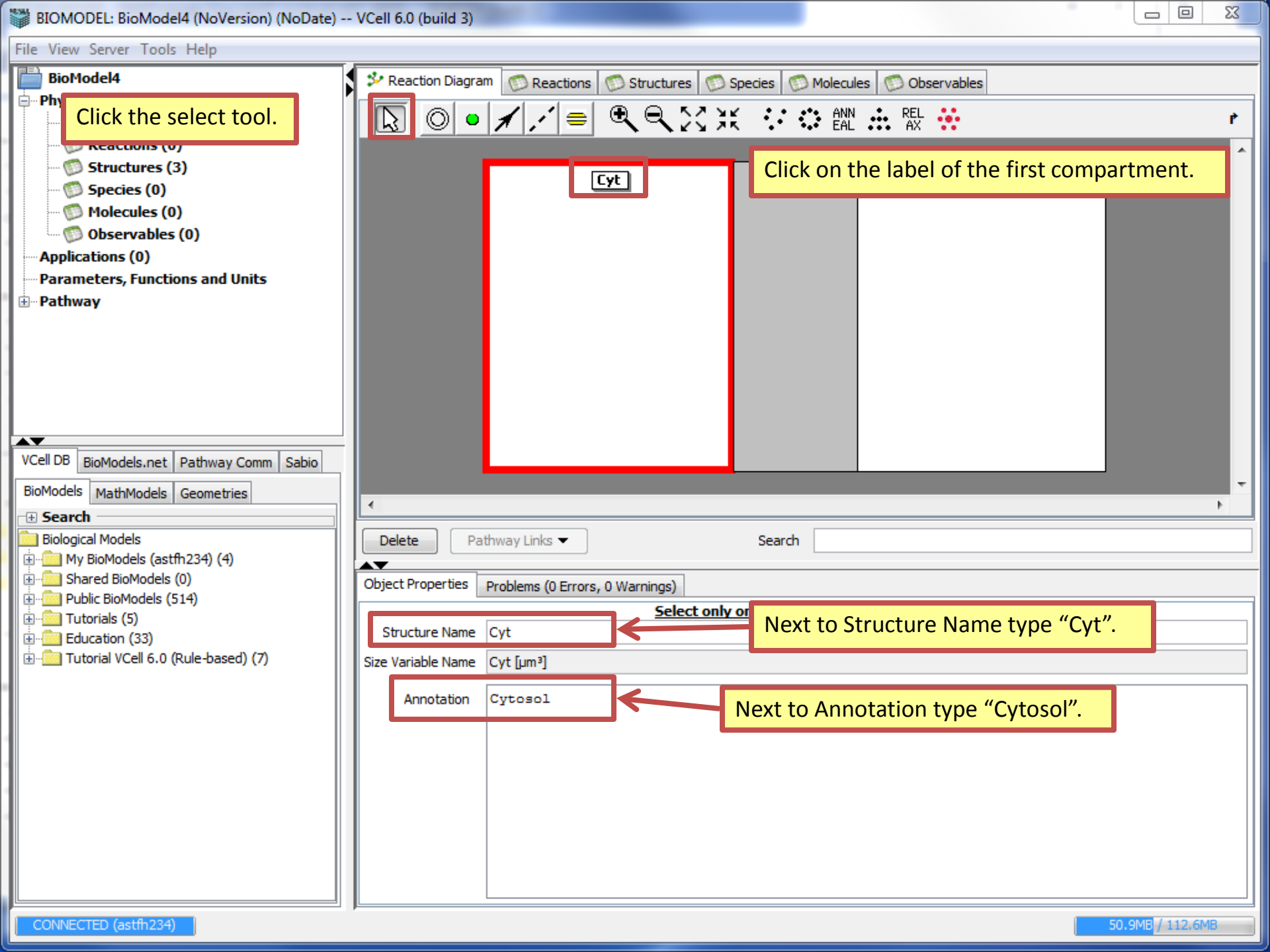
In this tutorial…

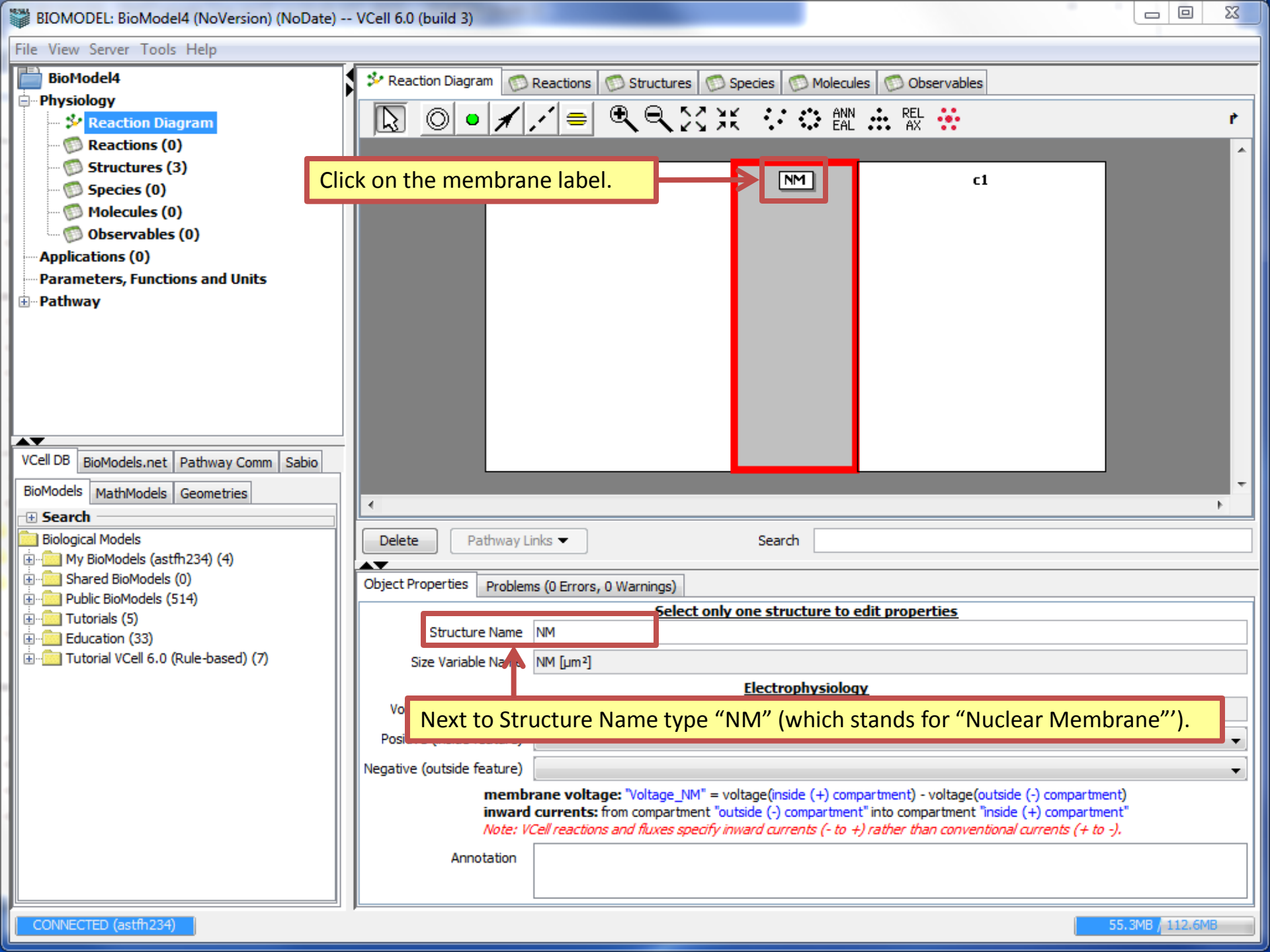
- Gain a basic introduction to the Virtual Cell interface
- Create a simple biomodel with species and reactions
- Create a compartmental (ODE) application of the model to determine steady state binding conditions.
- Create a spatial deterministic (PDE) application using analytic equations to create a simple geometry
- Define initial concentrations that are non-uniform using Boolean expressions
- Created a timed event in a spatial simulation.
- View and analyze results of a spatial simulation.

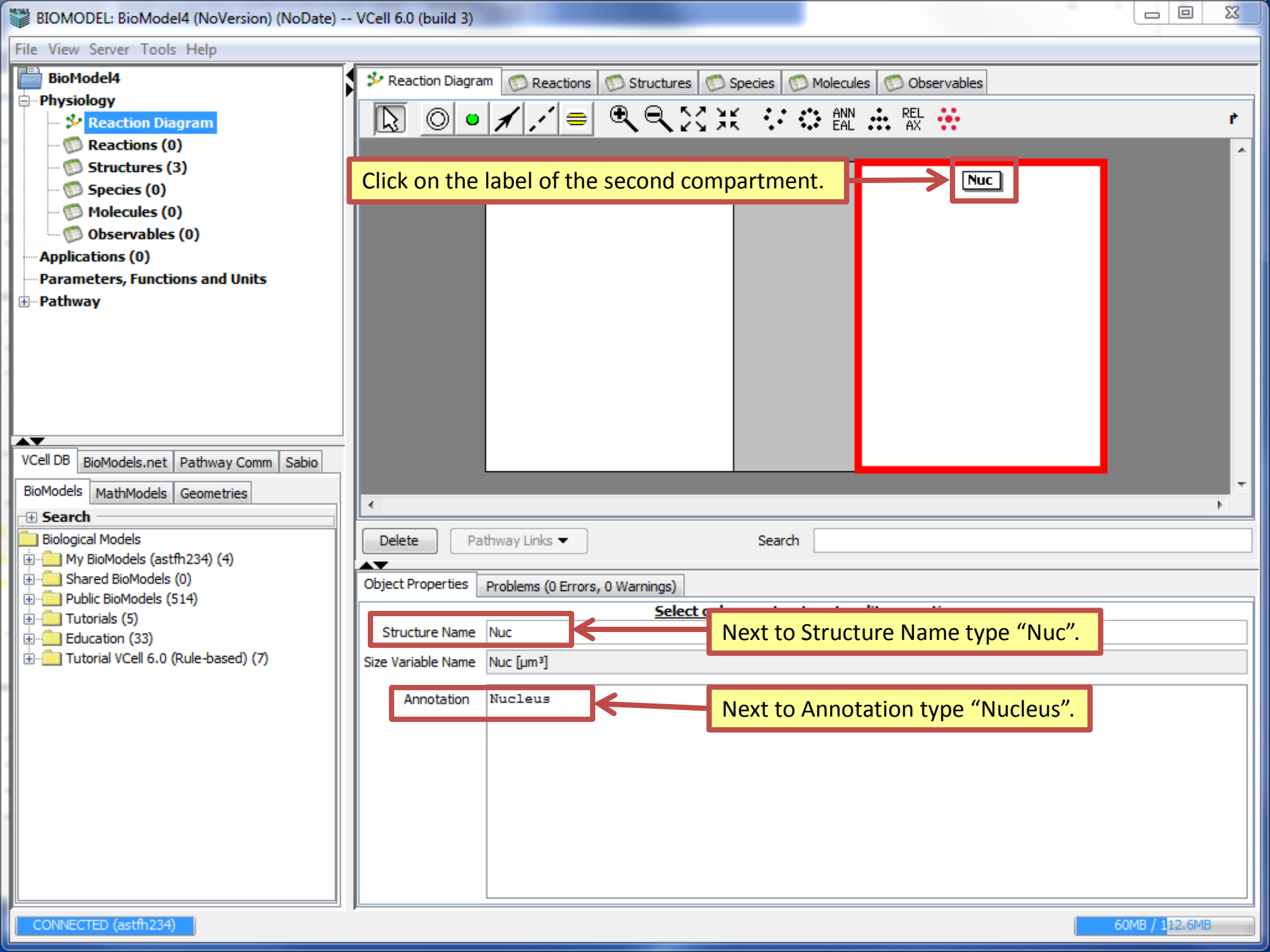

BIOMODEL: BioModel2 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel2
Physiology
Reaction Diagram
Reactions (0)
Structures (1)
Species (0)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
c0
To re-open a model, click on the folder that the model was saved in and double-click on the model.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (2
Model2
tutorial 3
Private Tue Jun 30 16:47:35 EDT 201
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Database File Info
Spacial Deterministic
Deterministic
geom_20150630_115646 (3D)
CONNECTED (astfh234)
58.5MB / 77.8MB

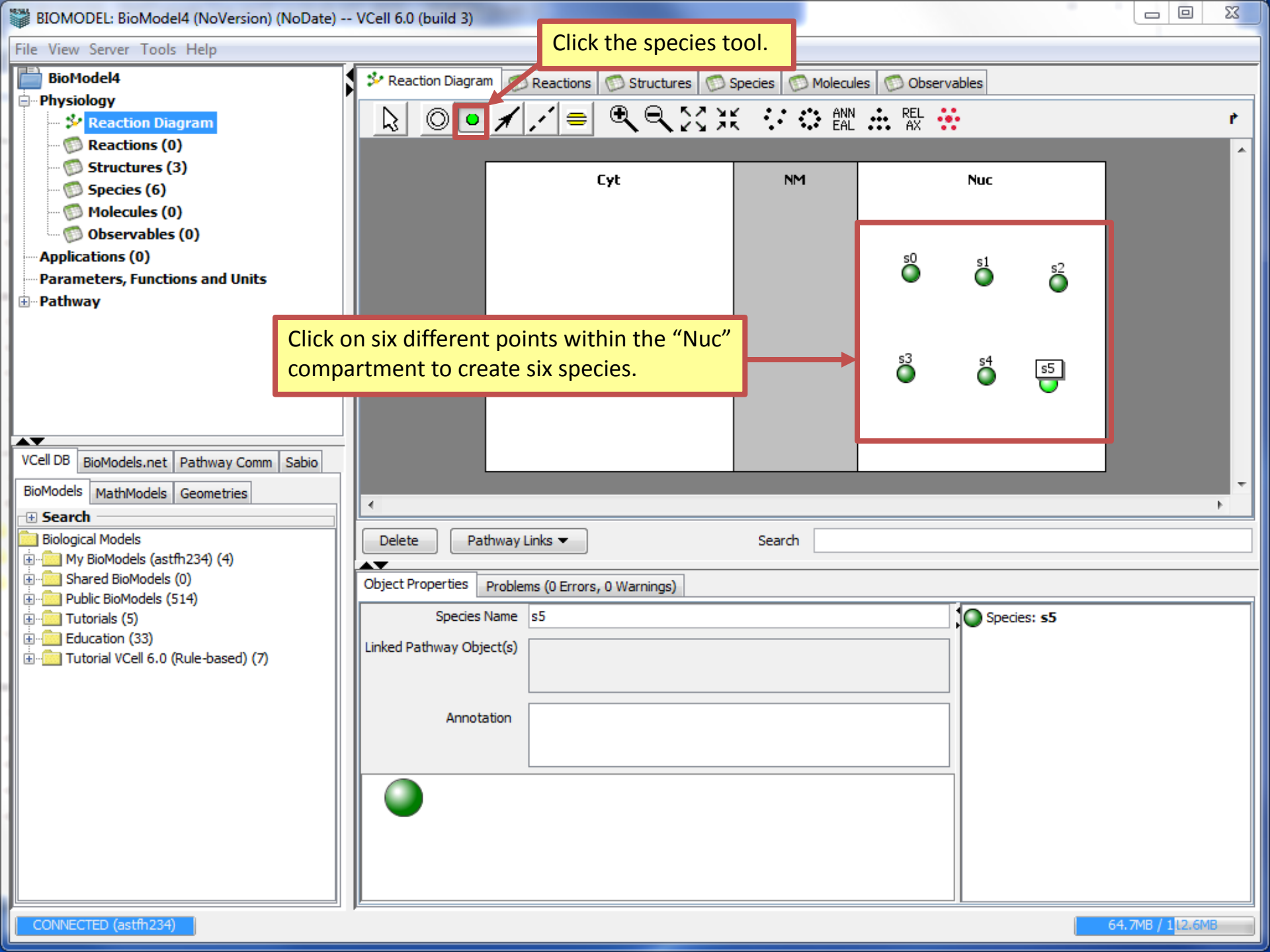

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
Starting from a new model…
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (1)
Species (0)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
EC
Click on the compartment tool, click the dotted black lines so they turn green and click “Add Membrane”.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (3)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
56.9MB / 88.2MB

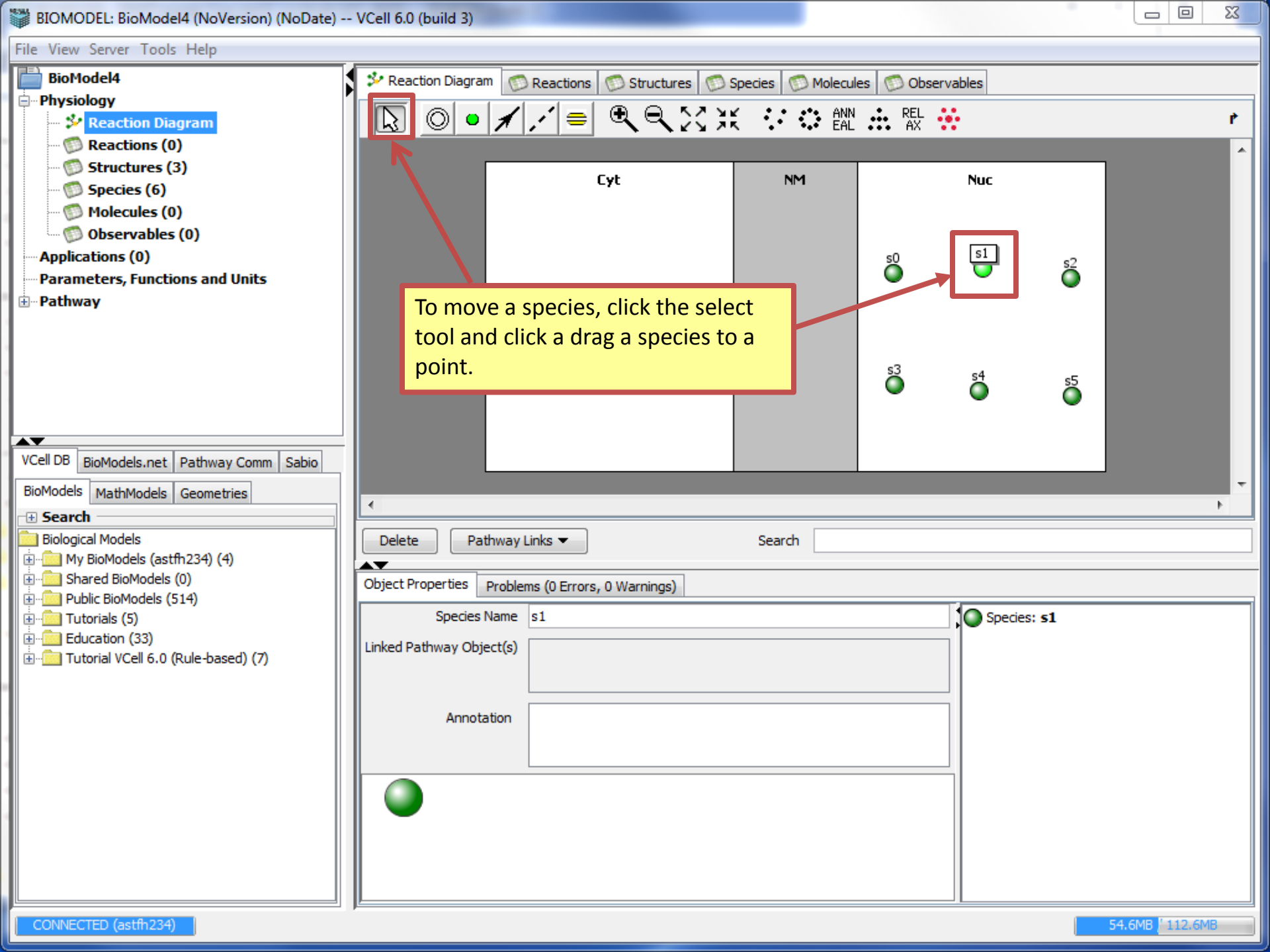

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (2)
Species (0)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
EC
PM
Click on the black lines and select “Add Compartment”.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (3)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
42.7MB / 88.2MB

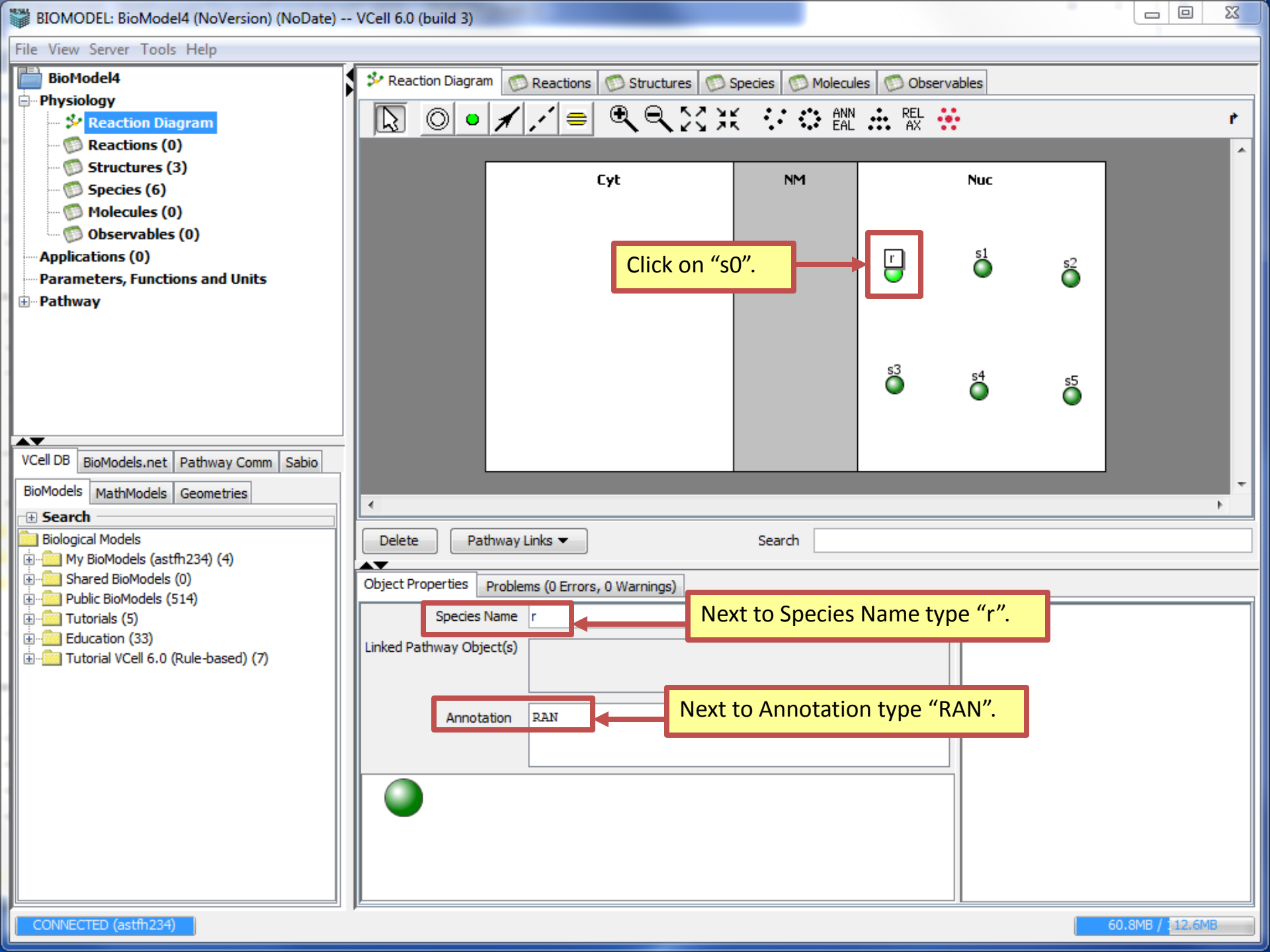

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Structures (3)
Species (0)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Click the select tool.
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
Click on the label of the first compartment.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Structure Name
Cyt
Next to Structure Name type “Cyt”.
Size Variable Name
Cyt [µm³]
Annotation
Cytosol
Next to Annotation type “Cytosol”.
CONNECTED (astfh234)
50.9MB / 112.6MB

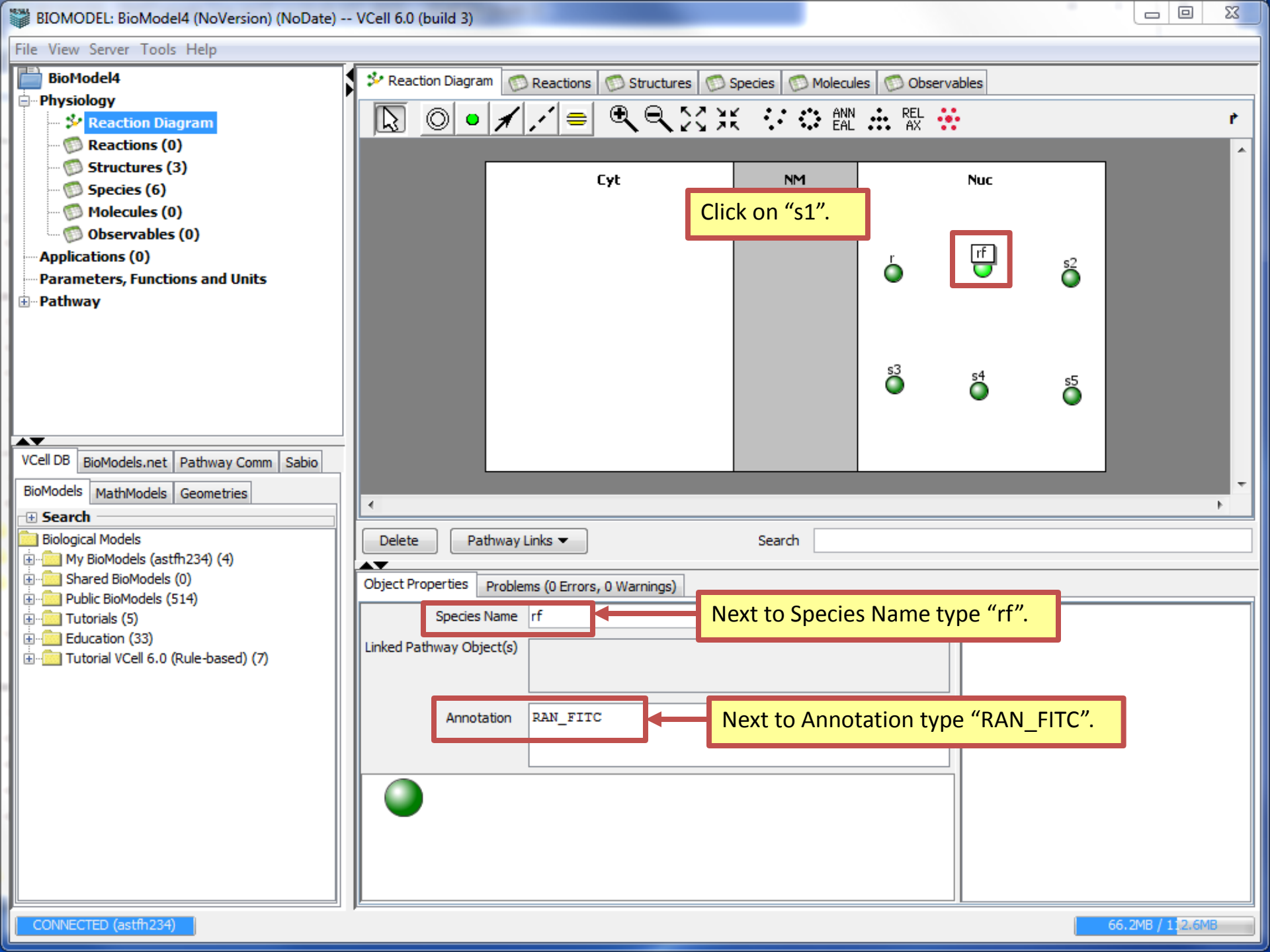

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (0)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Click on the membrane label.
NM
c1
Delete
Pathway Links
Search
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one structure to edit properties
Structure Name
NM
Size Variable Name
NM [μm²]
Electrophysiology
Next to Structure Name type “NM” (which stands for “Nuclear Membrane”’).
Negative (outside feature)
membrane voltage: "Voltage_NM" = voltage(inside (+) compartment) - voltage(outside (-) compartment)
inward currents: from compartment "outside (-) compartment" into compartment "inside (+) compartment"
Note: VCell reactions and fluxes specify inward currents (- to +) rather than conventional currents (+ to -).
Annotation
CONNECTED (astfh234)
55.3MB / 112.6MB

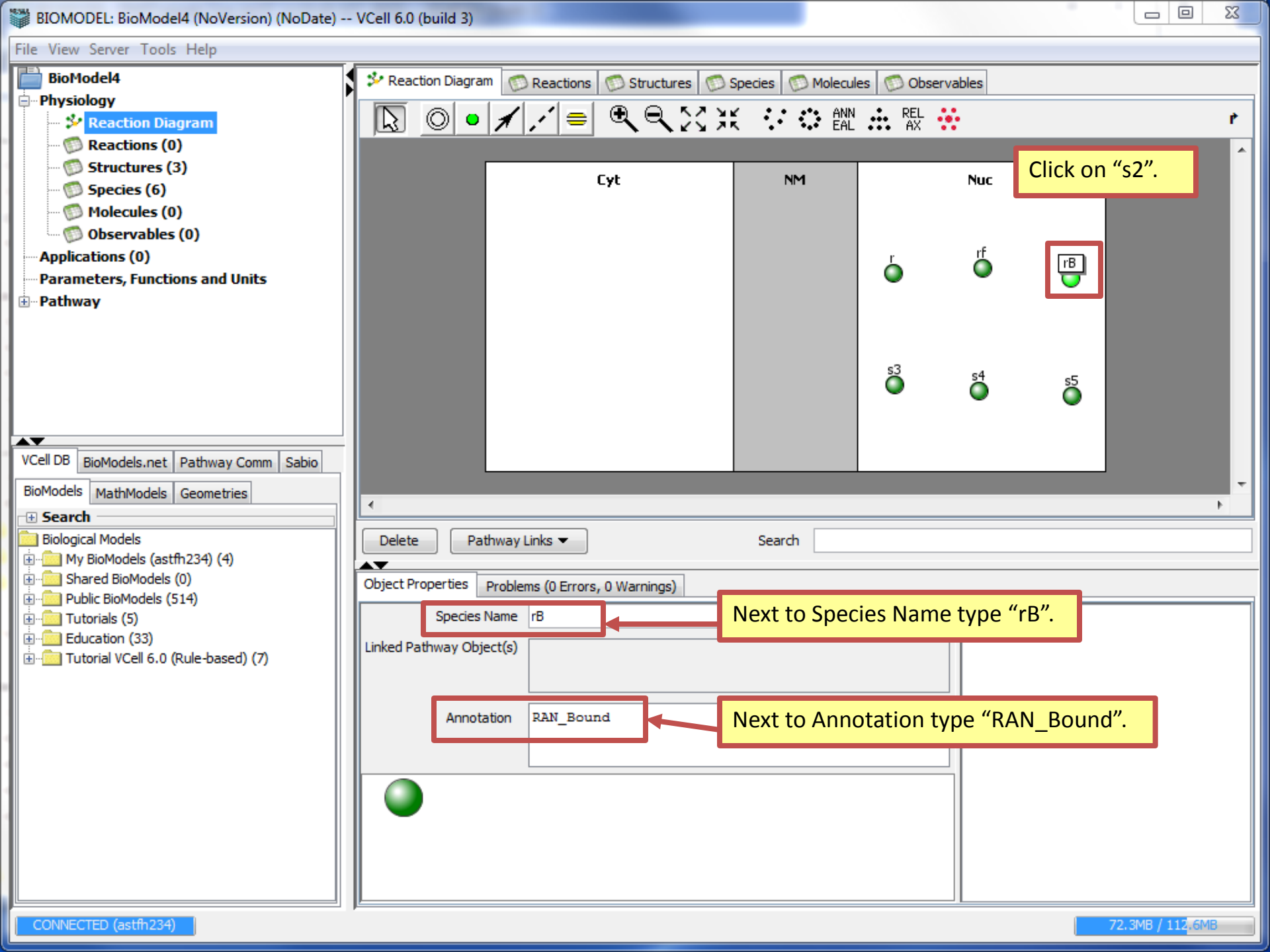

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (0)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Click on the label of the second compartment.
Nuc
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Structure Name
Nuc
Next to Structure Name type “Nuc”.
Size Variable Name
Nuc [μm³]
Annotation
Nucleus
Next to Annotation type “Nucleus”.
CONNECTED (astfh234)
60MB / 112.6MB

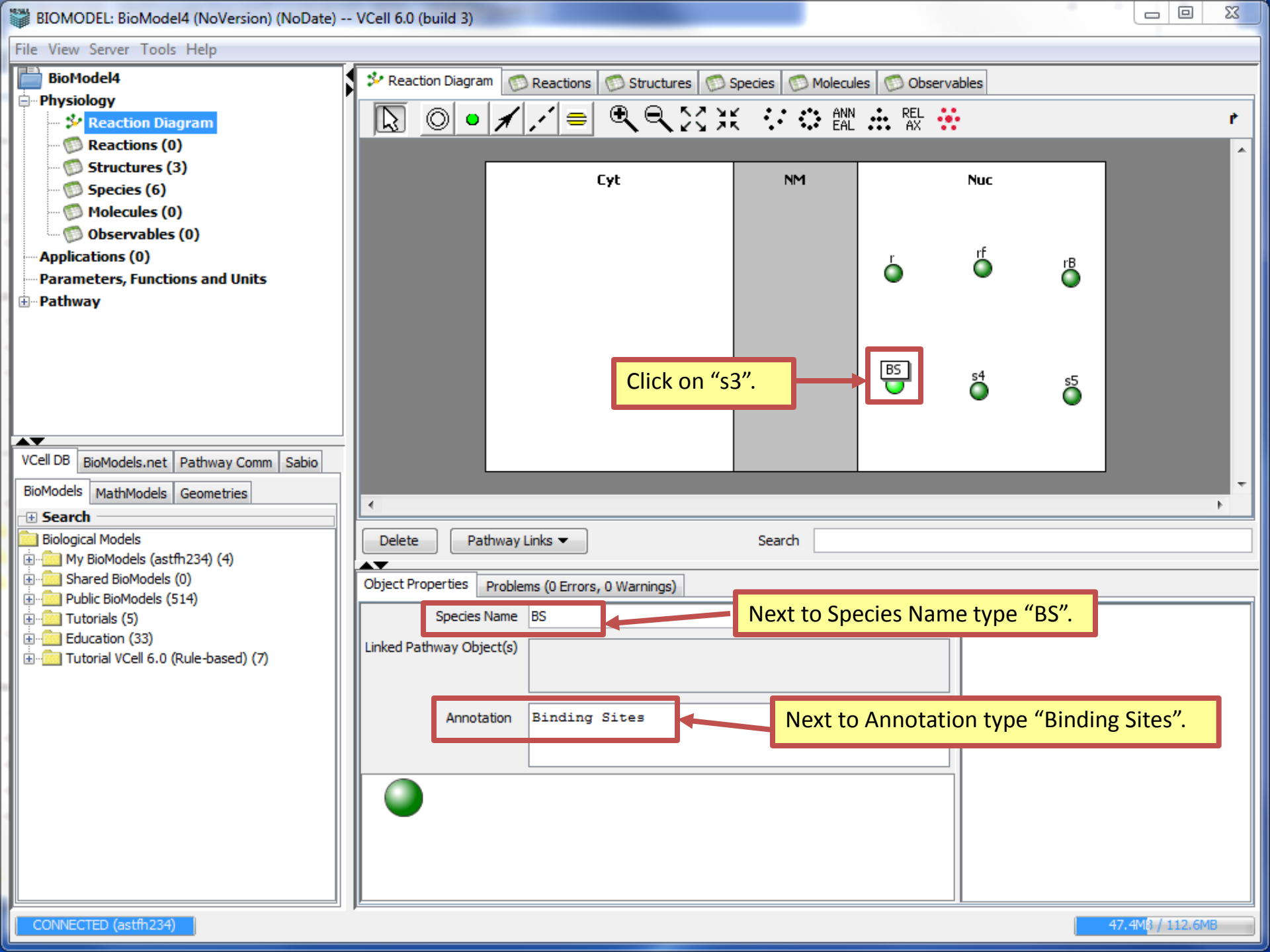

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Click the species tool.
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
s0
s1
s2
s3
s4
s5
Click on six different points within the “Nuc” compartment to create six species.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
s5
Linked Pathway Object(s)
Annotation
Species: s5
CONNECTED (astfh234)
64.7MB / 1

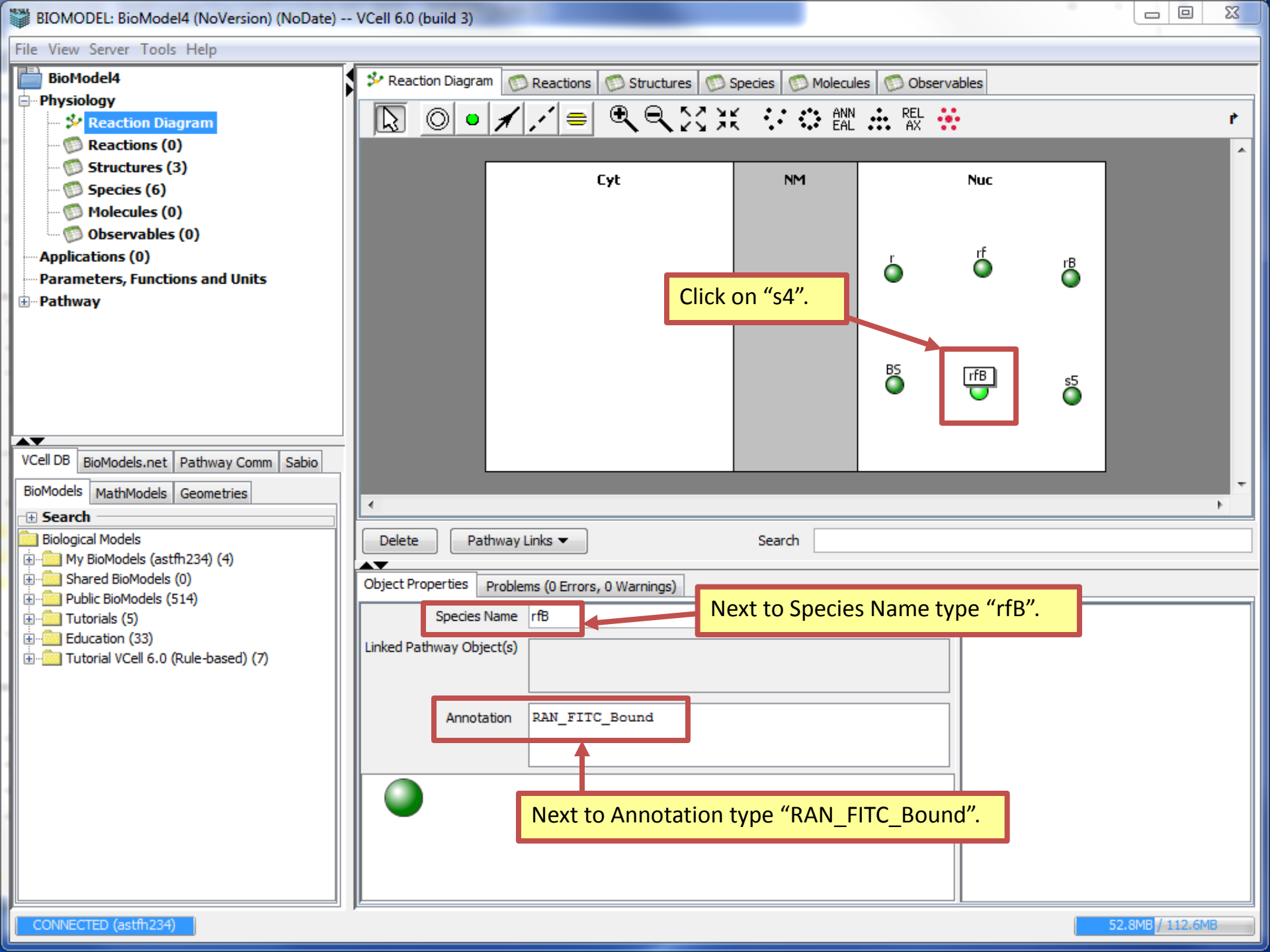

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
s0
s1
s2
s3
s4
s5
To move a species, click the select tool and click a drag a species to a point.
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
s1
Linked Pathway Object(s)
Annotation
Species: s1
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
CONNECTED (astfh234)
54.6MB
112.6MB

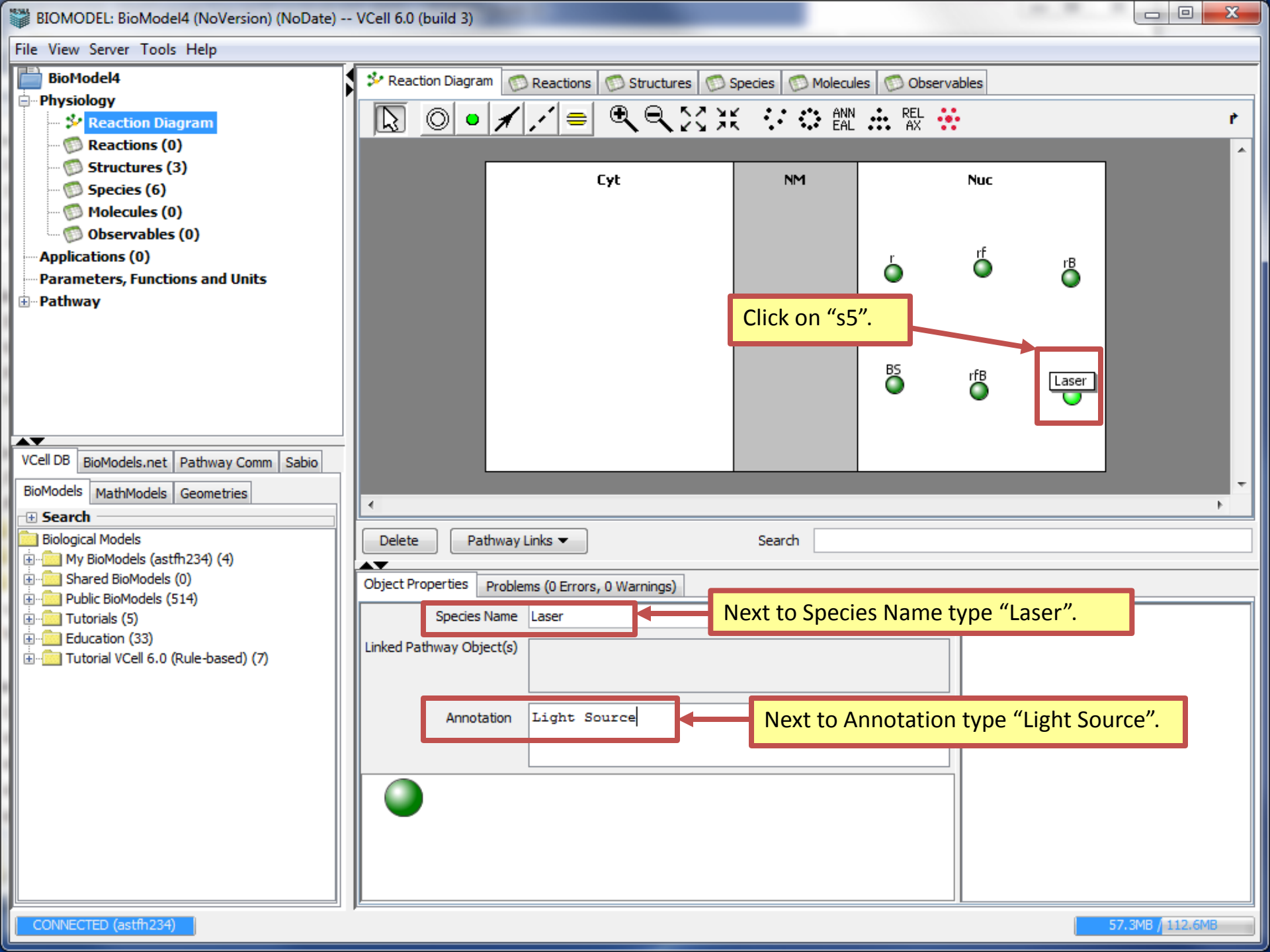

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
s1
s2
s3
s4
s5
Click on “s0”.
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
r
Next to Species Name type “r”.
Linked Pathway Object(s)
Annotation
RAN
Next to Annotation type “RAN”.
CONNECTED (astfh234)
60.8MB / 112.6MB

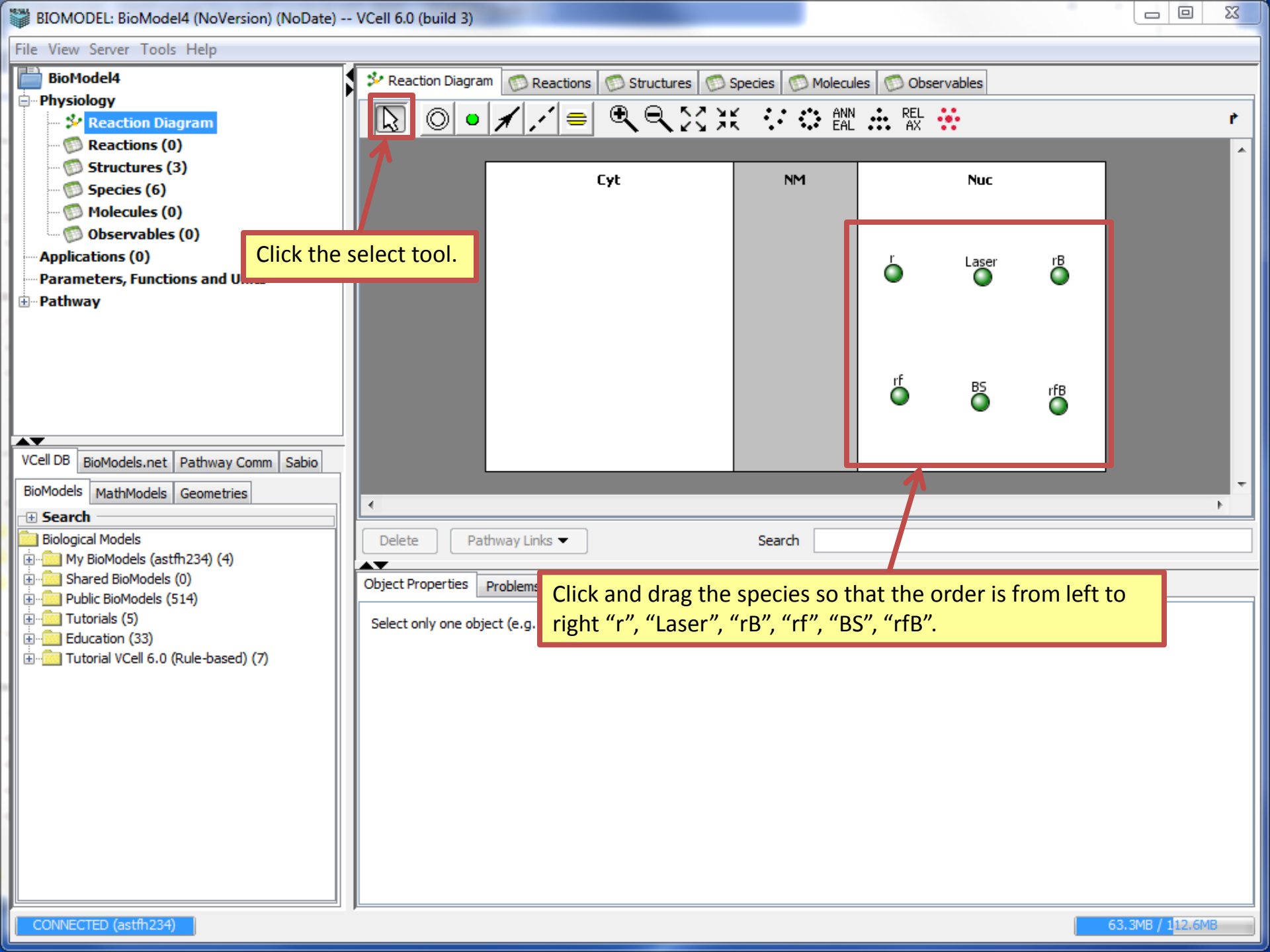

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
Click on “s1”.
r
rf
s2
s3
s4
s5
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
rf
Next to Species Name type “rf”.
Linked Pathway Object(s)
Annotation
RAN_FITC
Next to Annotation type “RAN_FITC”.
CONNECTED (astfh234)
66.2MB / 1 2.6MB

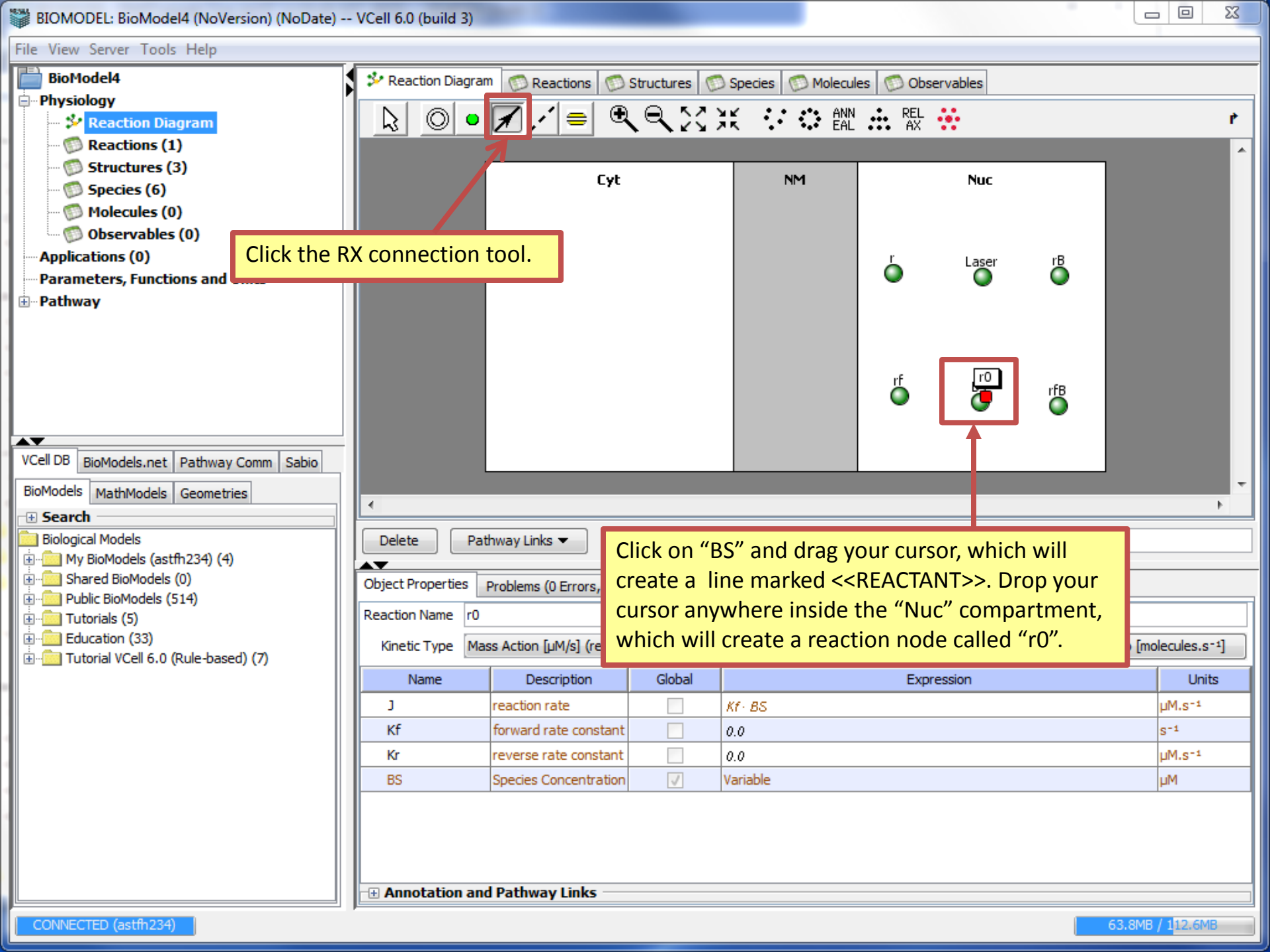

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
rf
rB
s3
s4
s5
Click on “s2”.
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
rB
Next to Species Name type “rB”.
Linked Pathway Object(s)
Annotation
RAN_Bound
Next to Annotation type “RAN_Bound”.
CONNECTED (astfh234)
72.3MB / 112.6MB

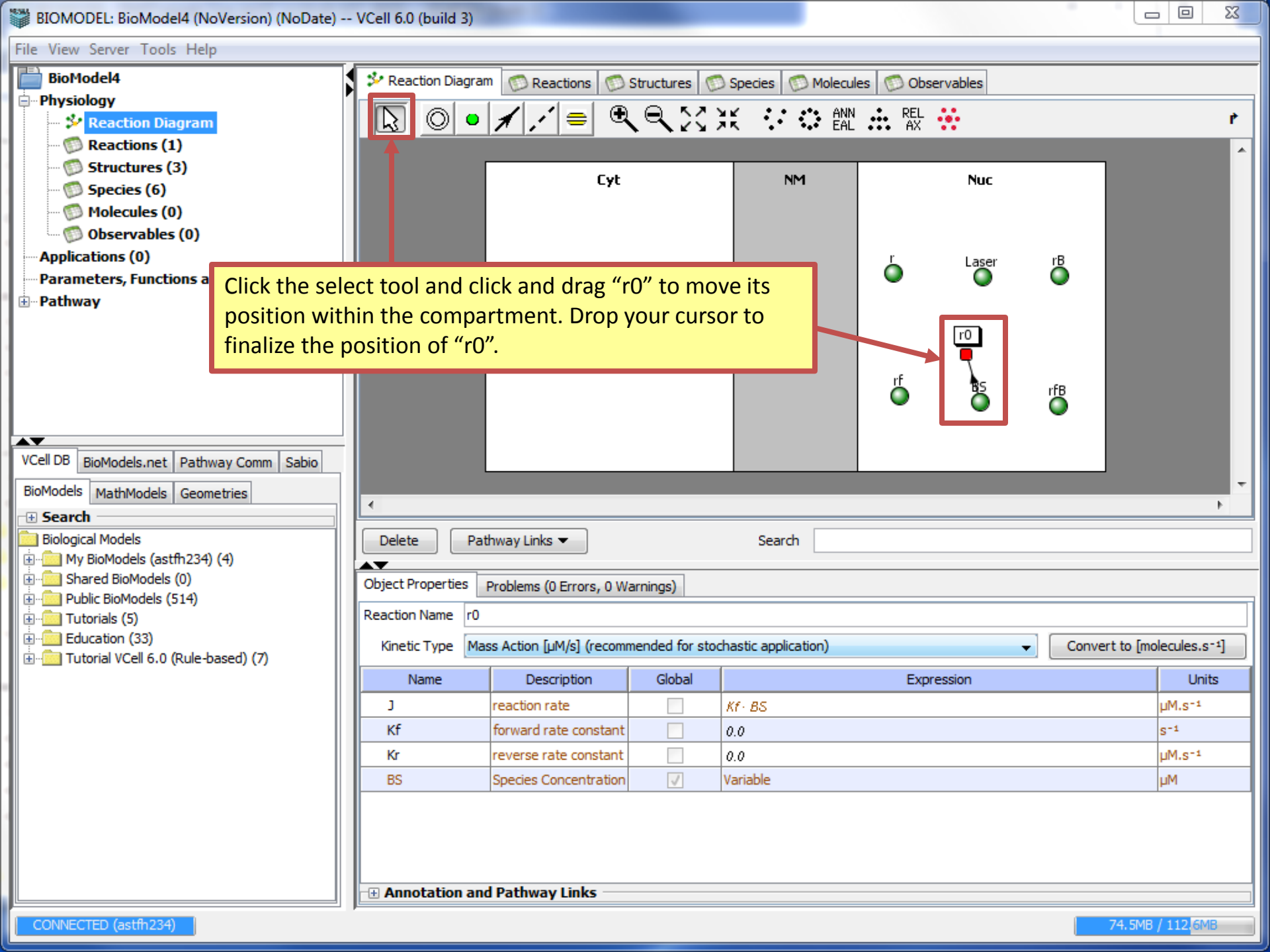

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
rf
rB
BS
s4
s5
Click on “s3”.
Delete
Pathway Links
Search
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
BS
Next to Species Name type “BS”.
Linked Pathway Object(s)
Annotation
Binding Sites
Next to Annotation type “Binding Sites”.
CONNECTED (astfh234)
47.4MB / 112.6MB

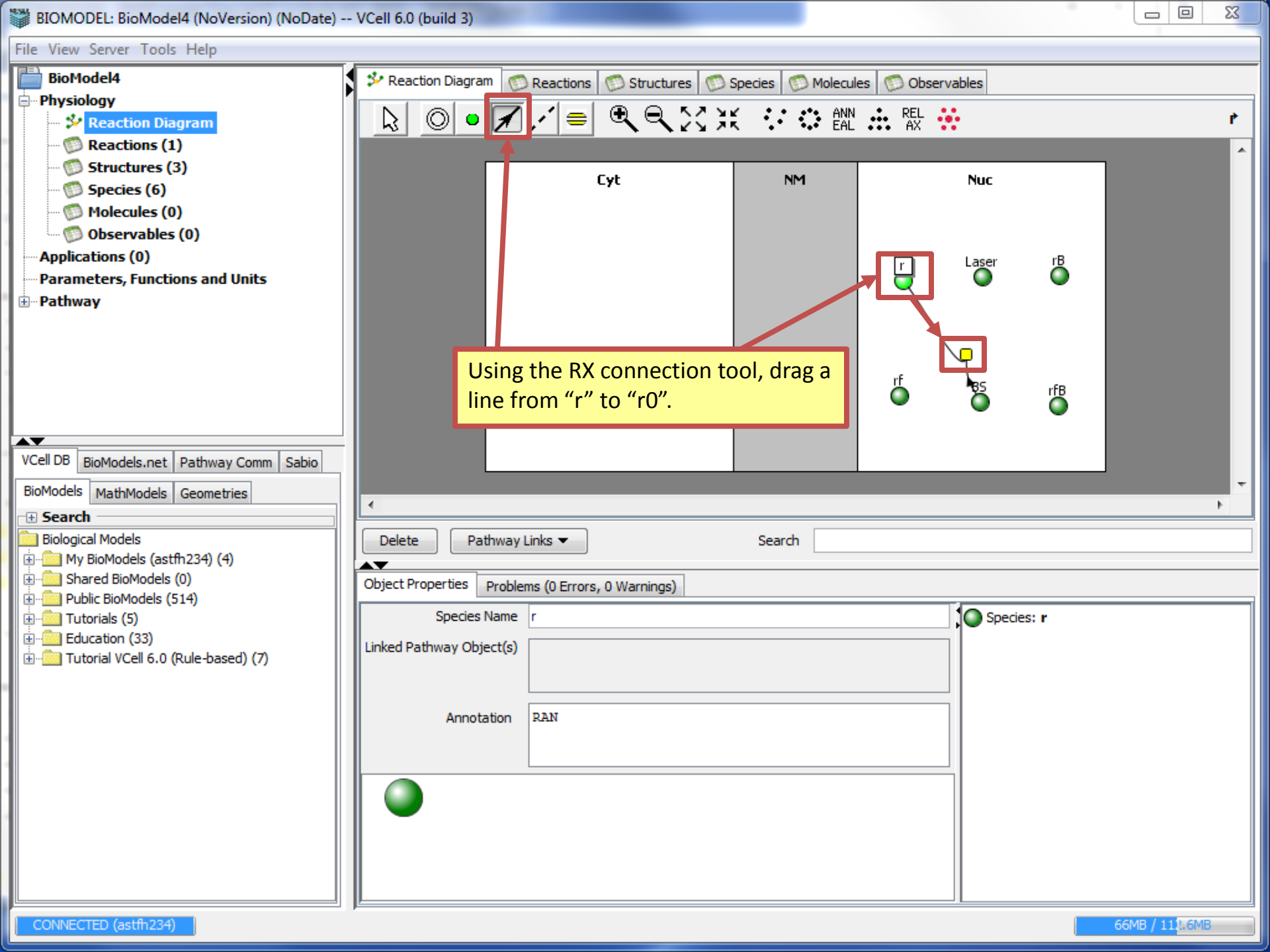

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
rf
rB
BS
rfB
s5
Click on “s4”.
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
rfB
Next to Species Name type “rfB”.
Linked Pathway Object(s)
Annotation
RAN_FITC_Bound
Next to Annotation type “RAN_FITC_Bound”.
CONNECTED (astfh234)
52.8MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
rf
rB
BS
rfB
Laser
Click on “s5”.
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
Laser
Next to Species Name type “Laser”.
Linked Pathway Object(s)
Annotation
Light Source
Next to Annotation type “Light Source”.
CONNECTED (astfh234)
57.3MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Click the select tool.
Cyt
NM
Nuc
r
Laser
rB
rf
BS
rfB
Delete
Pathway Links
Search
Object Properties
Problems
Select only one object (e.g.
Click and drag the species so that the order is from left to right “r”, “Laser”, “rB”, “rf”, “BS”, “rfB”.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
CONNECTED (astfh234)
63.3MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (1)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
Laser
rB
rf
r0
rfB
Click the RX connection tool.
Click on “BS” and drag your cursor, which will create a line marked <<REACTANT>>. Drop your cursor anywhere inside the “Nuc” compartment, which will create a reaction node called “r0”.
Delete
Pathway Links
Object Properties
Problems (0 Errors,
Reaction Name
r0
Kinetic Type
Mass Action [µM/s] (re
[molecules.s⁻¹]
Name
Description
Global
Expression
Units
J
reaction rate
Kf · BS
µM.s⁻¹
Kf
forward rate constant
0.0
s⁻¹
Kr
reverse rate constant
0.0
µM.s⁻¹
BS
Species Concentration
Variable
µM
Annotation and Pathway Links
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
CONNECTED (astfh234)
63.8MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (1)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions a
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
Laser
rB
r0
rf
BS
rfB
Click the select tool and click and drag “r0” to move its position within the compartment. Drop your cursor to finalize the position of “r0”.
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
r0
Kinetic Type
Mass Action [μM/s] (recommended for stochastic application)
Convert to [molecules.s-1]
Name
Description
Global
Expression
Units
J
reaction rate
Kf· BS
μM.s-1
Kf
forward rate constant
0.0
s-1
Kr
reverse rate constant
0.0
μM.s-1
BS
Species Concentration
Variable
μM
Annotation and Pathway Links
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
CONNECTED (astfh234)
74.5MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (1)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
Laser
rB
rf
BS
rfB
Using the RX connection tool, drag a line from “r” to “r0”.
Delete
Pathway Links
Search
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
r
Linked Pathway Object(s)
Annotation
RAN
Species: r
CONNECTED (astfh234)
66MB / 11

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)

File View Server Tools Help

BioModel4
- Physiology
  - Reaction Diagram
  - Reactions (1)
  - Structures (3)
  - Species (6)
  - Molecules (0)
  - Observables (0)
- Applications (0)
- Parameters, Functions and Units
- Pathway

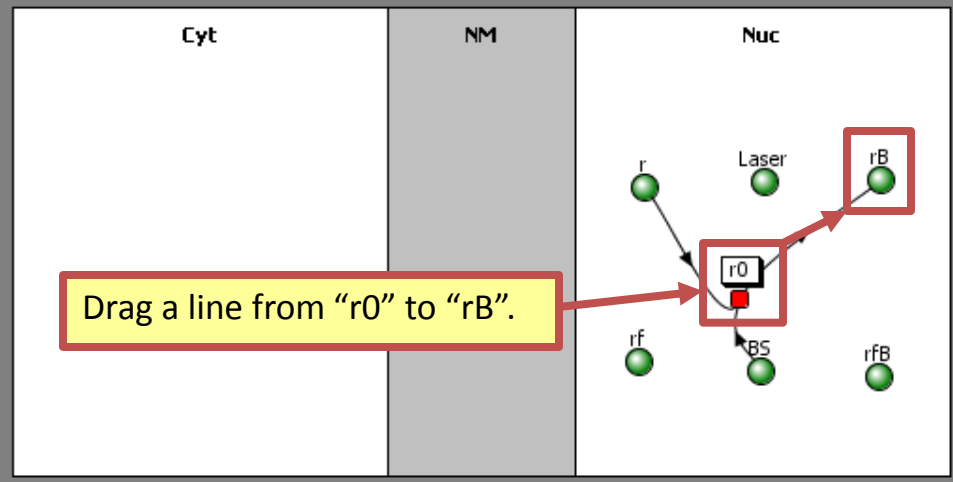
VCell DB | BioModels.net | Pathway Comm | Sabio

BioModels | MathModels | Geometries

Search

Biological Models
- My BioModels (astfh234) (4)
- Shared BioModels (0)
- Public BioModels (514)
- Tutorials (5)
- Education (33)
- Tutorial VCell 6.0 (Rule-based) (7)

Reaction Diagram | Reactions | Structures | Species | Molecules | Observables



Drag a line from “r0” to “rB”.

Delete | Pathway Links | Search

Object Properties | Problems (0 Errors, 0 Warnings)

Reaction Name: r0

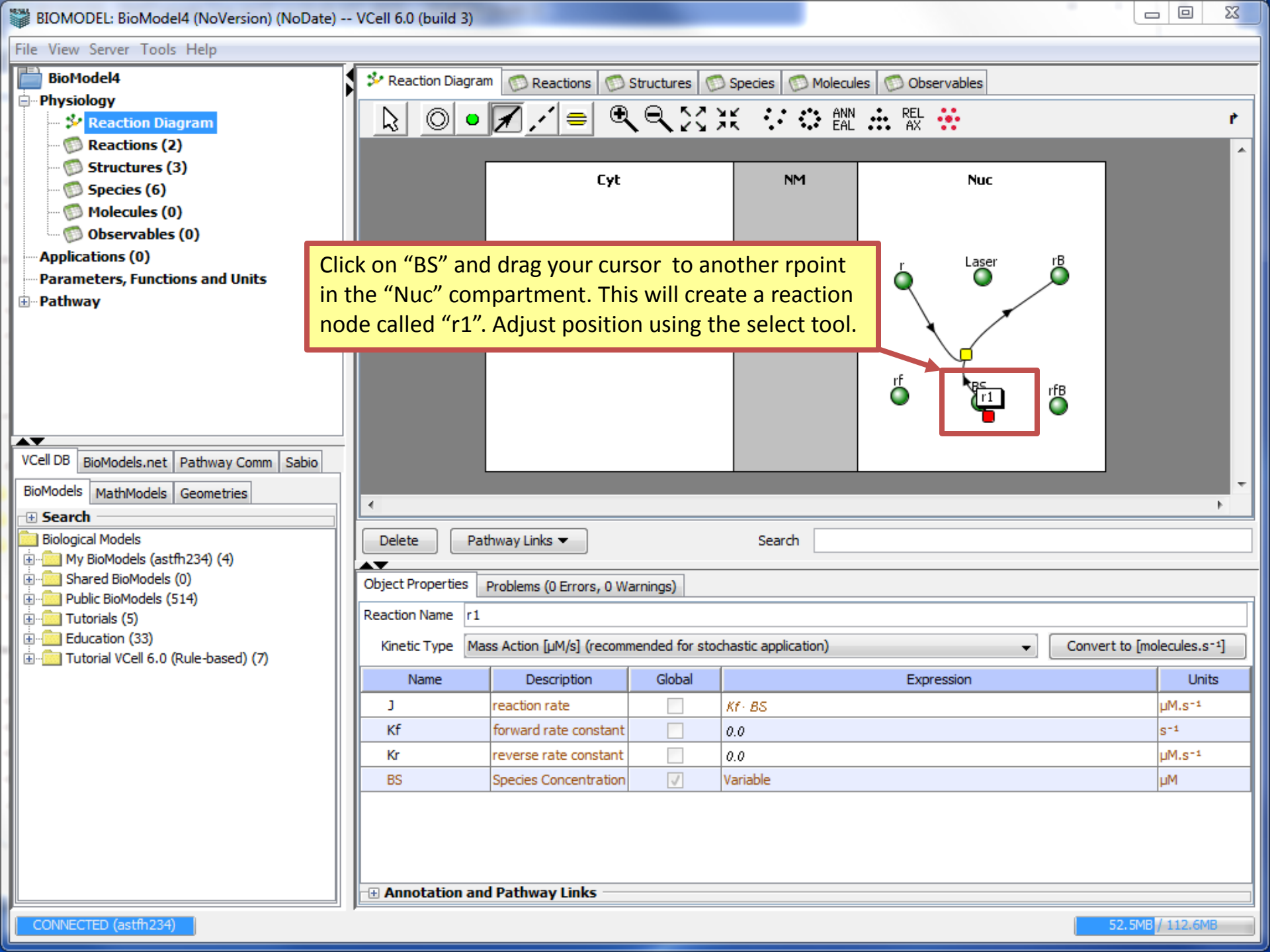
Kinetic Type: Mass Action [μM/s] (recommended for stochastic application) | Convert to [molecules.s⁻¹]

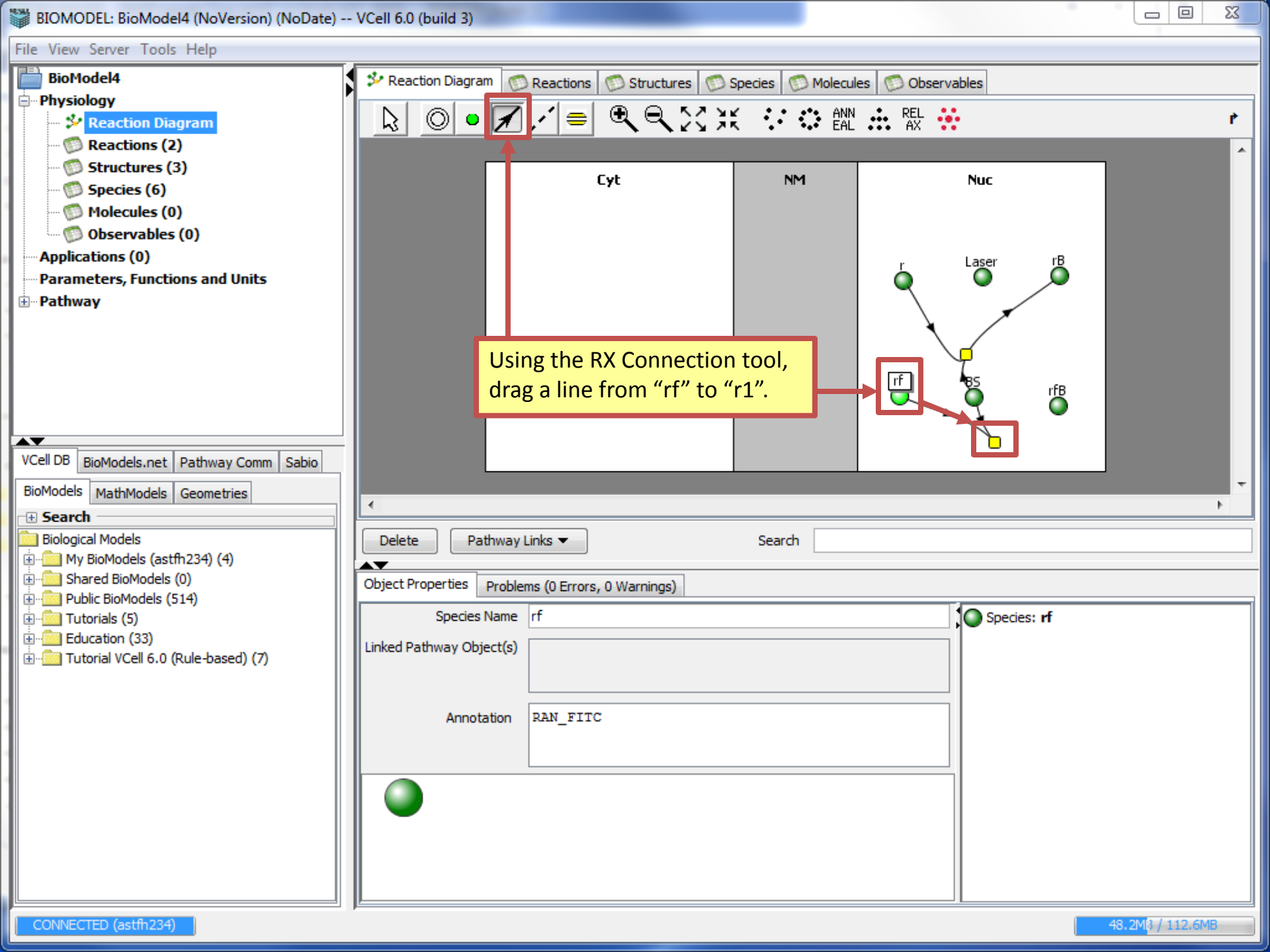
Name	Description	Global	Expression	Units
J	reaction rate	☐	(Kf · BS · r − Kr · rB)	μM.s⁻¹
Kf	forward rate constant	☐	0.0	s⁻¹.μM⁻¹
Kr	reverse rate constant	☐	0.0	s⁻¹
BS	Species Concentration	☑	Variable	μM
r	Species Concentration	☑	Variable	μM
rB	Species Concentration	☑	Variable	μM

Annotation and Pathway Links

CONNECTED (astfh234)

77.1MB / 112.5MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (2)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
Laser
rB
rf
BS
r1
rfB
Click on “BS” and drag your cursor to another rpoint in the “Nuc” compartment. This will create a reaction node called “r1”. Adjust position using the select tool.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
r1
Kinetic Type
Mass Action [μM/s] (recommended for stochastic application)
Convert to [molecules.s-1]
Name
Description
Global
Expression
Units
J
reaction rate
Kf · BS
μM.s-1
Kf
forward rate constant
0.0
s-1
Kr
reverse rate constant
0.0
μM.s-1
BS
Species Concentration
Variable
μM
Annotation and Pathway Links
CONNECTED (astfh234)
52.5MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (2)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
Laser
rB
rf
BS
rfB
Using the RX Connection tool, drag a line from “rf” to “r1”.
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
rf
Linked Pathway Object(s)
Annotation
RAN_FITC
Species: rf
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
CONNECTED (astfh234)

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)

File View Server Tools Help

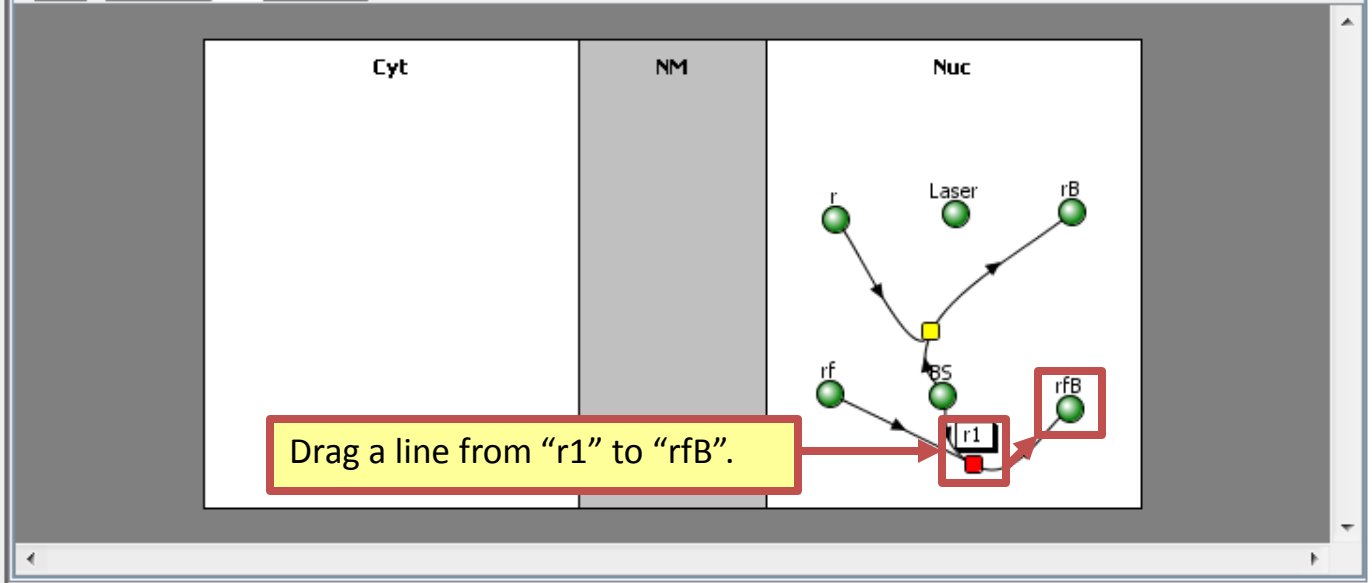
BioModel4
Physiology
Reaction Diagram
Reactions (2)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway

VCell DB | BioModels.net | Pathway Comm | Sabio

BioModels | MathModels | Geometries

Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)

Reaction Diagram | Reactions | Structures | Species | Molecules | Observables



Delete | Pathway Links | Search

Object Properties | Problems (0 Errors, 0 Warnings)

Reaction Name: r1

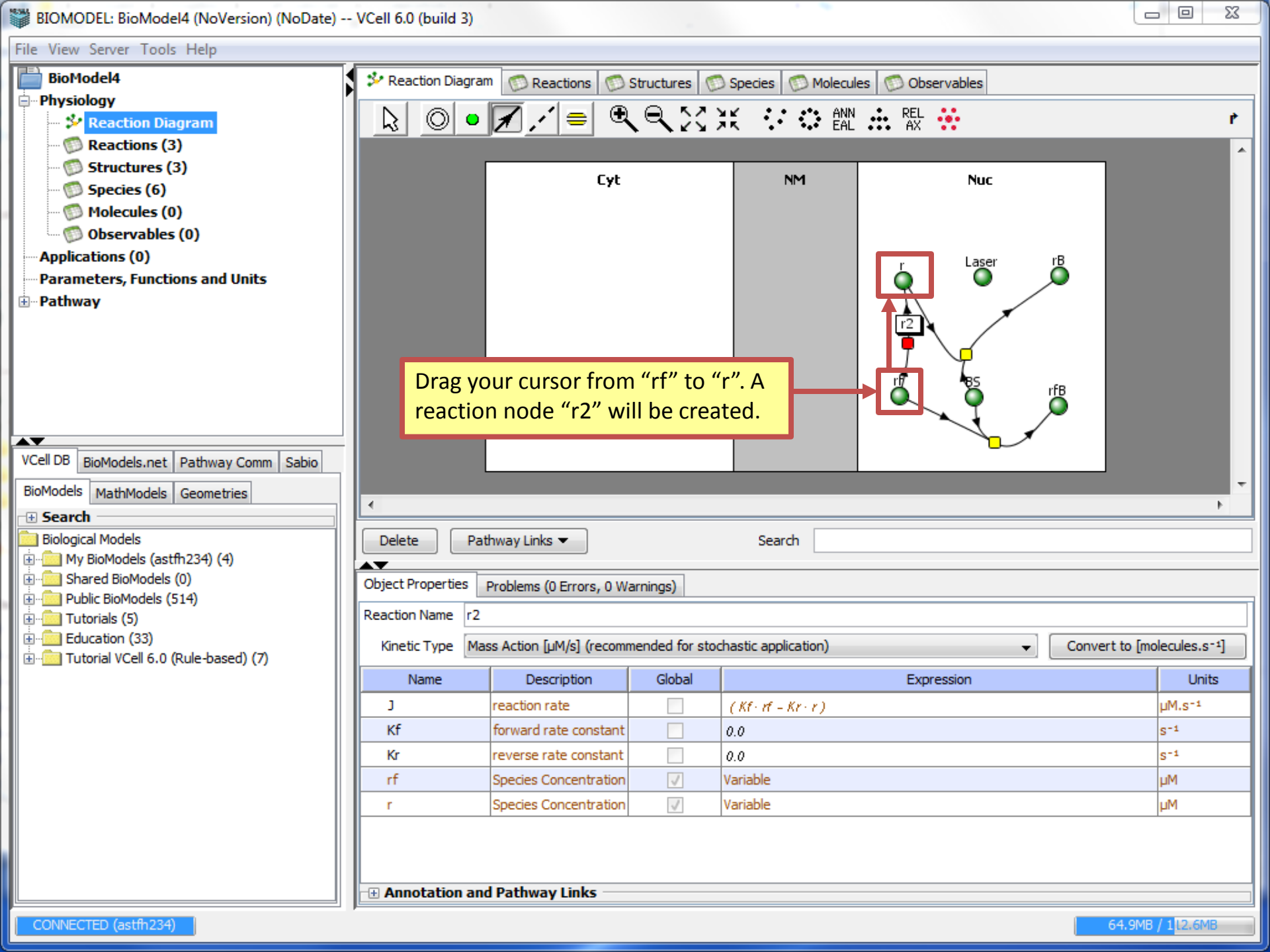
Kinetic Type: Mass Action [μM/s] (recommended for stochastic application) | Convert to [molecules.s⁻¹]

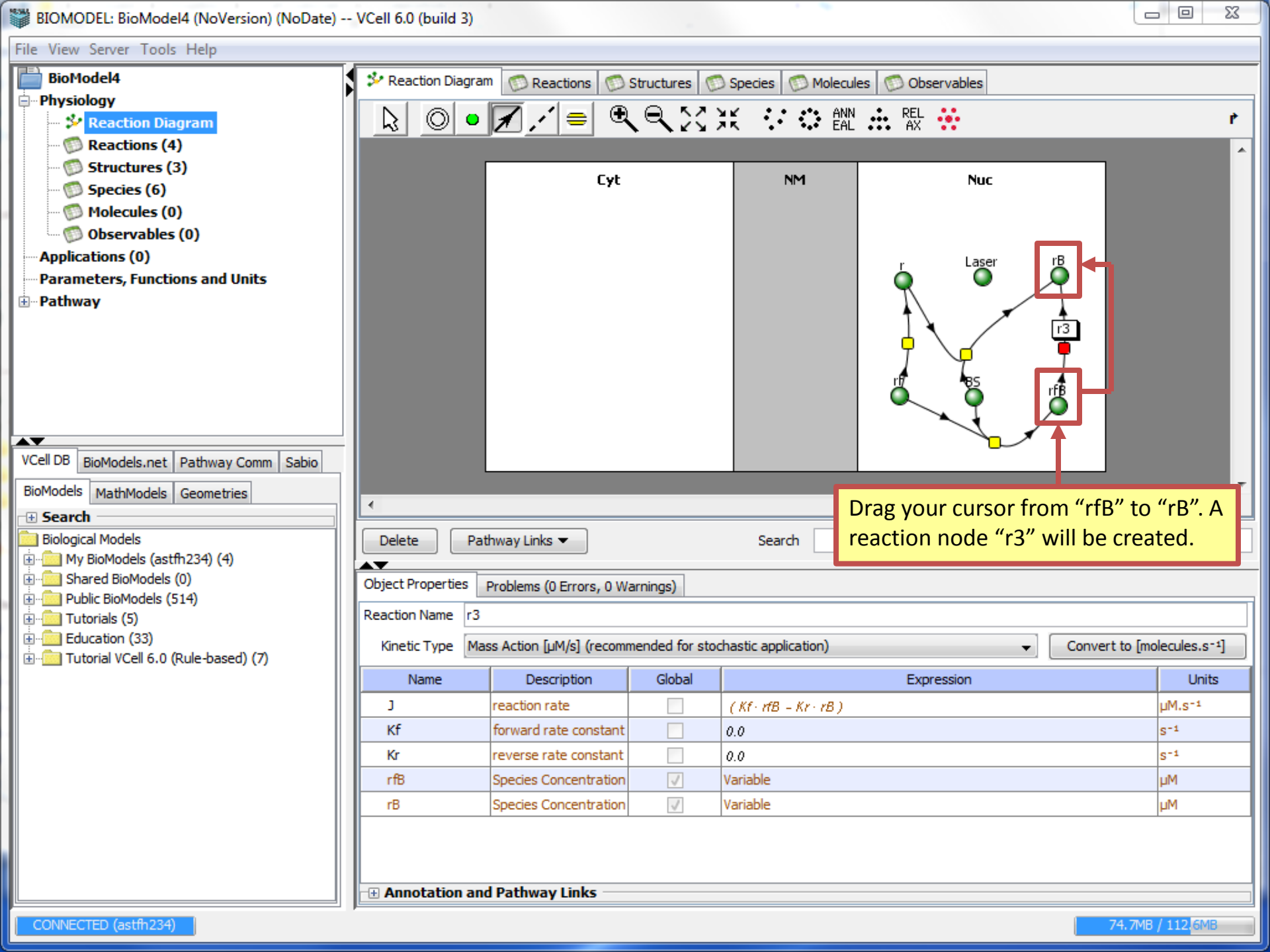
Name	Description	Global	Expression	Units
J	reaction rate	☐	(Kf · BS · rf – Kr · rfB)	μM.s⁻¹
Kf	forward rate constant	☐	0.0	s⁻¹.μM⁻¹
Kr	reverse rate constant	☐	0.0	s⁻¹
BS	Species Concentration	☑	Variable	μM
rf	Species Concentration	☑	Variable	μM
rfB	Species Concentration	☑	Variable	μM

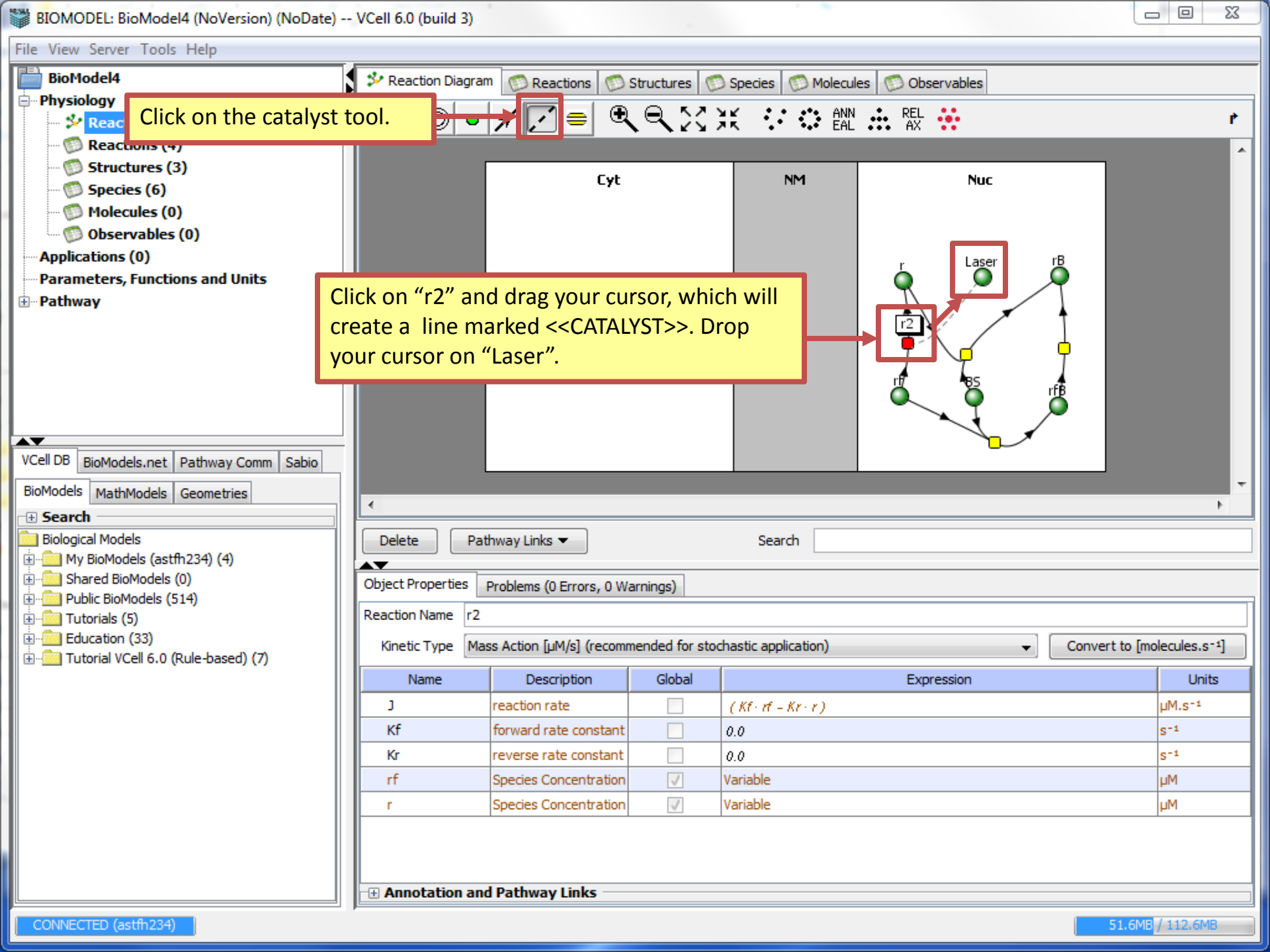
Annotation and Pathway Links

CONNECTED (astfh234)

57MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (3)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
Laser
rB
r2
rf
BS
rfB
Drag your cursor from “rf” to “r”. A reaction node “r2” will be created.
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
r2
Kinetic Type
Mass Action [μM/s] (recommended for stochastic application)
Convert to [molecules.s-1]
Name
Description
Global
Expression
Units
J
reaction rate
(Kf · rf - Kr · r)
μM.s-1
Kf
forward rate constant
0.0
s-1
Kr
reverse rate constant
0.0
s-1
rf
Species Concentration
Variable
μM
r
Species Concentration
Variable
μM
Annotation and Pathway Links
CONNECTED (astfh234)
64.9MB / 1


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
Laser
rB
r3
rf
BS
rfB
Delete
Pathway Links
Search
Drag your cursor from “rfB” to “rB”. A reaction node “r3” will be created.
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
r3
Kinetic Type
Mass Action [μM/s] (recommended for stochastic application)
Convert to [molecules.s-1]
Name
Description
Global
Expression
Units
J
reaction rate
(Kf · rfB - Kr · rB)
μM.s-1
Kf
forward rate constant
0.0
s-1
Kr
reverse rate constant
0.0
s-1
rfB
Species Concentration
Variable
μM
rB
Species Concentration
Variable
μM
Annotation and Pathway Links
CONNECTED (astfh234)
74.7MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reac
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Click on the catalyst tool.
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
r
Laser
rB
r2
rf
BS
rfB
Click on “r2” and drag your cursor, which will create a line marked <<CATALYST>>. Drop your cursor on “Laser”.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
r2
Kinetic Type
Mass Action [μM/s] (recommended for stochastic application)
Convert to [molecules.s-1]
Name
Description
Global
Expression
Units
J
reaction rate
(Kf · rf - Kr · r)
μM.s-1
Kf
forward rate constant
0.0
s-1
Kr
reverse rate constant
0.0
s-1
rf
Species Concentration
Variable
μM
r
Species Concentration
Variable
μM
Annotation and Pathway Links
CONNECTED (astfh234)
51.6MB / 112.6MB

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)

File View Server Tools Help

BioModel4
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway

VCell DB | BioModels.net | Pathway Comm | Sabio

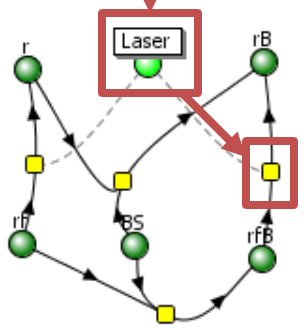
BioModels | MathModels | Geometries

Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)

Reaction Diagram | Reactions | Structures | Species | Molecules | Observables

Cyt

Drag a line from “Laser” to “r3”.



Delete | Pathway Links | Search

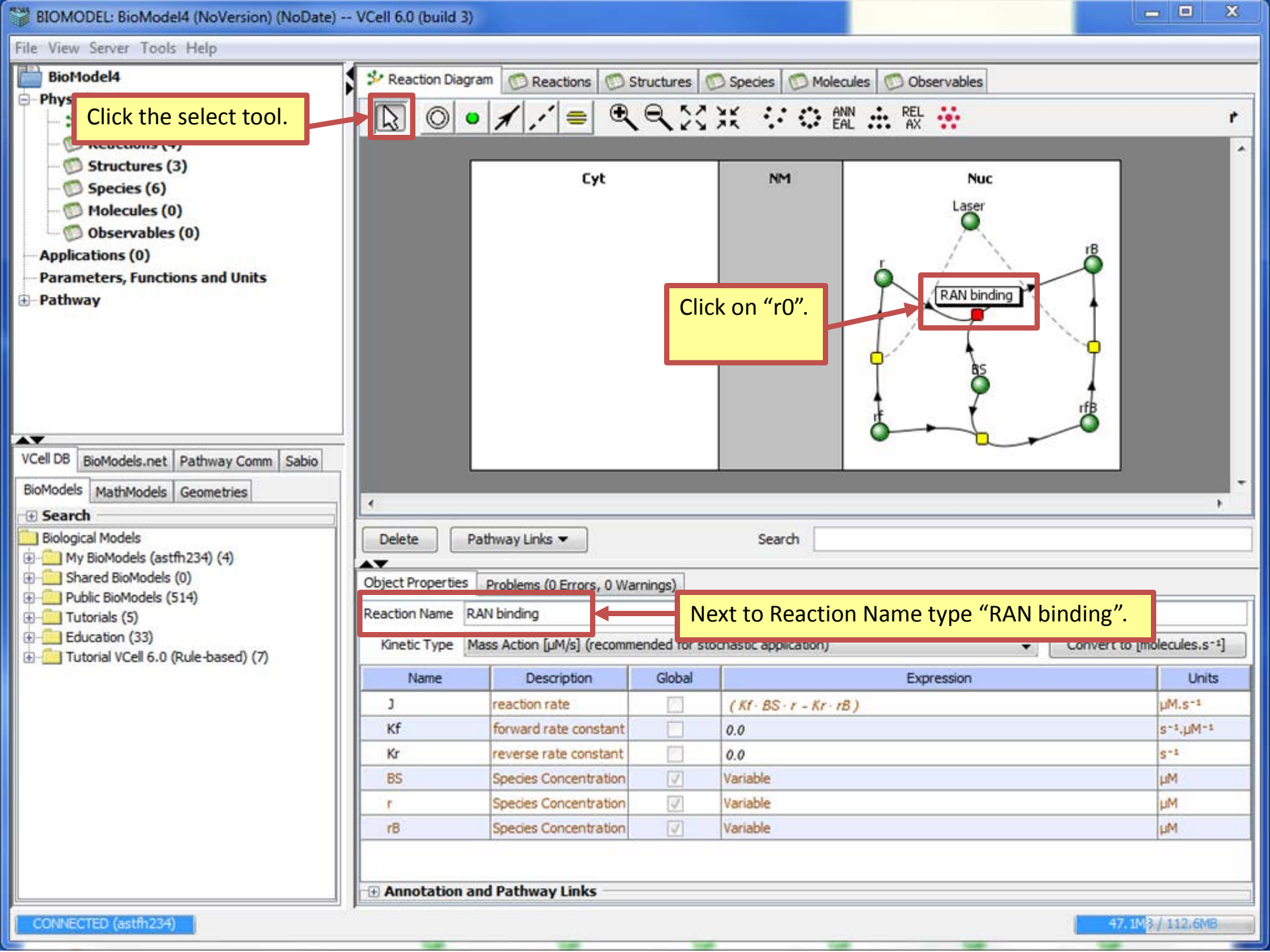
Object Properties | Problems (0 Errors, 0 Warnings)

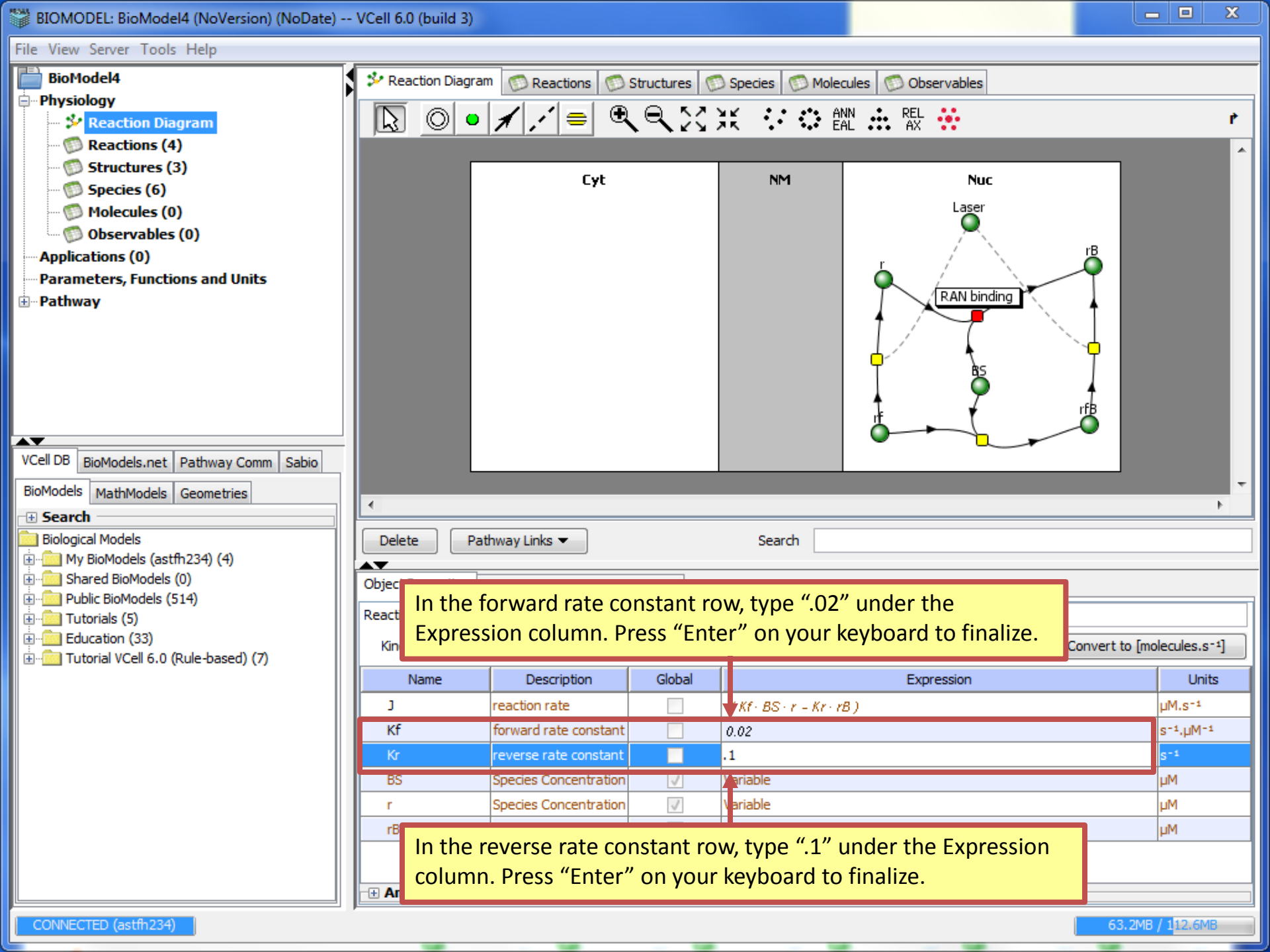
Species Name: Laser
Linked Pathway Object(s):
Annotation: Light Source

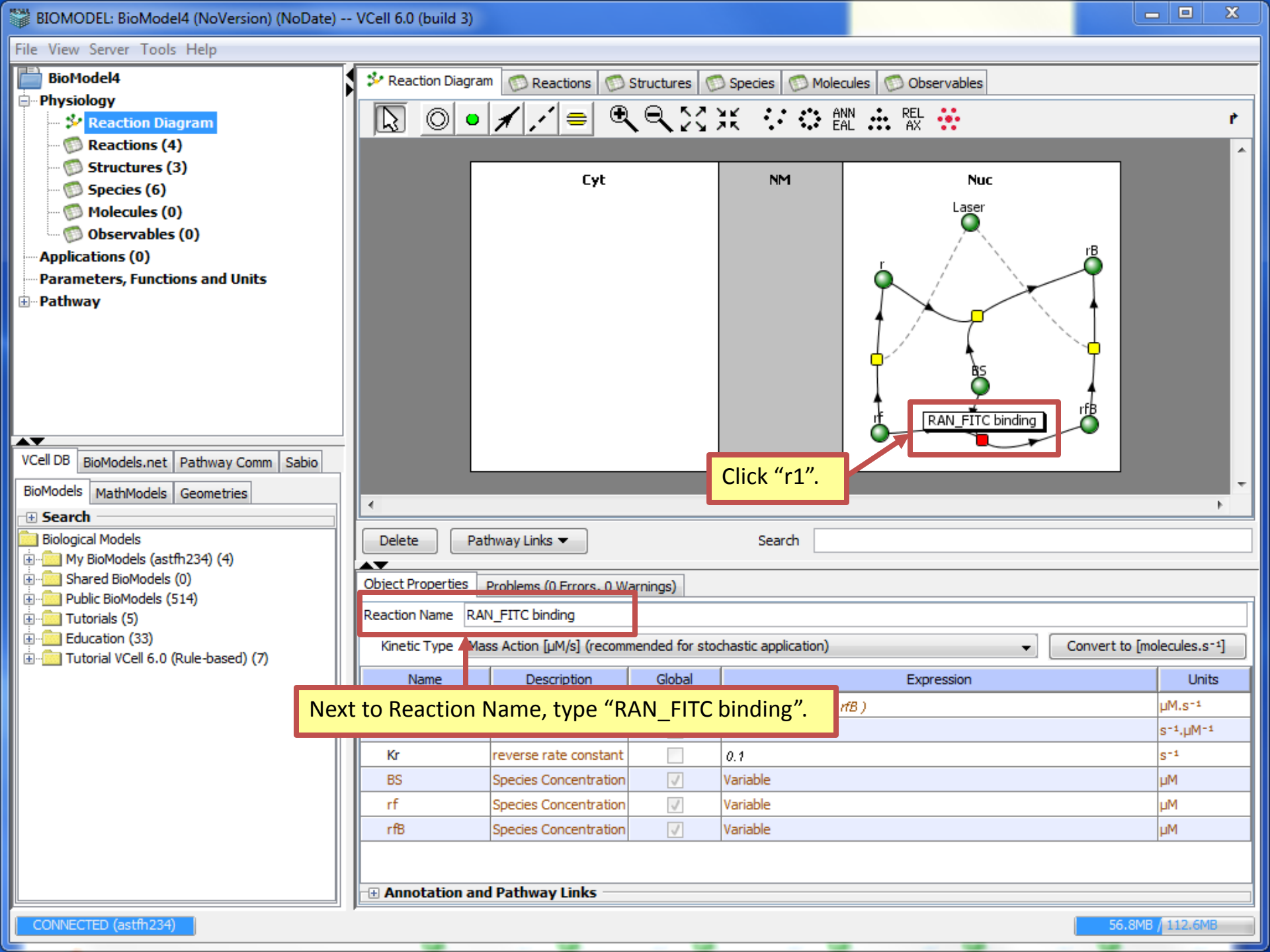
Species: **Laser**

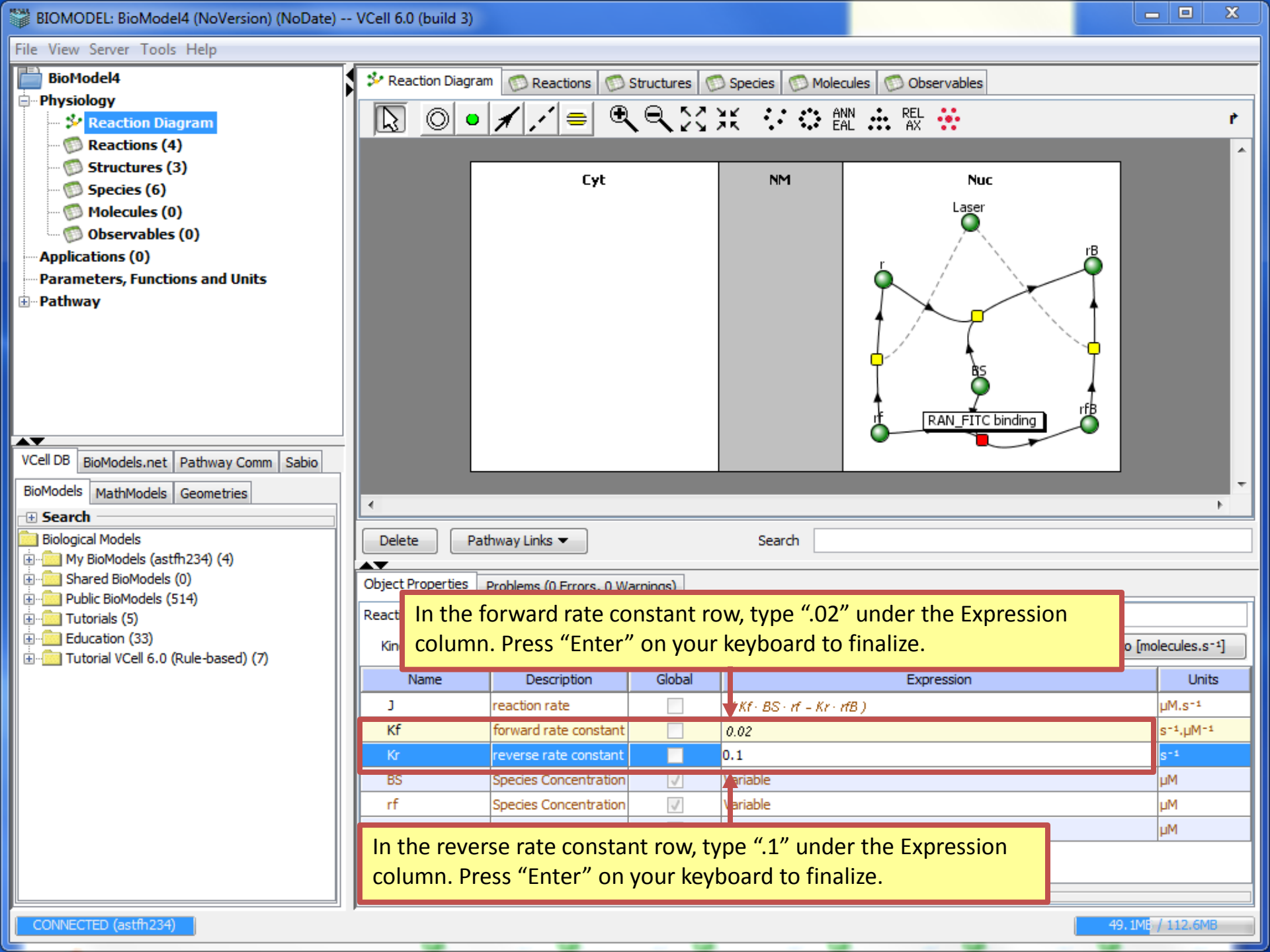
CONNECTED (astfh234)

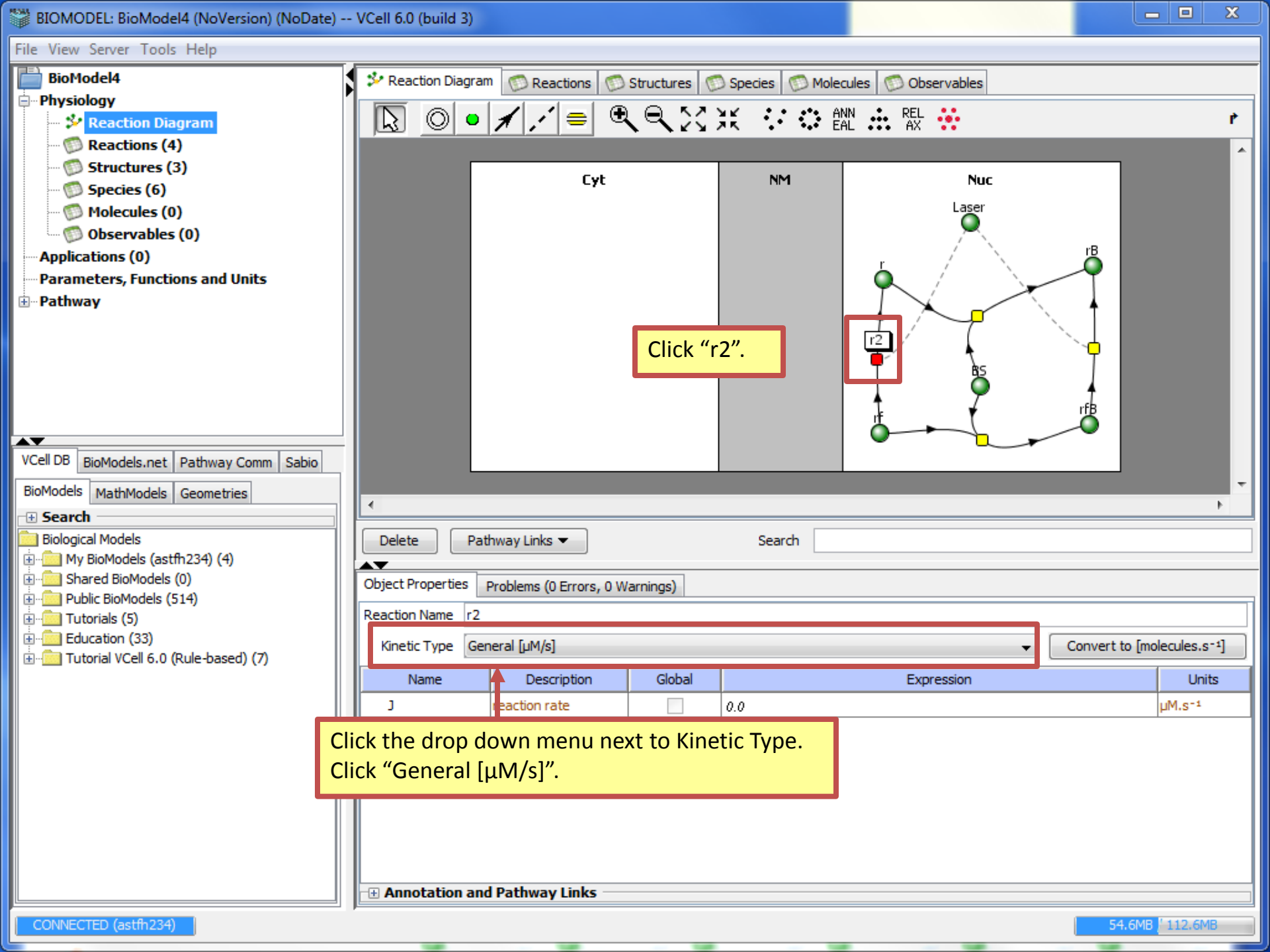
55.5MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Click the select tool.
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
Laser
r
rB
RAN binding
BS
rF
rFB
Click on “r0”.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
RAN binding
Next to Reaction Name type “RAN binding”.
Kinetic Type
Mass Action [μM/s] (recommended for stochastic application)
Convert to [molecules.s⁻¹]
Name
Description
Global
Expression
Units
J
reaction rate
(Kf · BS · r - Kr · rB)
μM.s⁻¹
Kf
forward rate constant
0.0
s⁻¹.μM⁻¹
Kr
reverse rate constant
0.0
s⁻¹
BS
Species Concentration
Variable
μM
r
Species Concentration
Variable
μM
rB
Species Concentration
Variable
μM
Annotation and Pathway Links
CONNECTED (astfh234)
47.1M / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
Laser
r
rB
RAN binding
BS
rF
rFB
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Delete
Pathway Links
Search
Convert to [molecules.s-1]
Name
Description
Global
Expression
Units
J
reaction rate
Kf · BS · r - Kr · rB)
µM.s-1
Kf
forward rate constant
0.02
s-1.µM-1
Kr
reverse rate constant
.1
s-1
BS
Species Concentration
µM
r
Species Concentration
µM
rB
µM
In the forward rate constant row, type ".02" under the Expression column. Press "Enter" on your keyboard to finalize.
In the reverse rate constant row, type ".1" under the Expression column. Press "Enter" on your keyboard to finalize.
CONNECTED (astfh234)
63.2MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
Laser
r
rB
BS
rf
rfB
RAN_FITC binding
Click "r1".
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
RAN_FITC binding
Kinetic Type
Mass Action [μM/s] (recommended for stochastic application)
Convert to [molecules.s-1]
Name
Description
Global
Expression
Units
rfB)
μM.s-1
s-1.μM-1
Kr
reverse rate constant
0.1
s-1
BS
Species Concentration
Variable
μM
rf
Species Concentration
Variable
μM
rfB
Species Concentration
Variable
μM
Annotation and Pathway Links
Next to Reaction Name, type "RAN_FITC binding".
CONNECTED (astfh234)
56.8MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
Laser
r
rB
BS
rf
rfB
RAN_FITC binding
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
In the forward rate constant row, type ".02" under the Expression column. Press "Enter" on your keyboard to finalize.
Name
Description
Global
Expression
Units
J
reaction rate
Kf · BS · rf - Kr · rfB)
μM.s⁻¹
Kf
forward rate constant
0.02
s⁻¹.μM⁻¹
Kr
reverse rate constant
0.1
s⁻¹
BS
Species Concentration
μM
rf
Species Concentration
μM
μM
In the reverse rate constant row, type ".1" under the Expression column. Press "Enter" on your keyboard to finalize.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
CONNECTED (astfh234)
49.1MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
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Biological Models
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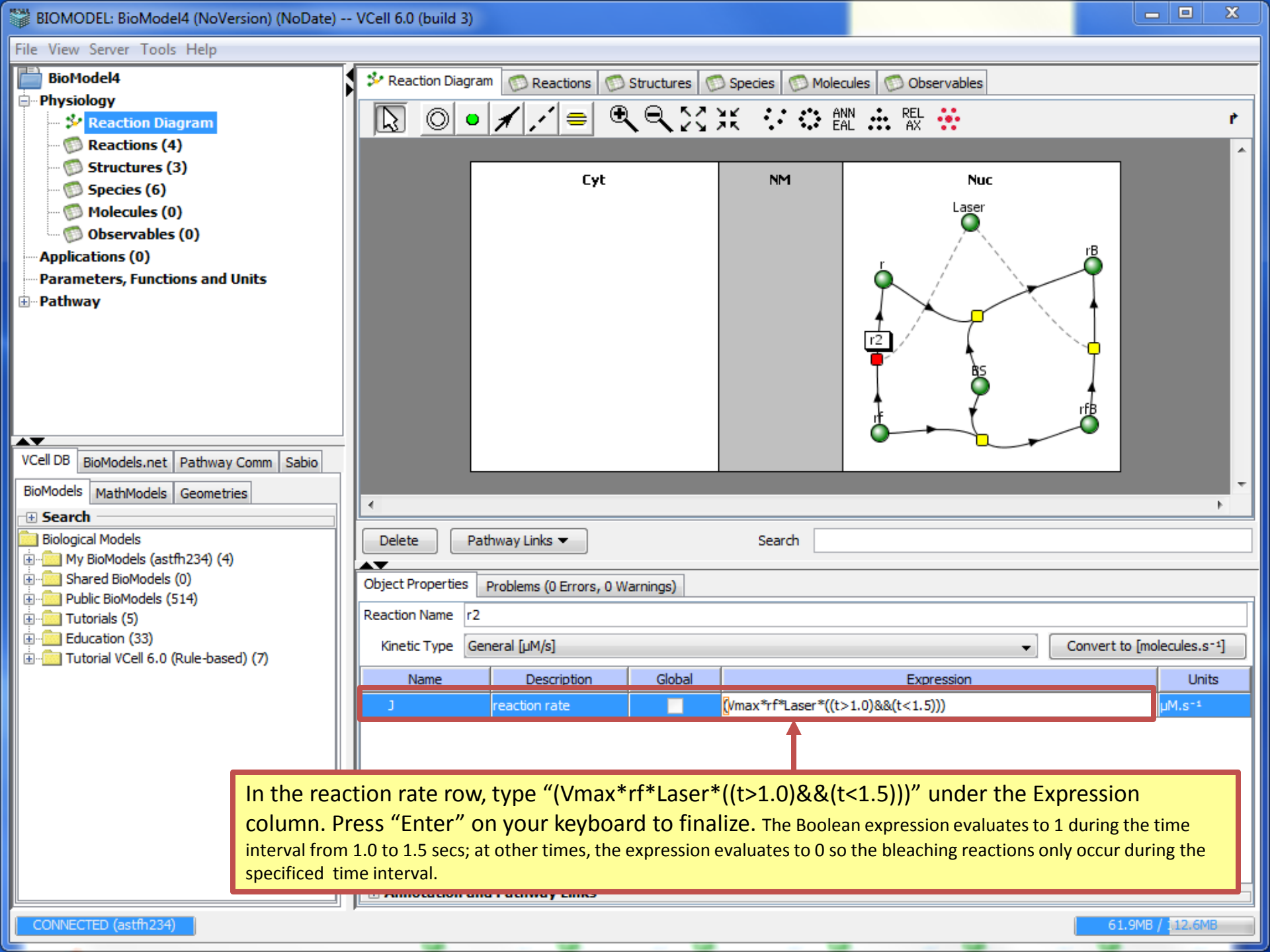
Tutorial VCell 6.0 (Rule-based) (7)
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
Laser
r
rB
r2
BS
rF
rfB
Click "r2".
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
r2
Kinetic Type
General [µM/s]
Convert to [molecules.s⁻¹]
Name
Description
Global
Expression
Units
J
eaction rate
0.0
µM.s⁻¹
Click the drop down menu next to Kinetic Type.
Click "General [µM/s]".
Annotation and Pathway Links
CONNECTED (astfh234)
54.6MB
112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
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Reactions (4)
Structures (3)
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Molecules (0)
Observables (0)
Applications (0)
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Cyt
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Nuc
Laser
r
rB
r2
BS
rF
rfB
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Public BioModels (514)
Tutorials (5)
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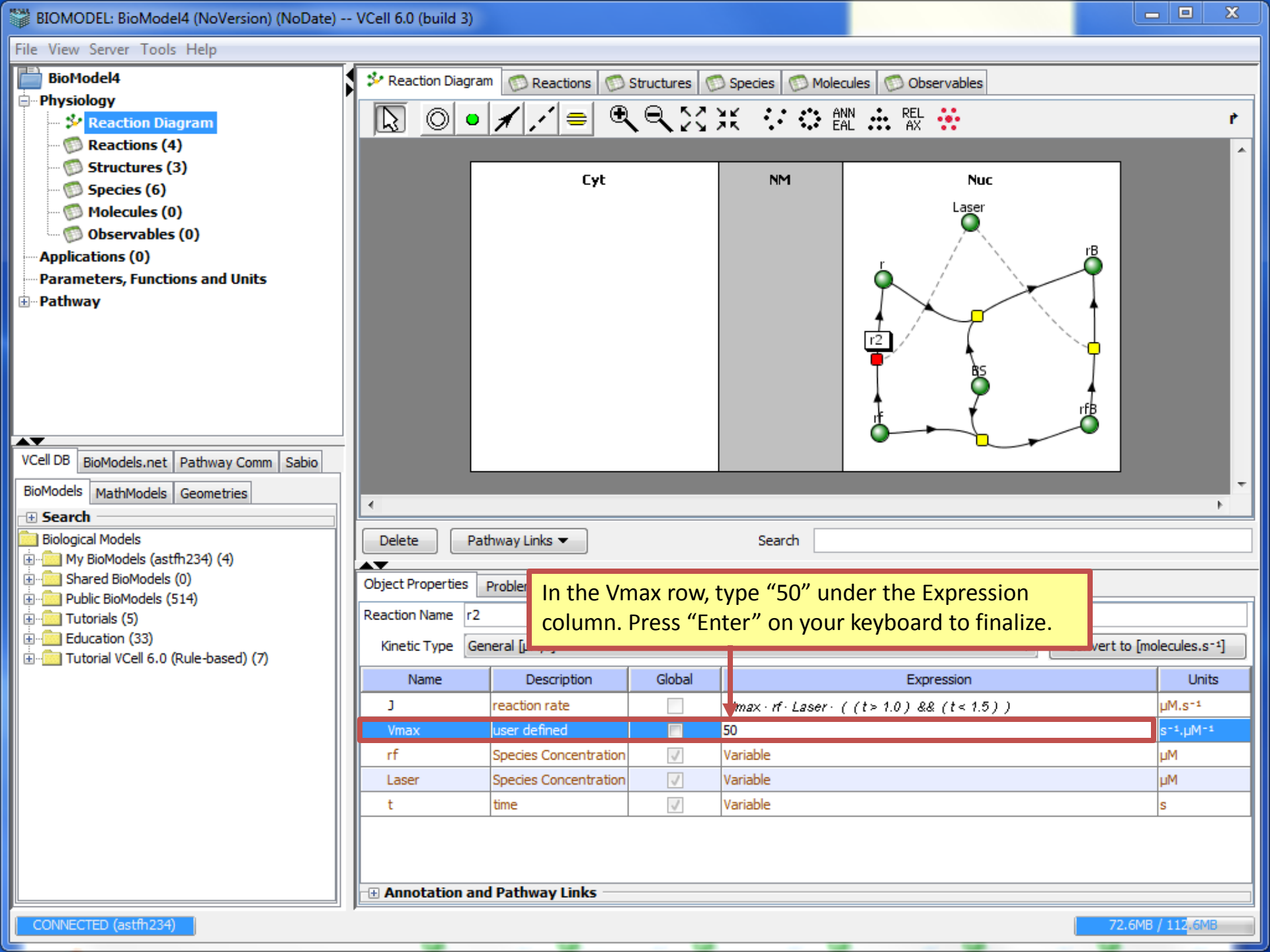
Tutorial VCell 6.0 (Rule-based) (7)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
r2
Kinetic Type
General [µM/s]
Convert to [molecules.s⁻¹]
Name
Description
Global
Expression
Units
J
reaction rate
(Vmax*rf*Laser*((t>1.0)&&(t<1.5)))
µM.s⁻¹
In the reaction rate row, type “(Vmax*rf*Laser*((t>1.0)&&(t<1.5)))” under the Expression column. Press “Enter” on your keyboard to finalize. The Boolean expression evaluates to 1 during the time interval from 1.0 to 1.5 secs; at other times, the expression evaluates to 0 so the bleaching reactions only occur during the specificed time interval.
CONNECTED (astfh234)
61.9MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
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Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
Laser
r
rB
r2
BS
rf
rfB
Delete
Pathway Links
Search
Object Properties
Reaction Name
r2
Kinetic Type
In the Vmax row, type “50” under the Expression column. Press “Enter” on your keyboard to finalize.
Name
Description
Global
Expression
Units
J
reaction rate
Vmax · rf · Laser · ((t > 1.0) && (t < 1.5))
µM.s⁻¹
Vmax
user defined
50
s⁻¹.µM⁻¹
rf
Species Concentration
Variable
µM
Laser
Species Concentration
Variable
µM
t
time
Variable
s
Annotation and Pathway Links
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Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
CONNECTED (astfh234)
72.6MB / 112.6MB

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)

File View Server Tools Help

BioModel4
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Reaction Diagram
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Applications (0)
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Pathway

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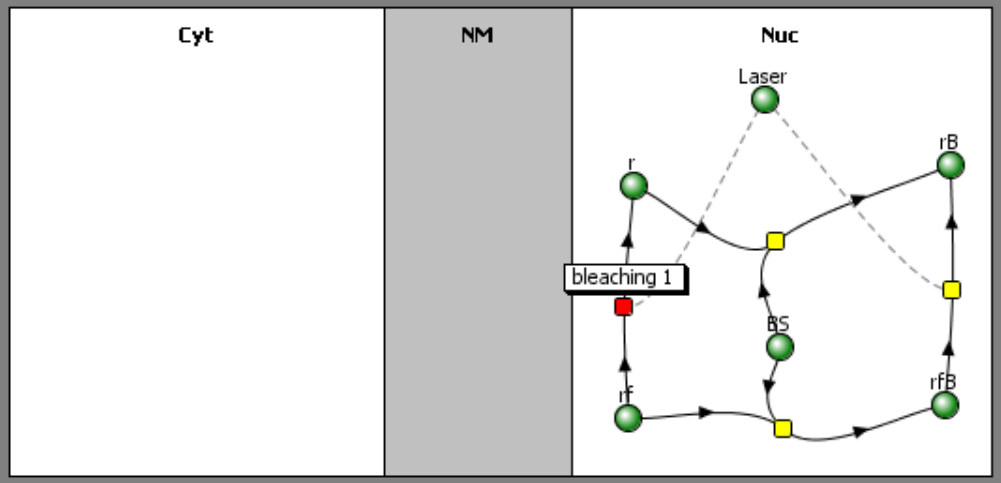
Tutorial VCell 6.0 (Rule-based) (7)

Reaction Diagram | Reactions | Structures | Species | Molecules | Observables



Delete | Pathway Links | Search

Object Properties | Problems (0 Errors, 0 Warnings)

Reaction Name: bleaching 1

Next to Reaction Name type “bleaching 1”.

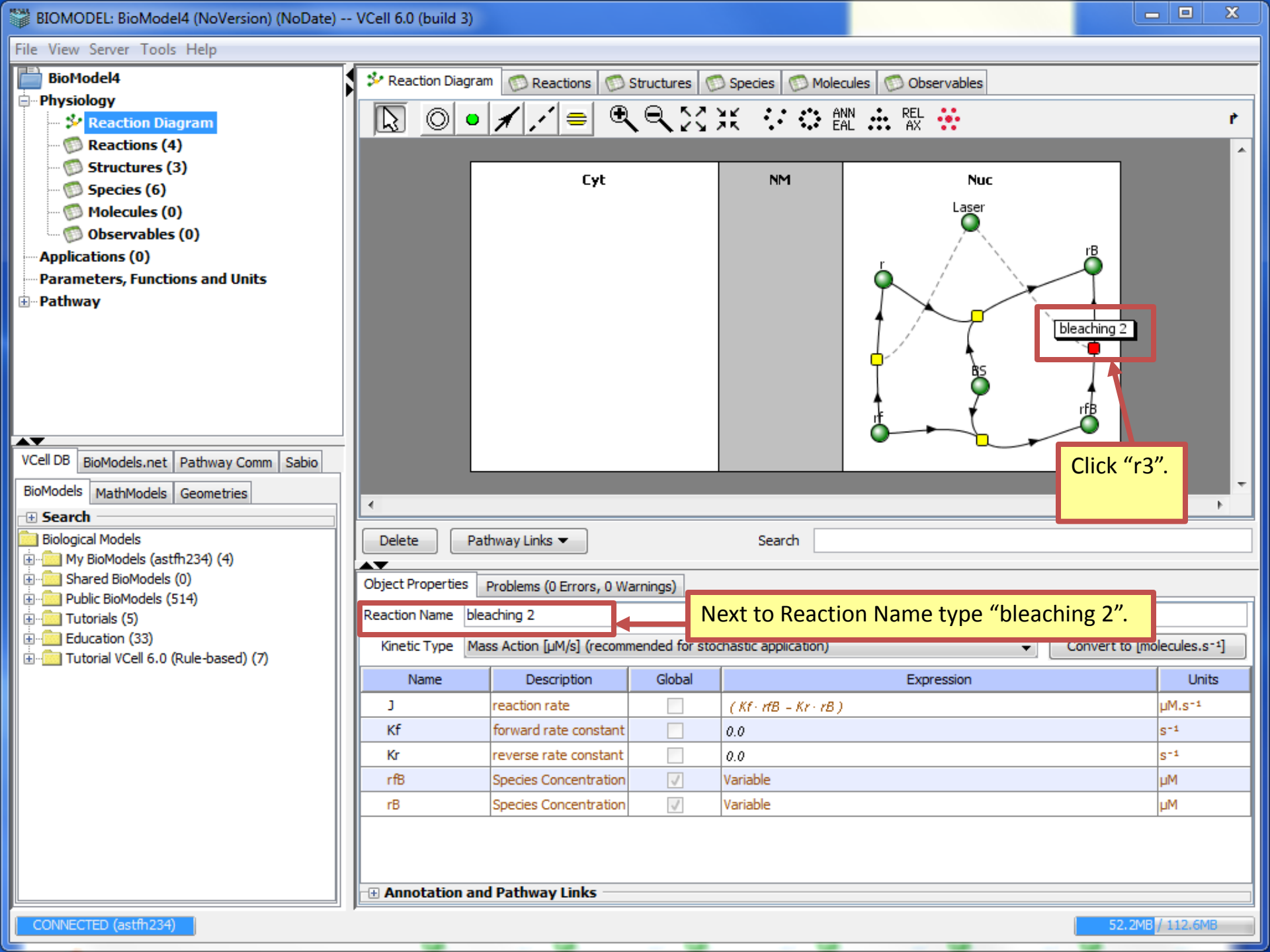
Kinetic Type: General [µM/s] | Convert to [molecules.s⁻¹]

Name	Description	Global	Expression	Units
J	reaction rate	☐	*Vmax · rf · Laser · ((t > 1.0) && (t < 1.5))*	µM.s⁻¹
Vmax	user defined	☐	*50.0*	s⁻¹.µM⁻¹
rf	Species Concentration	☑	Variable	µM
Laser	Species Concentration	☑	Variable	µM
t	time	☑	Variable	s

Annotation and Pathway Links

CONNECTED (astfh234)

77.7MB / 112.5MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
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Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
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Sabio
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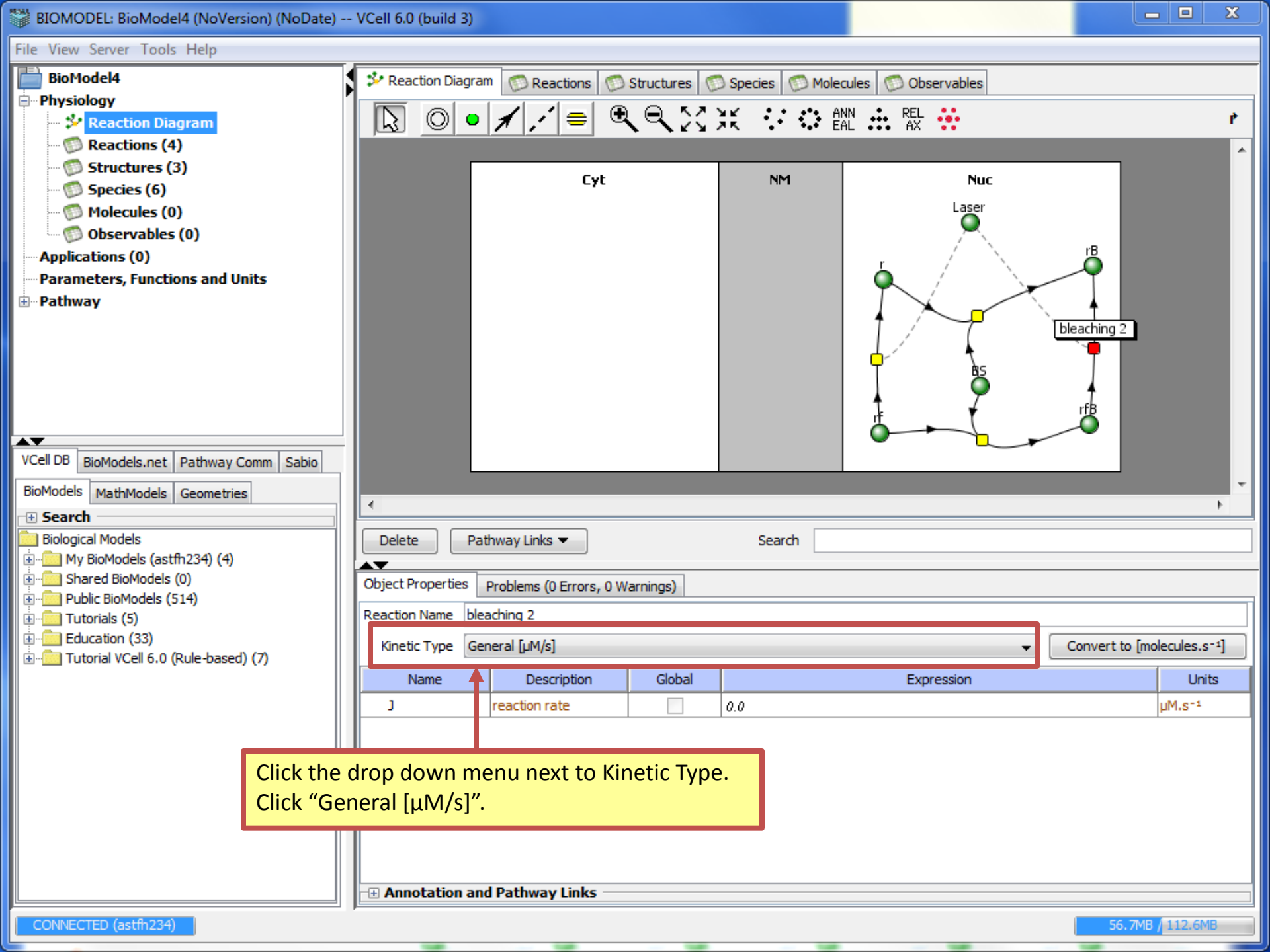
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
Laser
r
rB
bleaching 2
BS
rf
rfB
Click “r3”.
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
bleaching 2
Next to Reaction Name type “bleaching 2”.
Kinetic Type
Mass Action [μM/s] (recommended for stochastic application)
Convert to [molecules.s-1]
Name
Description
Global
Expression
Units
J
reaction rate
(Kf · rfB - Kr · rB)
μM.s-1
Kf
forward rate constant
0.0
s-1
Kr
reverse rate constant
0.0
s-1
rfB
Species Concentration
Variable
μM
rB
Species Concentration
Variable
μM
Annotation and Pathway Links
CONNECTED (astfh234)
52.2MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
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Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Reaction Diagram
Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
Laser
r
rB
bleaching 2
BS
rF
rfB
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
bleaching 2
Kinetic Type
General [µM/s]
Convert to [molecules.s⁻¹]
Name
Description
Global
Expression
Units
J
reaction rate
0.0
µM.s⁻¹
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Pathway Comm
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Geometries
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Biological Models
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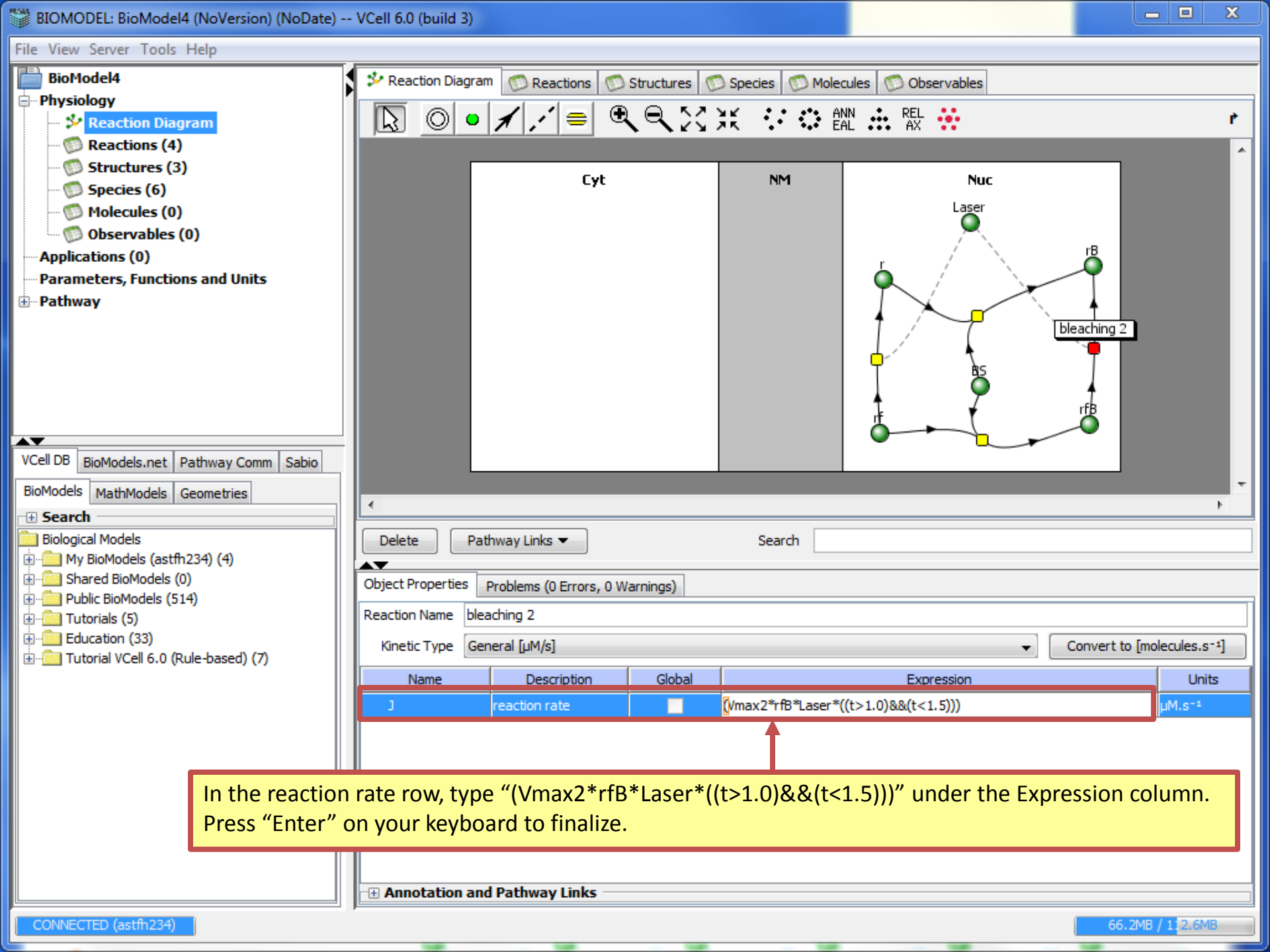
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Click the drop down menu next to Kinetic Type.
Click “General [µM/s]”.
CONNECTED (astfh234)
56.7MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
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Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
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Reactions
Structures
Species
Molecules
Observables
Cyt
NM
Nuc
Laser
r
rB
bleaching 2
BS
rF
rfB
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Public BioModels (514)
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Tutorial VCell 6.0 (Rule-based) (7)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
bleaching 2
Kinetic Type
General [µM/s]
Convert to [molecules.s⁻¹]
Name
Description
Global
Expression
Units
J
reaction rate
(Vmax2*rfB*Laser*((t>1.0)&&(t<1.5)))
µM.s⁻¹
In the reaction rate row, type “(Vmax2*rfB*Laser*((t>1.0)&&(t<1.5)))” under the Expression column. Press “Enter” on your keyboard to finalize.
Annotation and Pathway Links
CONNECTED (astfh234)
66.2MB / 1 2.6MB

BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)

File View Server Tools Help

BioModel4
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway

VCell DB | BioModels.net | Pathway Comm | Sabio

BioModels | MathModels | Geometries

Search
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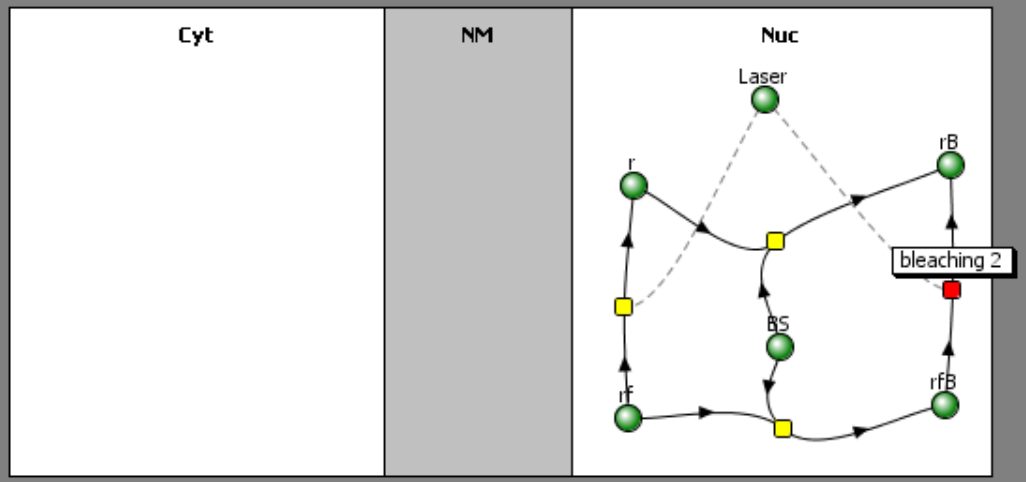
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)

Reaction Diagram | Reactions | Structures | Species | Molecules | Observables



Delete | Pathway Links | Search

Object Properties | Pro

Reaction Name bleach
Kinetic Type Gener
Convert to [molecules.s⁻¹]

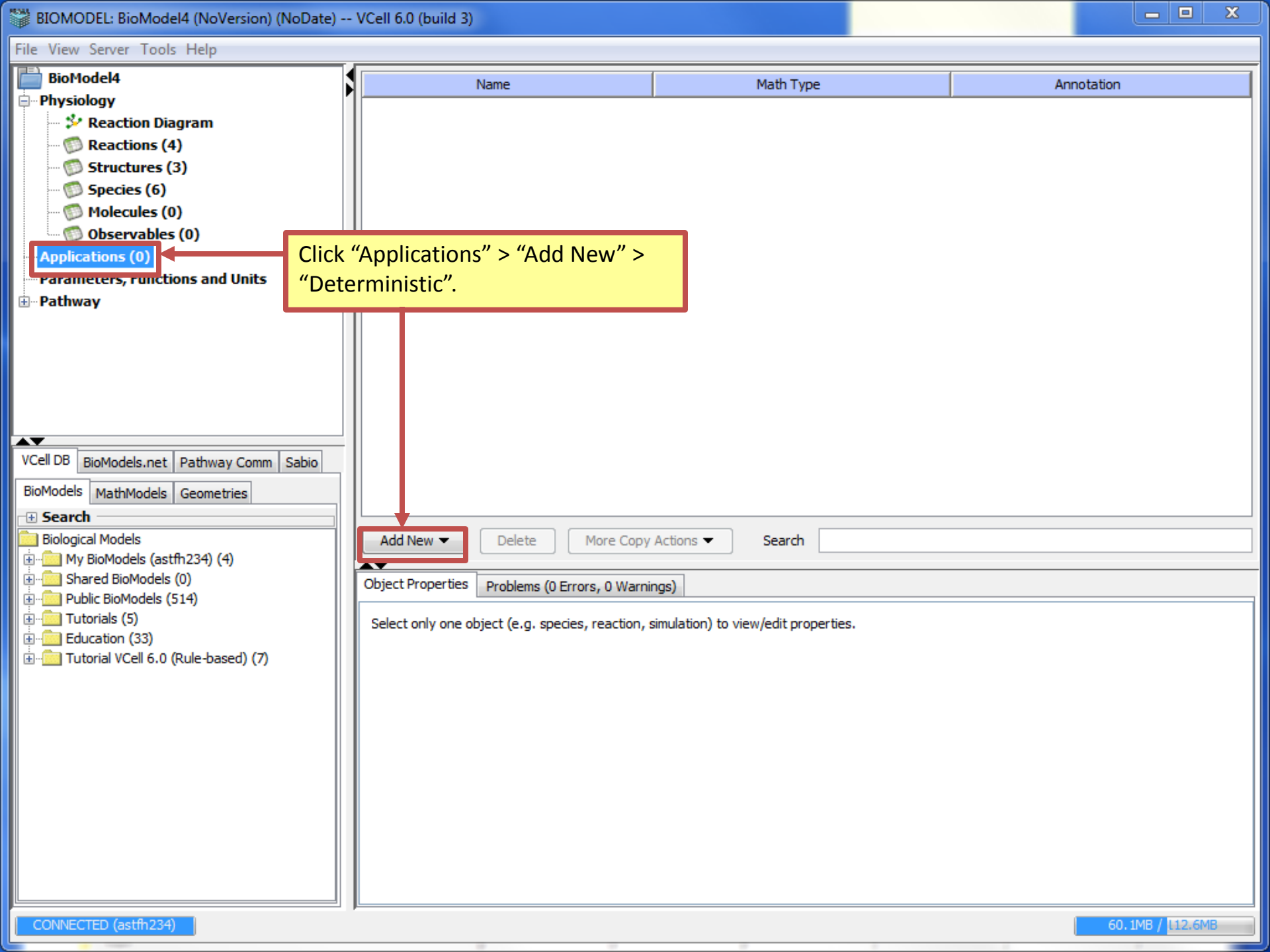
In the Vmax row, type “50” under the Expression column. Press “Enter” on your keyboard to finalize.

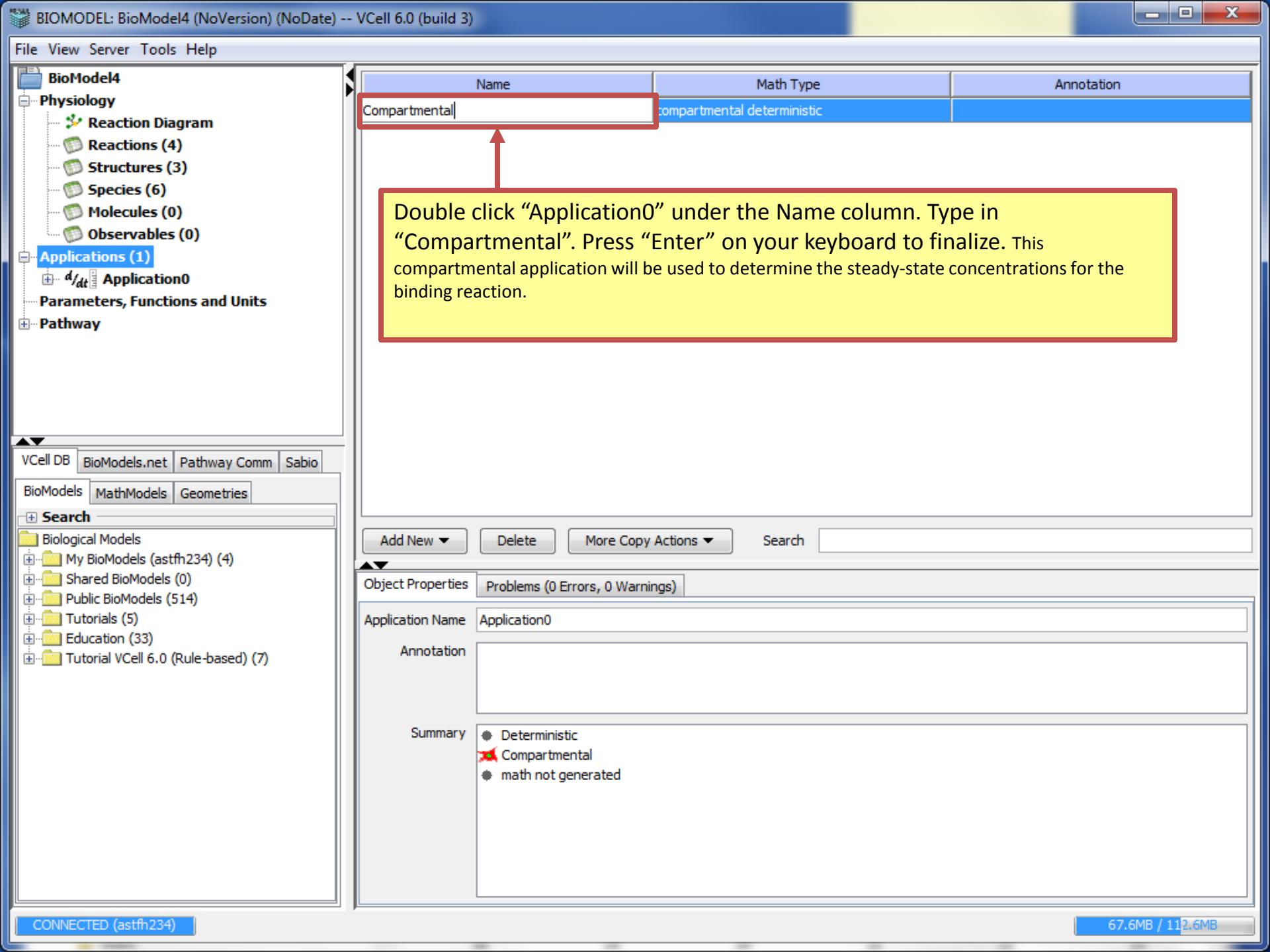
Name	Description	Global	Expression	Units
J	reaction rate	☐	Vmax2 · rfB · Laser · ((t > 1.0) && (t < 1.5))	µM.s⁻¹
Vmax2	user defined	☐	50	s⁻¹.µM⁻¹
rfB	Species Concentration	☑	Variable	µM
Laser	Species Concentration	☑	Variable	µM
t	time	☑	Variable	s

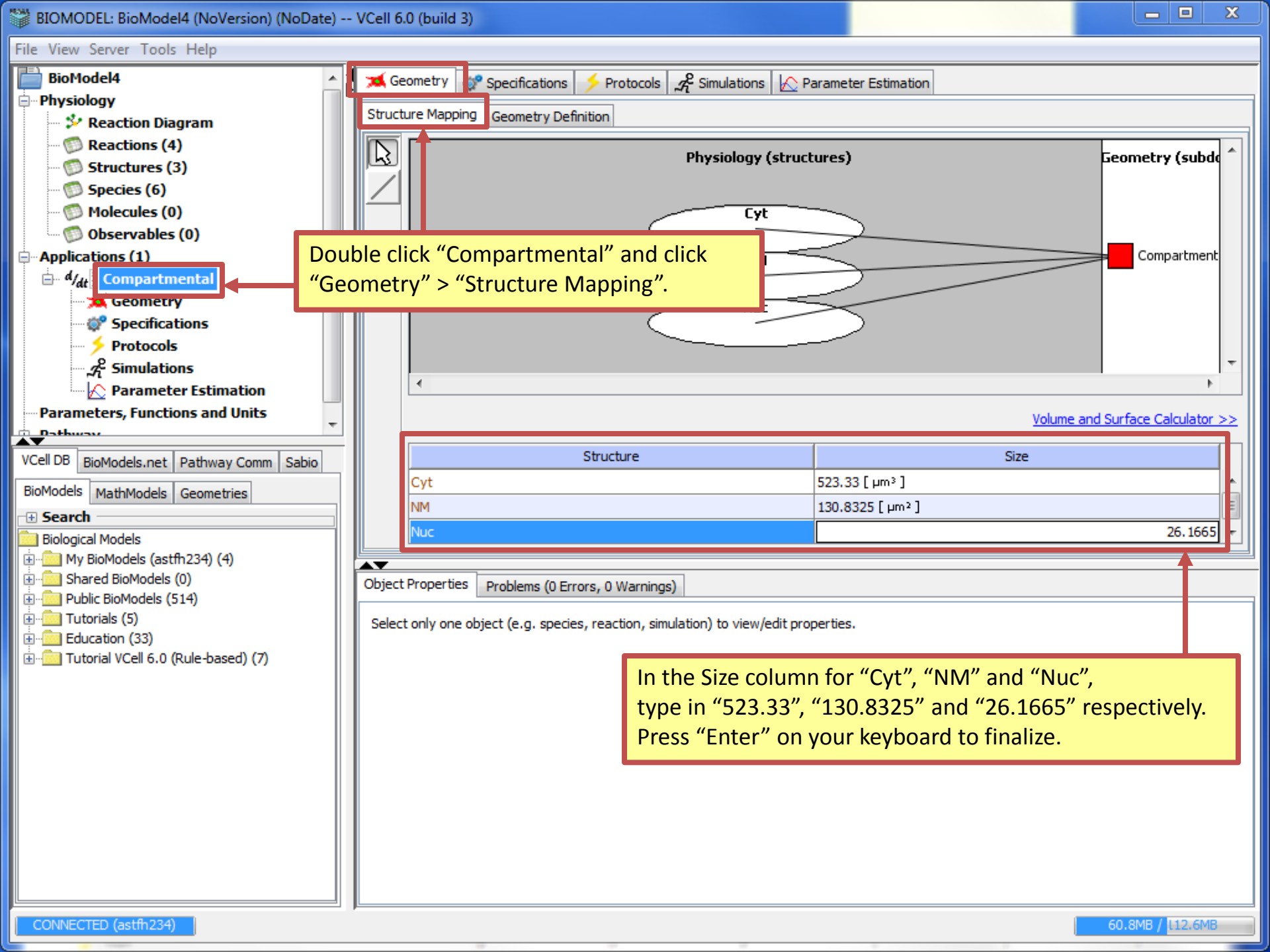
Annotation and Pathway Links

CONNECTED (astfh234)

75.4MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (0)
Parameters, Functions and Units
Pathway
Name
Math Type
Annotation
Click “Applications” > “Add New” > “Deterministic”.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Add New
Delete
More Copy Actions
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
60.1MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (1)
Application0
Parameters, Functions and Units
Pathway
Name
Math Type
Annotation
Compartmental
compartmental deterministic
Double click “Application0” under the Name column. Type in “Compartmental”. Press “Enter” on your keyboard to finalize. This compartmental application will be used to determine the steady-state concentrations for the binding reaction.
Add New
Delete
More Copy Actions
Search
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Application Name
Application0
Annotation
Summary
Deterministic
Compartmental
math not generated
CONNECTED (astfh234)
67.6MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (1)
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Parameter Estimation
Parameters, Functions and Units
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Structure Mapping
Geometry Definition
Physiology (structures)
Geometry (subdo
Cyt
Compartment
Volume and Surface Calculator >>
Structure
Size
Cyt
523.33 [µm³]
NM
130.8325 [µm²]
Nuc
26.1665
Double click “Compartmental” and click “Geometry” > “Structure Mapping”.
In the Size column for “Cyt”, “NM” and “Nuc”, type in “523.33”, “130.8325” and “26.1665” respectively. Press “Enter” on your keyboard to finalize.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
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Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
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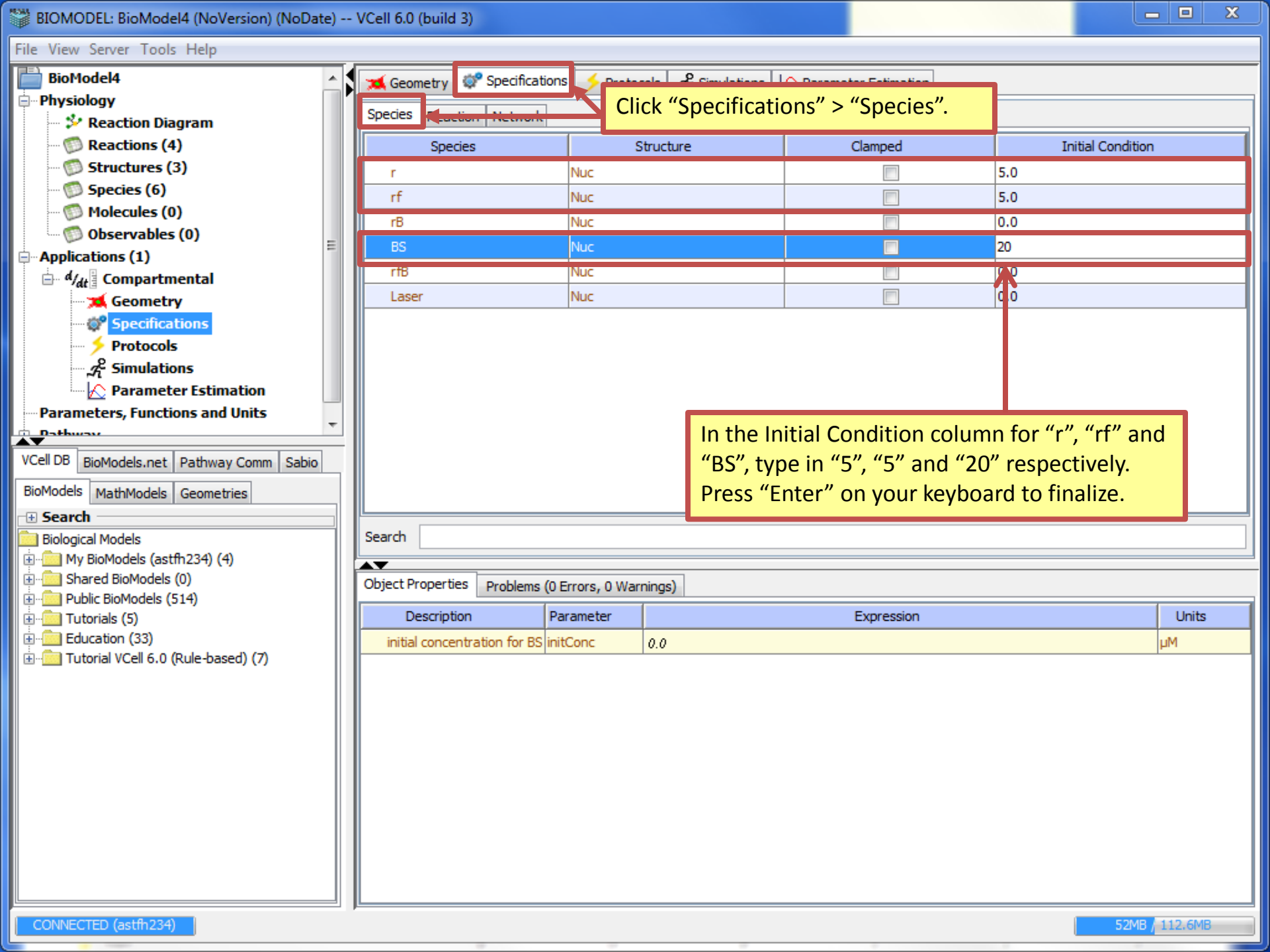
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
60.8MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
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Public BioModels (514)
Tutorials (5)
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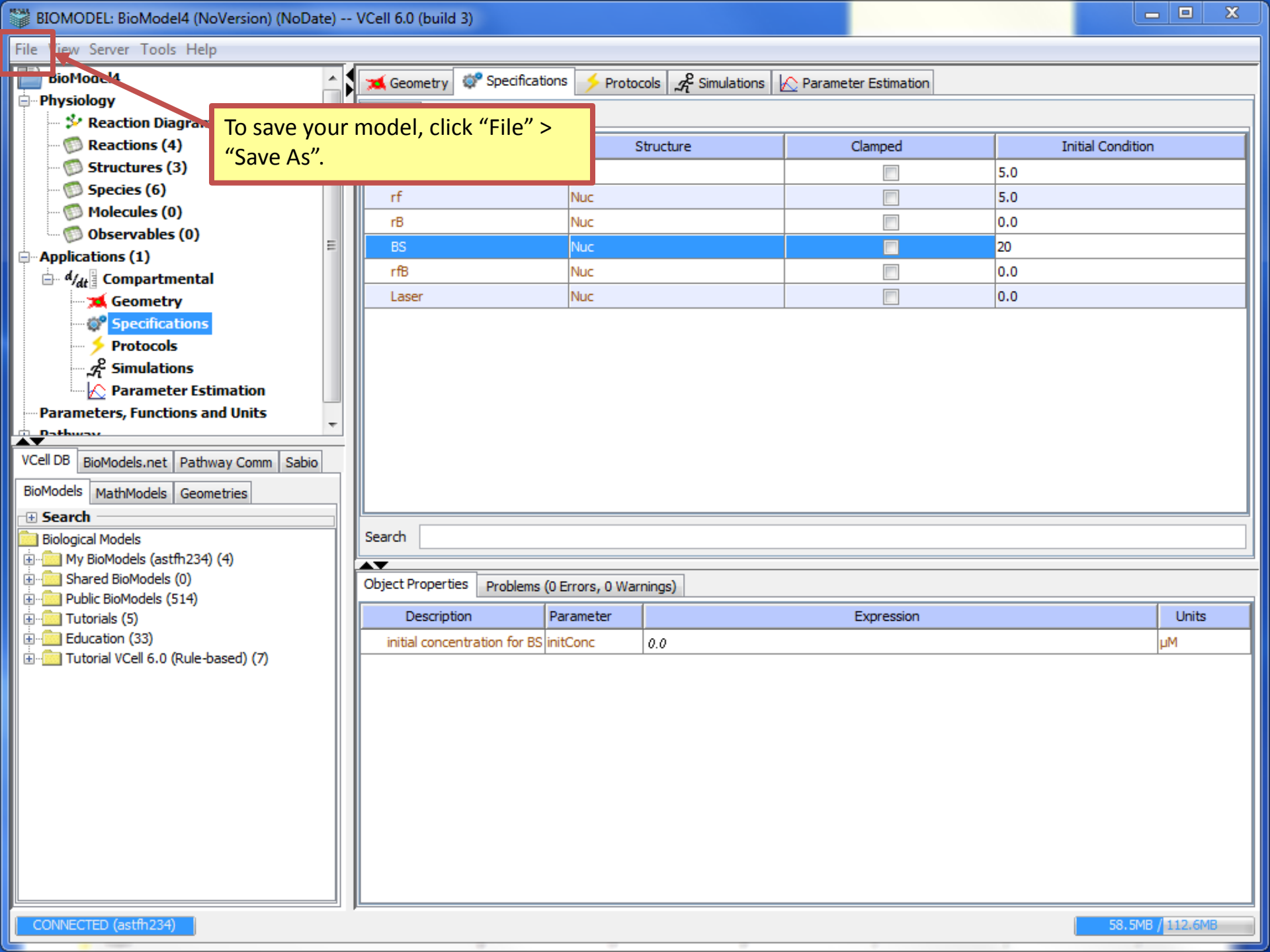
Tutorial VCell 6.0 (Rule-based) (7)
Geometry
Specifications
Species
Click “Specifications” > “Species”.
Species
Structure
Clamped
Initial Condition
r
Nuc
5.0
rf
Nuc
5.0
rB
Nuc
0.0
BS
Nuc
20
rfB
Nuc
0.0
Laser
Nuc
0.0
In the Initial Condition column for “r”, “rf” and “BS”, type in “5”, “5” and “20” respectively. Press “Enter” on your keyboard to finalize.
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Description
Parameter
Expression
Units
initial concentration for BS
initConc
0.0
μM
CONNECTED (astfh234)
52MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
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Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (1)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Parameters, Functions and Units
To save your model, click “File” > “Save As”.
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Structure
Clamped
Initial Condition
5.0
rf
Nuc
5.0
rB
Nuc
0.0
BS
Nuc
20
rfB
Nuc
0.0
Laser
Nuc
0.0
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Description
Parameter
Expression
Units
initial concentration for BS
initConc
0.0
µM
VCell DB
BioModels.net
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My BioModels (astfh234) (4)
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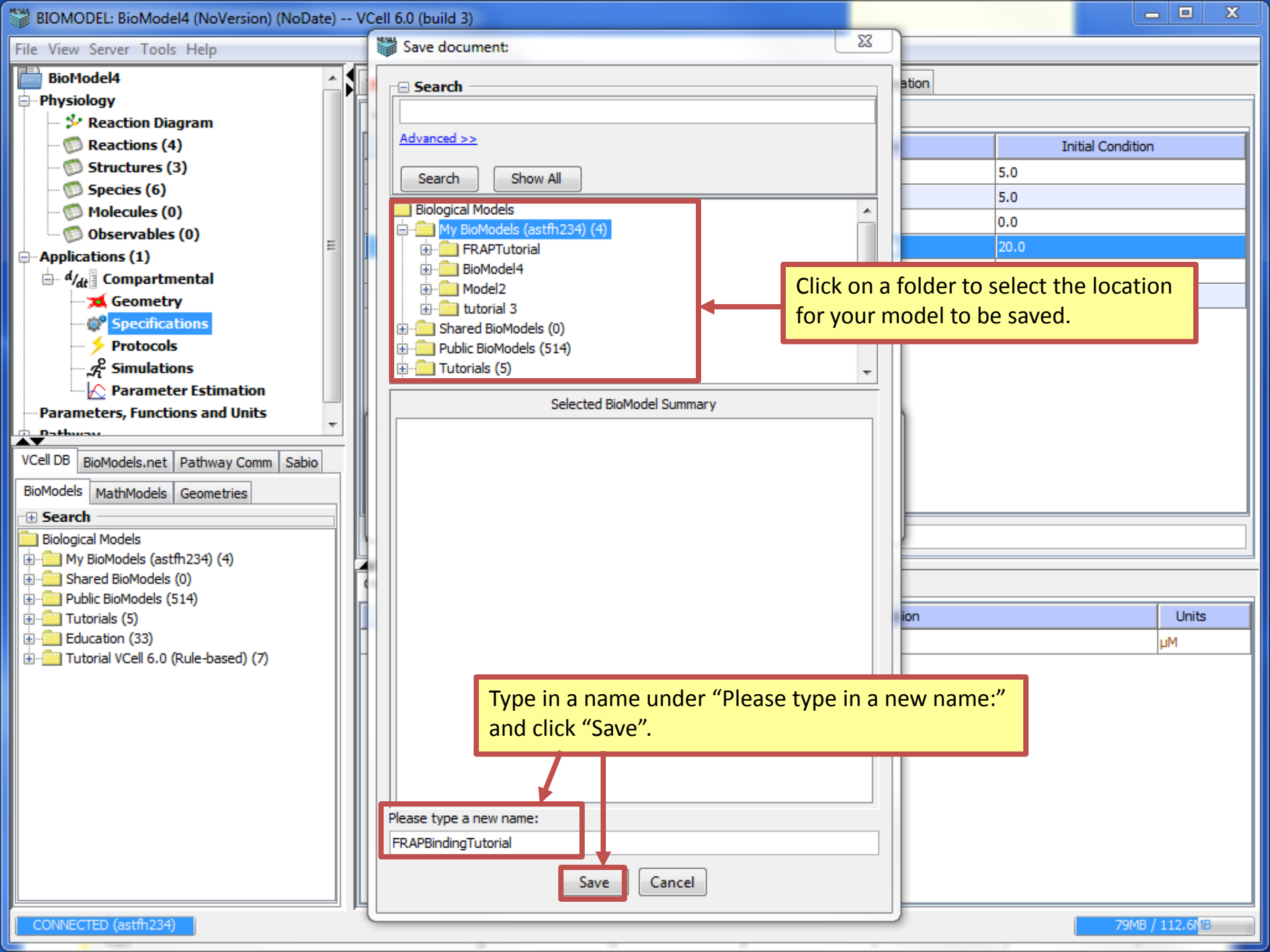
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
CONNECTED (astfh234)
58.5MB / 112.6MB


BIOMODEL: BioModel4 (NoVersion) (NoDate) -- VCell 6.0 (build 3)
File View Server Tools Help
BioModel4
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (1)
Compartmental
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Tutorials (5)
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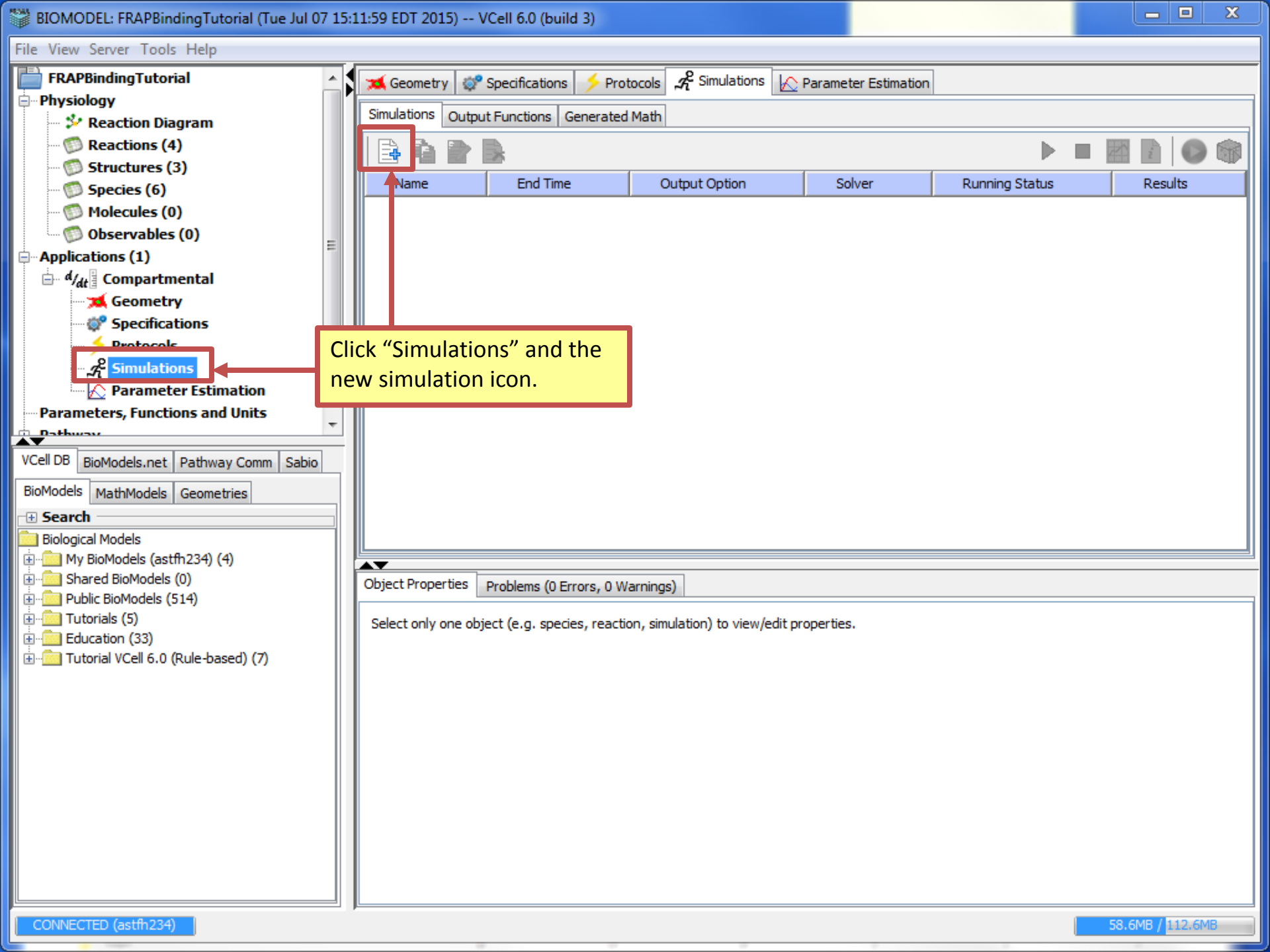
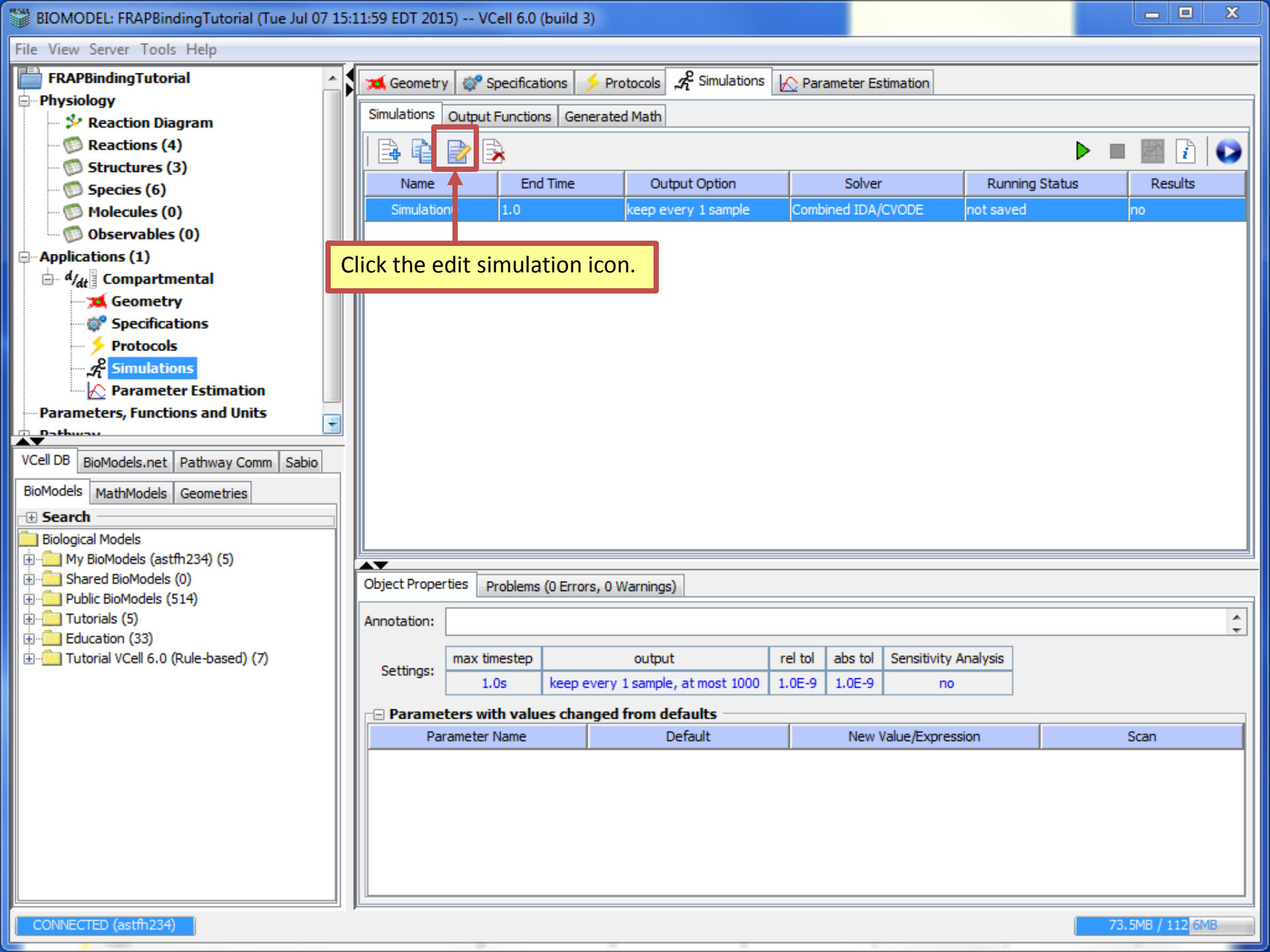
CONNECTED (astfh234)
Save document:
Search
Advanced >>
Search
Show All
Biological Models
My BioModels (astfh234) (4)
FRAPTutorial
BioModel4
Model2
tutorial 3
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Selected BioModel Summary
Click on a folder to select the location for your model to be saved.
Type in a name under “Please type in a new name:” and click “Save”.
Please type a new name:
FRAPBindingTutorial
Save
Cancel
Initial Condition
5.0
5.0
0.0
20.0
Units
µM
79MB / 112.6MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:11:59 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (1)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Parameters, Functions and Units
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Click “Simulations” and the new simulation icon.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (4)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
58.6MB / 112.6MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:11:59 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (1)
Compartmental
Geometry
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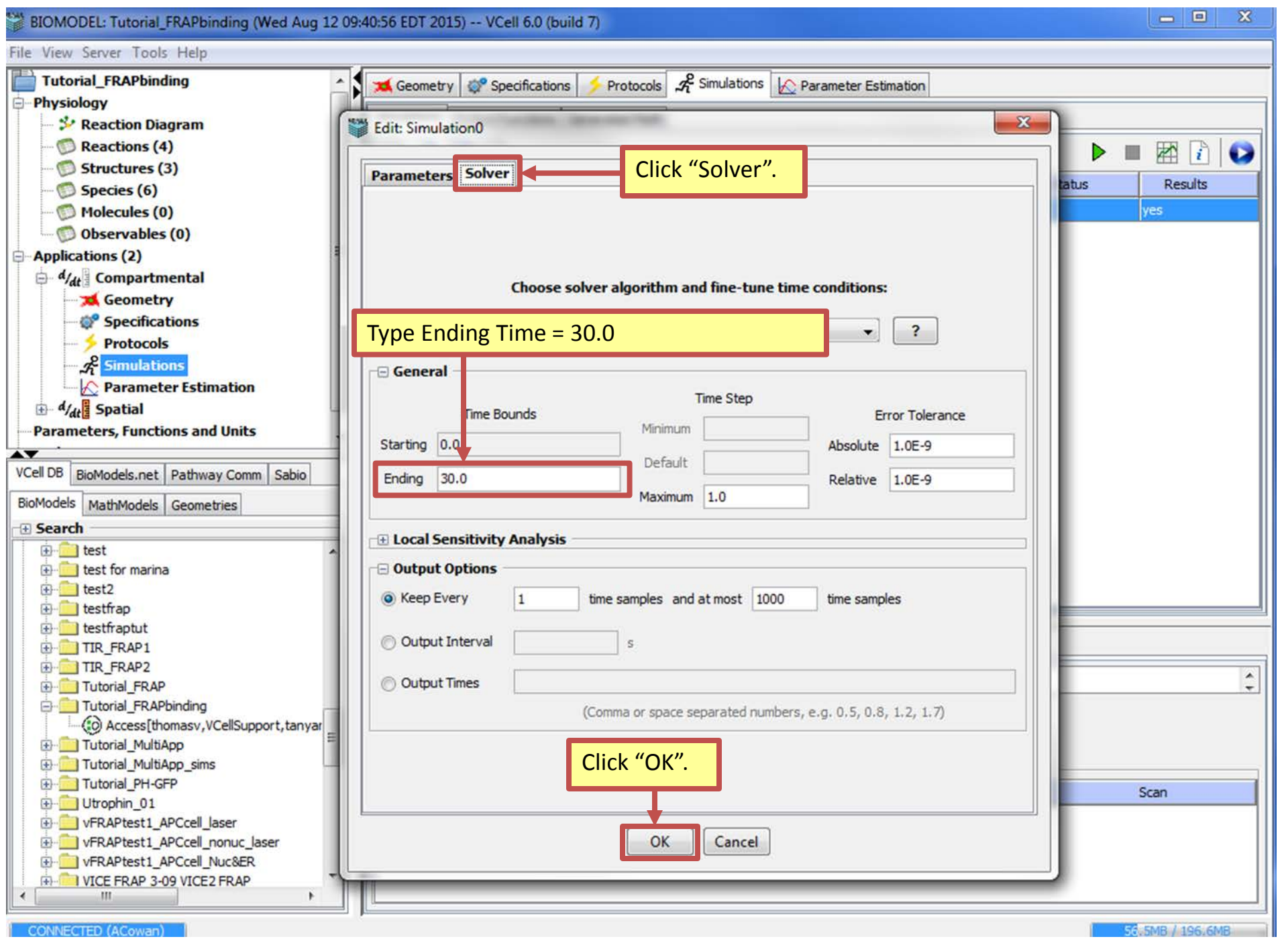
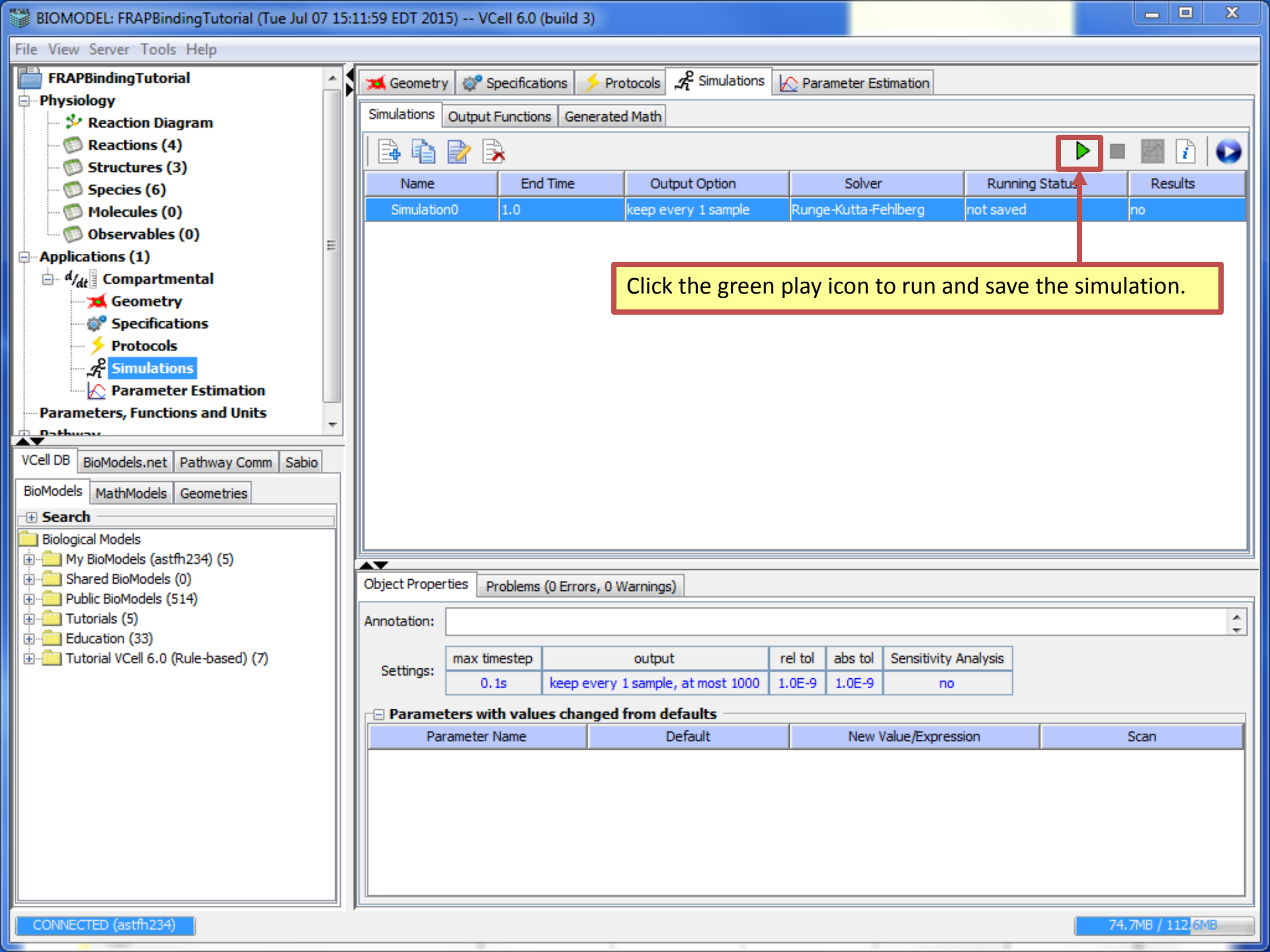
Protocols
Simulations
Parameter Estimation
Parameters, Functions and Units
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation
1.0
keep every 1 sample
Combined IDA/CVODE
not saved
no
Click the edit simulation icon.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Annotation:
Settings:
max timestep
output
rel tol
abs tol
Sensitivity Analysis
1.0s
keep every 1 sample, at most 1000
1.0E-9
1.0E-9
no
Parameters with values changed from defaults
Parameter Name
Default
New Value/Expression
Scan
CONNECTED (astfh234)
73.5MB / 112.6MB


BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 6.0 (build 7)
File View Server Tools Help
Tutorial_FRAPbinding
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (2)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Spatial
Parameters, Functions and Units
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Edit: Simulation0
Parameters
Solver
Click “Solver”.
Choose solver algorithm and fine-tune time conditions:
Type Ending Time = 30.0
General
Time Bounds
Starting 0.0
Ending 30.0
Time Step
Minimum
Default
Maximum 1.0
Error Tolerance
Absolute 1.0E-9
Relative 1.0E-9
Local Sensitivity Analysis
Output Options
Keep Every 1 time samples and at most 1000 time samples
Output Interval s
Output Times
(Comma or space separated numbers, e.g. 0.5, 0.8, 1.2, 1.7)
Click “OK”.
OK
Cancel
Results
yes
Scan
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
test
test for marina
test2
testfrap
testfraptut
TIR_FRAP1
TIR_FRAP2
Tutorial_FRAP
Tutorial_FRAPbinding
Tutorial_MultiApp
Tutorial_MultiApp_sims
Tutorial_PH-GFP
Utrophin_01
vFRAPtest1_APCcell_laser
vFRAPtest1_APCcell_nonuc_laser
vFRAPtest1_APCcell_Nuc&ER
VICE FRAP 3-09 VICE2 FRAP
CONNECTED (ACowan)


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:11:59 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
Physiology
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Observables (0)
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Pathway Comm
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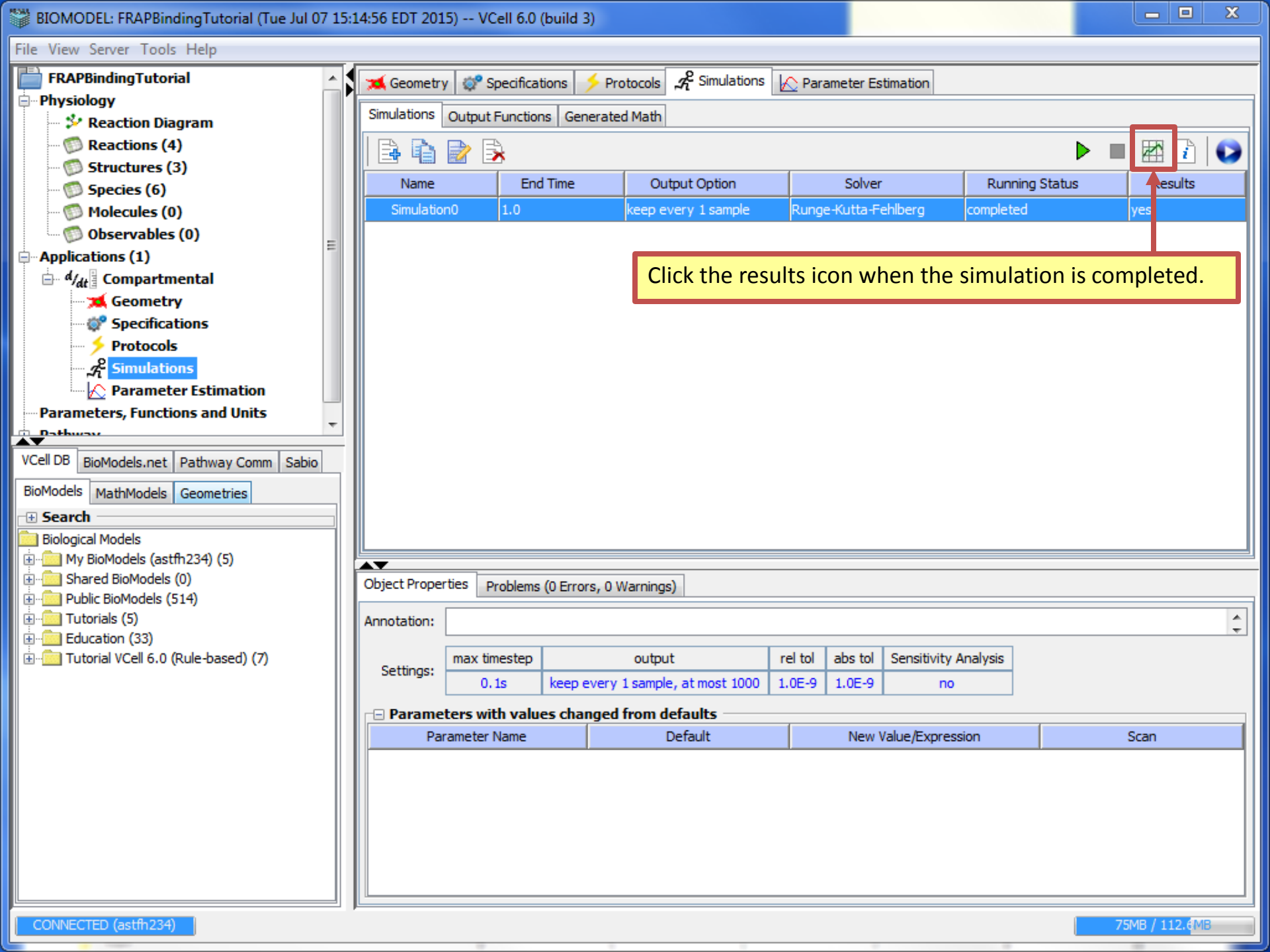
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation0
1.0
keep every 1 sample
Runge-Kutta-Fehlberg
not saved
no
Click the green play icon to run and save the simulation.
Object Properties
Problems (0 Errors, 0 Warnings)
Annotation:
Settings:
max timestep
output
rel tol
abs tol
Sensitivity Analysis
0.1s
keep every 1 sample, at most 1000
1.0E-9
1.0E-9
no
Parameters with values changed from defaults
Parameter Name
Default
New Value/Expression
Scan
CONNECTED (astfh234)
74.7MB / 112.6MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
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Molecules (0)
Observables (0)
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Parameters, Functions and Units
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Sabio
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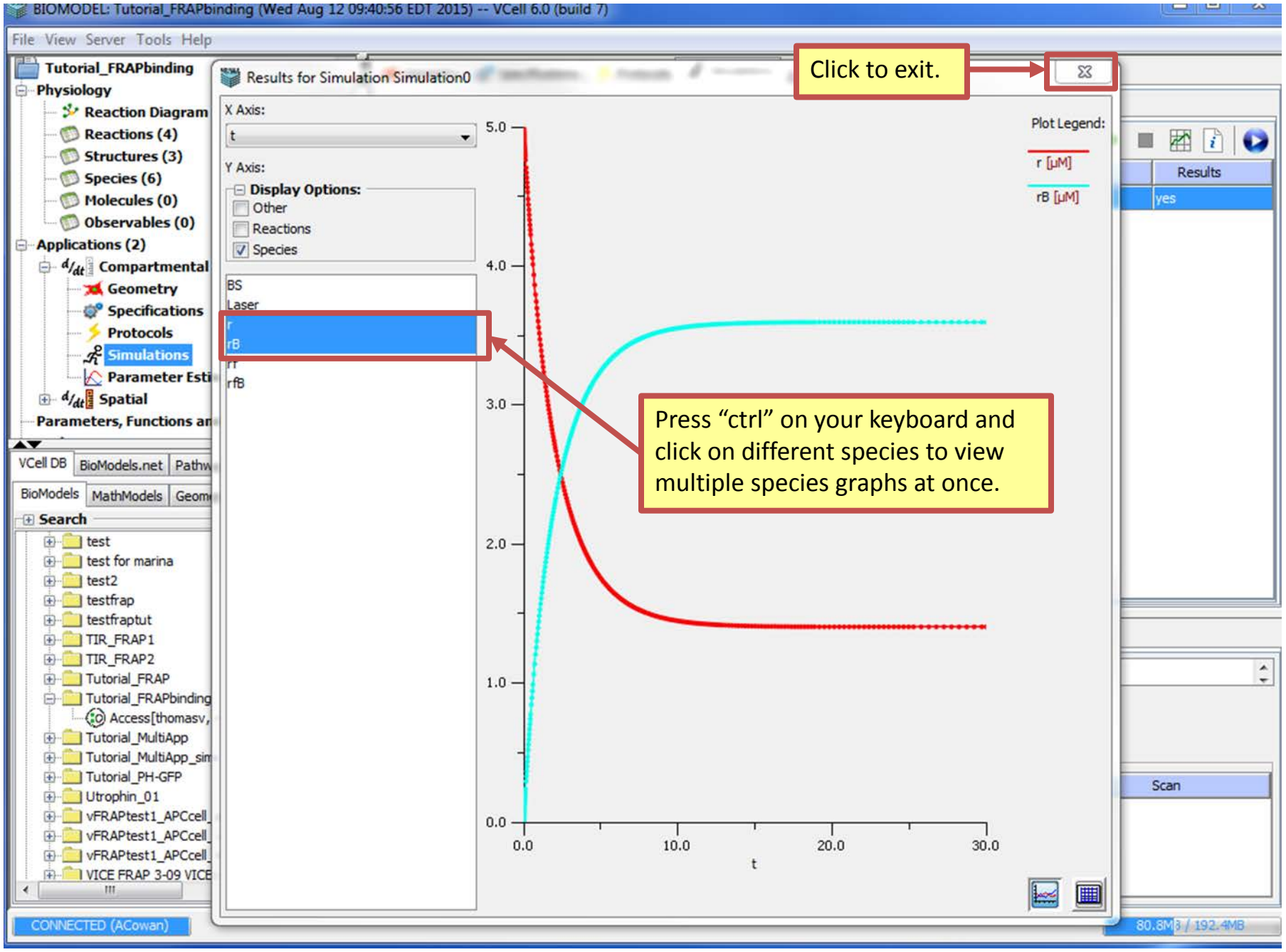
Specifications
Protocols
Simulations
Parameter Estimation
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation0
1.0
keep every 1 sample
Runge-Kutta-Fehlberg
completed
yes
Click the results icon when the simulation is completed.
Object Properties
Problems (0 Errors, 0 Warnings)
Annotation:
Settings:
max timestep
output
rel tol
abs tol
Sensitivity Analysis
0.1s
keep every 1 sample, at most 1000
1.0E-9
1.0E-9
no
Parameters with values changed from defaults
Parameter Name
Default
New Value/Expression
Scan
CONNECTED (astfh234)
75MB / 112.6MB


BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 6.0 (build 7)
File View Server Tools Help
Tutorial_FRAPbinding
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (2)
Compartmental
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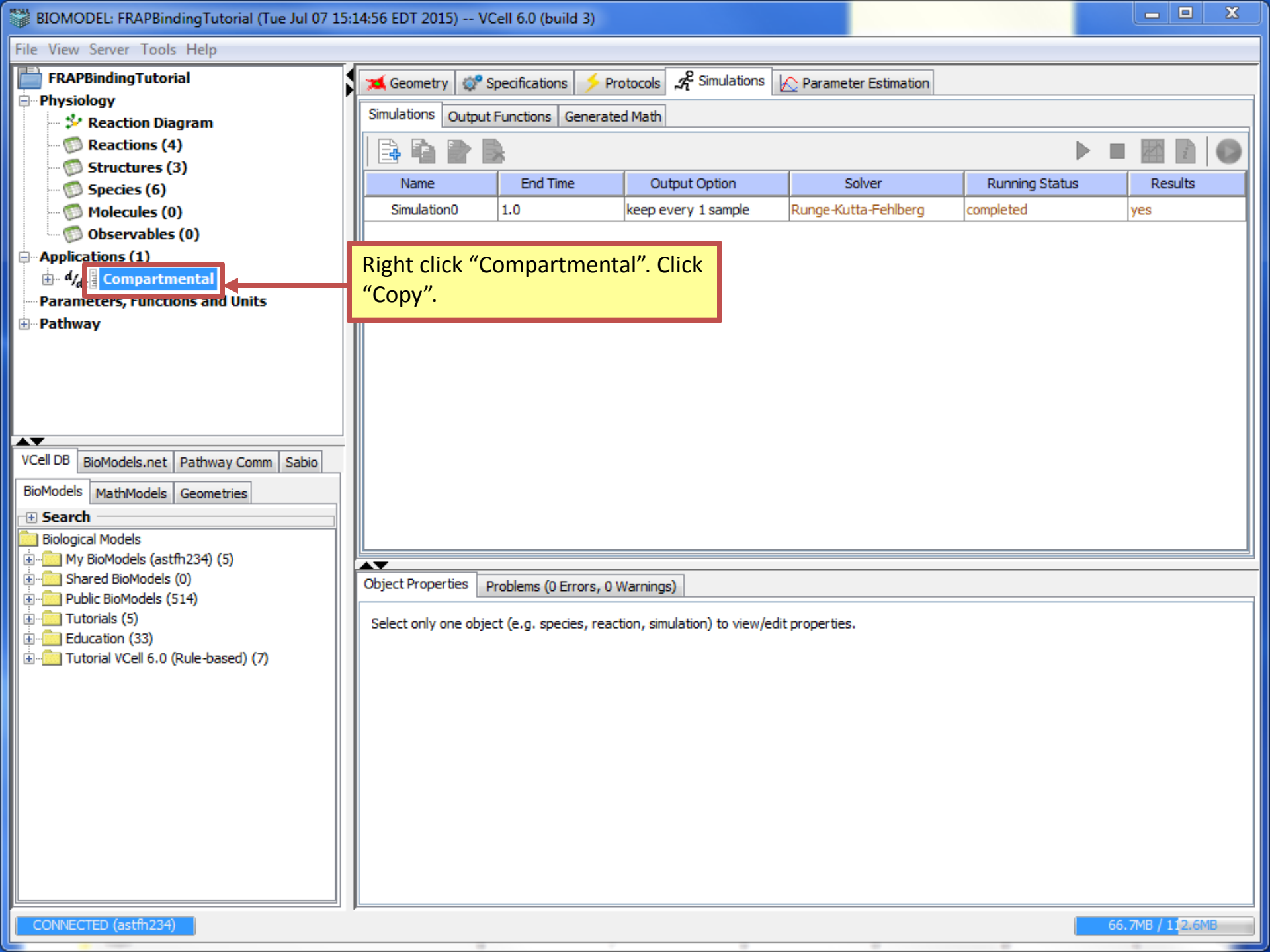
Specifications
Protocols
Simulations
Parameter Esti
Spatial
Parameters, Functions ar
VCell DB
BioModels.net
BioModels
MathModels
Search
test
test for marina
test2
testfrap
testfraptut
TIR_FRAP1
TIR_FRAP2
Tutorial_FRAP
Tutorial_FRAPbinding
Tutorial_MultiApp
Tutorial_PH-GFP
Utrophin_01
CONNECTED (ACowan)
Results for Simulation Simulation0
Click to exit.
X Axis:
t
Y Axis:
Display Options:
Other
Reactions
Species
BS
Laser
r
rB
rfB
Plot Legend:
r [µM]
rB [µM]
5.0
4.0
3.0
2.0
1.0
0.0
0.0
10.0
20.0
30.0
t
Press “ctrl” on your keyboard and click on different species to view multiple species graphs at once.
Results
yes
Scan


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
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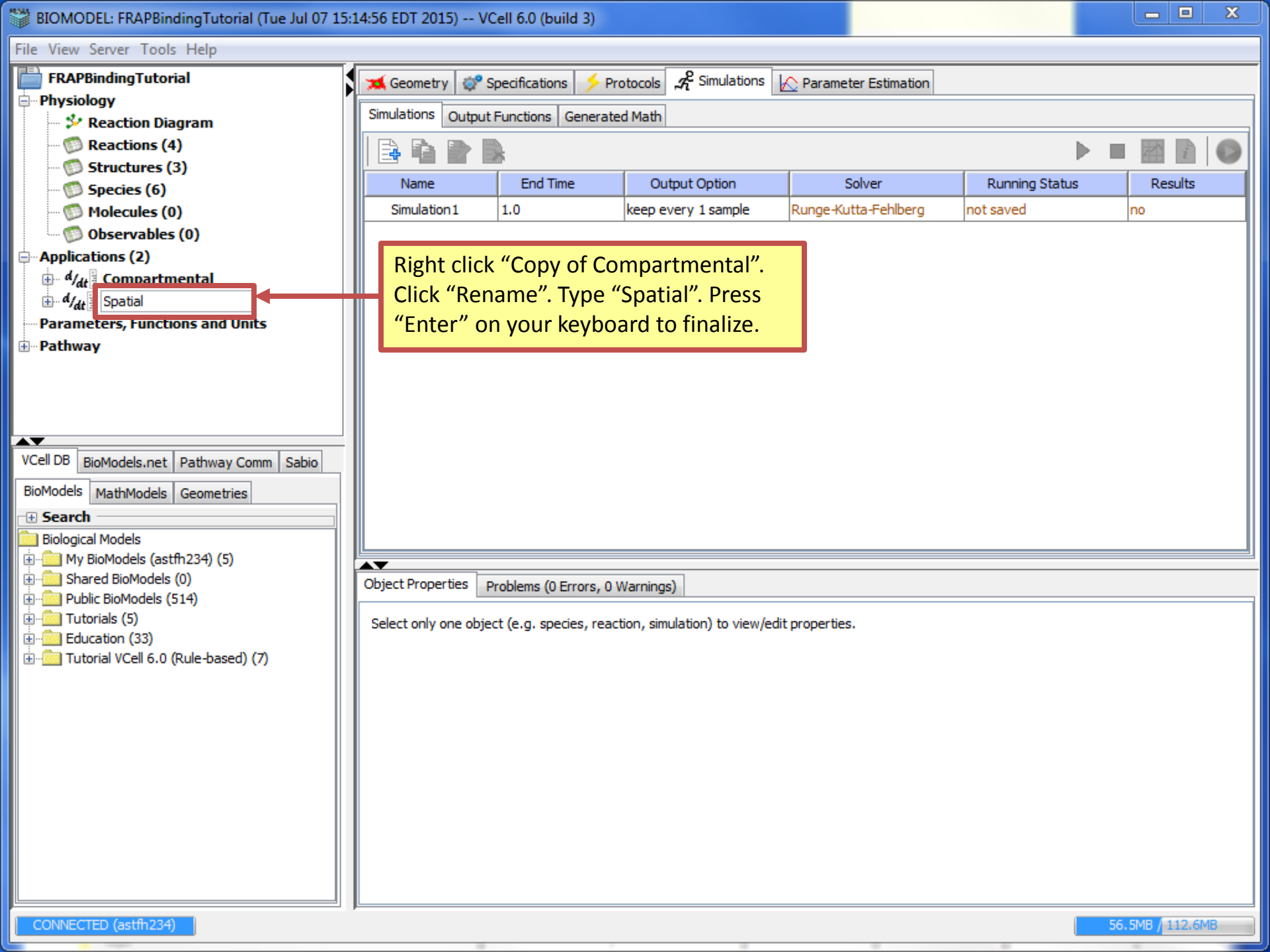
Species (6)
Molecules (0)
Observables (0)
Applications (1)
Compartmental
Parameters, Functions and Units
Pathway
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation0
1.0
keep every 1 sample
Runge-Kutta-Fehlberg
completed
yes
Right click “Compartmental”. Click “Copy”.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
66.7MB / 112.6MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
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Species (6)
Molecules (0)
Observables (0)
Applications (2)
Compartmental
Spatial
Parameters, Functions and Units
Pathway
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation1
1.0
keep every 1 sample
Runge-Kutta-Fehlberg
not saved
no
Right click “Copy of Compartmental”. Click “Rename”. Type “Spatial”. Press “Enter” on your keyboard to finalize.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
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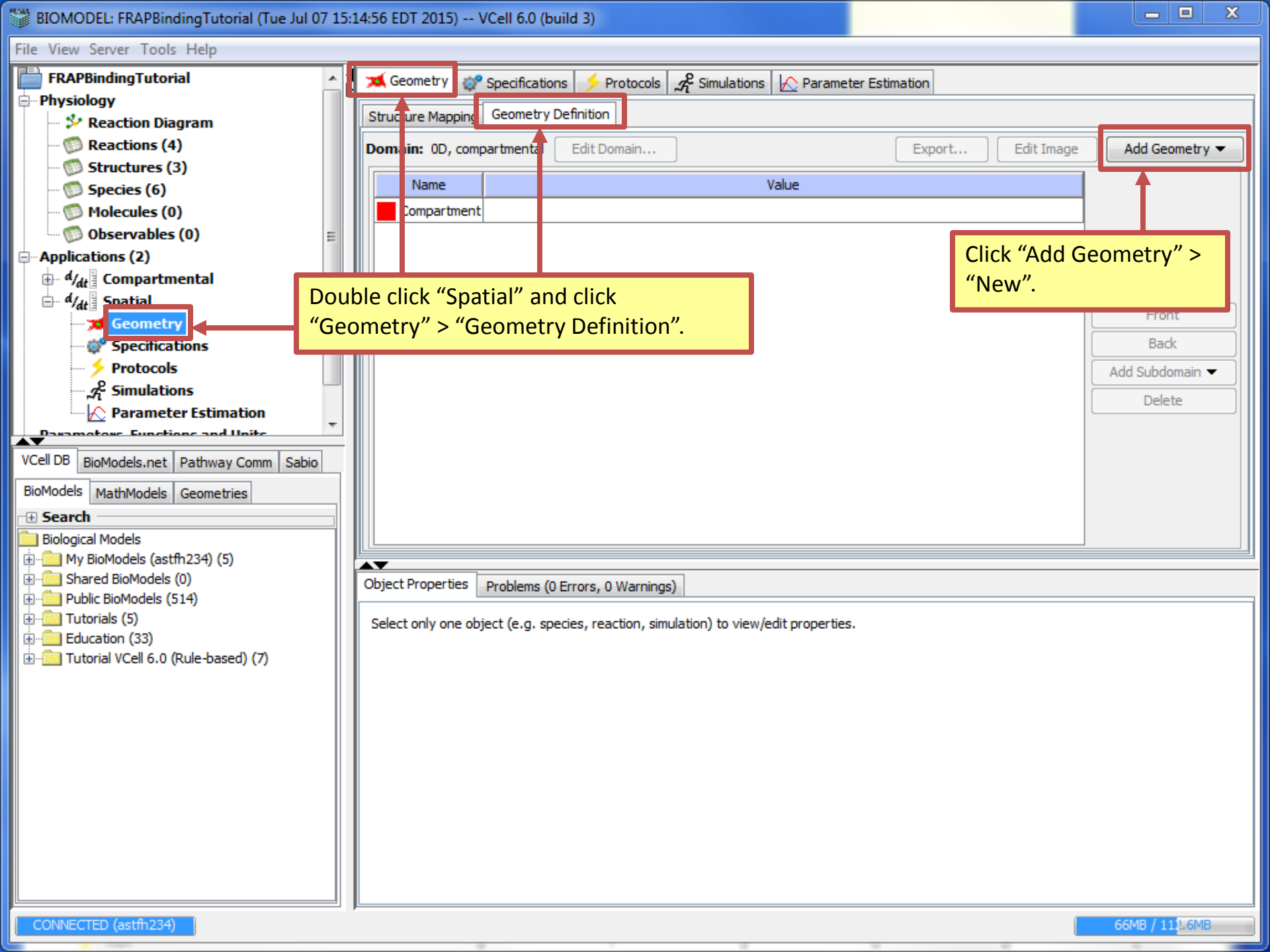
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
56.5MB / 112.6MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
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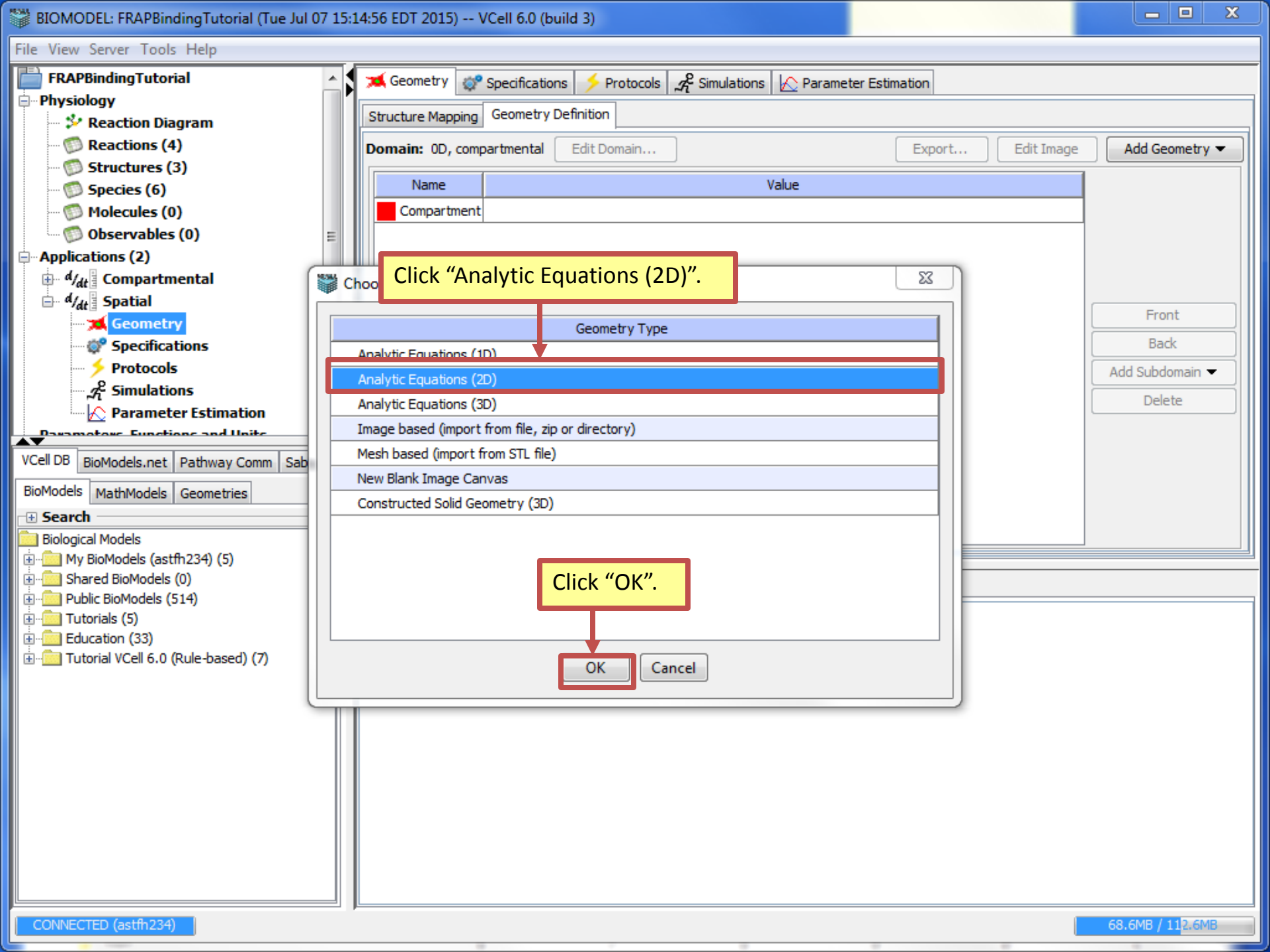
Species (6)
Molecules (0)
Observables (0)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Structure Mapping
Geometry Definition
Domain: 0D, compartmental
Edit Domain...
Export...
Edit Image
Add Geometry
Name
Value
Compartment
Front
Back
Add Subdomain
Delete
Double click “Spatial” and click “Geometry” > “Geometry Definition”.
Click “Add Geometry” > “New”.
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
66MB / 11


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
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Molecules (0)
Observables (0)
Applications (2)
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Spatial
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Structure Mapping
Geometry Definition
Domain: 0D, compartmental
Edit Domain...
Export...
Edit Image
Add Geometry
Name
Value
Compartment
Front
Back
Add Subdomain
Delete
Click “Analytic Equations (2D)”.
Geometry Type
Analytic Equations (1D)
Analytic Equations (2D)
Analytic Equations (3D)
Image based (import from file, zip or directory)
Mesh based (import from STL file)
New Blank Image Canvas
Constructed Solid Geometry (3D)
Click “OK”.
OK
Cancel
VCell DB
BioModels.net
Pathway Comm
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Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
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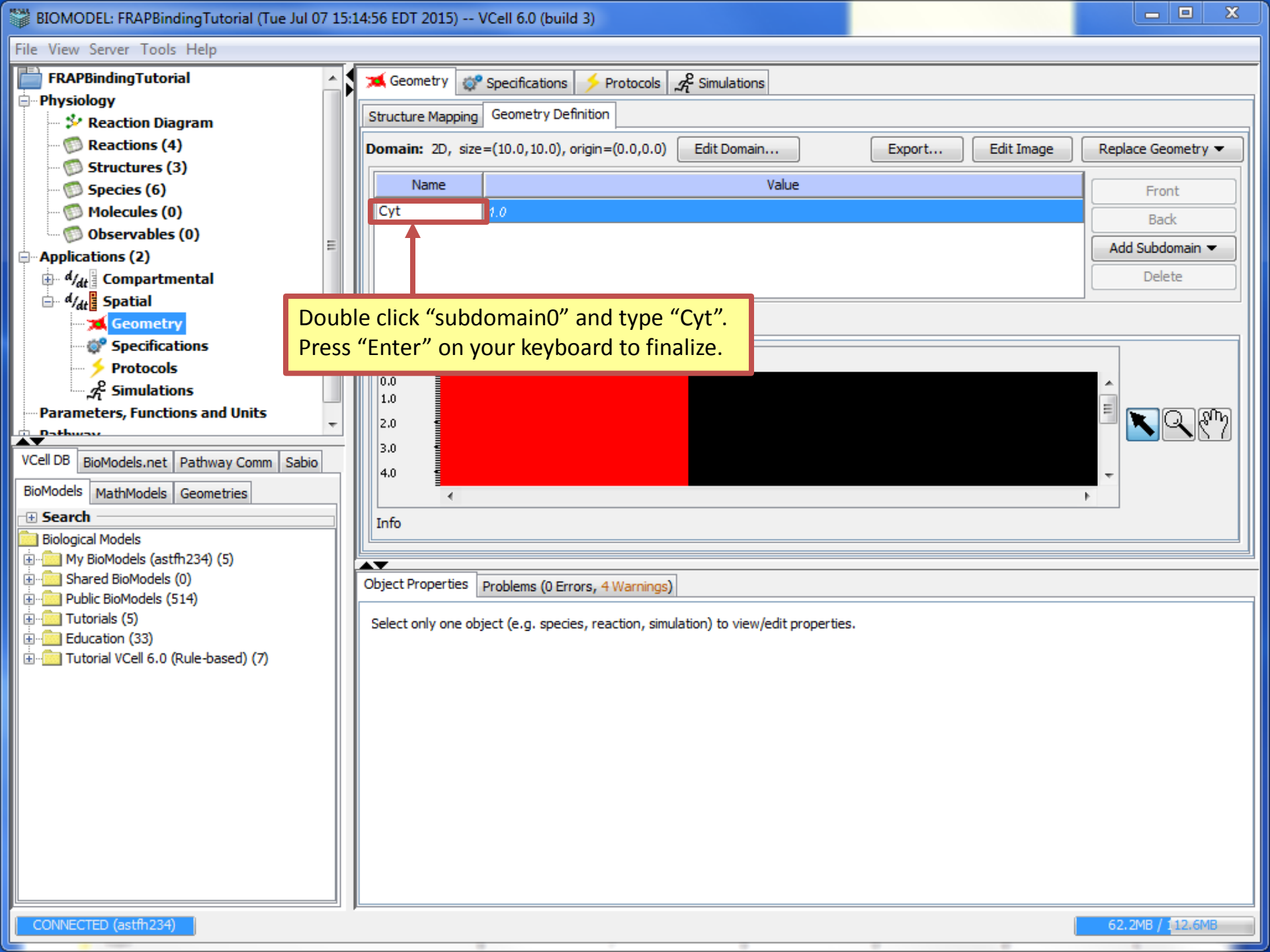
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
CONNECTED (astfh234)
68.6MB / 112.6MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
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Observables (0)
Applications (2)
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Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
Domain: 2D, size=(10.0,10.0), origin=(0.0,0.0)
Edit Domain...
Export...
Edit Image
Replace Geometry
Name
Value
Cyt
1.0
Front
Back
Add Subdomain
Delete
Double click “subdomain0” and type “Cyt”.
Press “Enter” on your keyboard to finalize.
0.0
1.0
2.0
3.0
4.0
Info
VCell DB
BioModels.net
Pathway Comm
Sabio
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MathModels
Geometries
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Shared BioModels (0)
Public BioModels (514)
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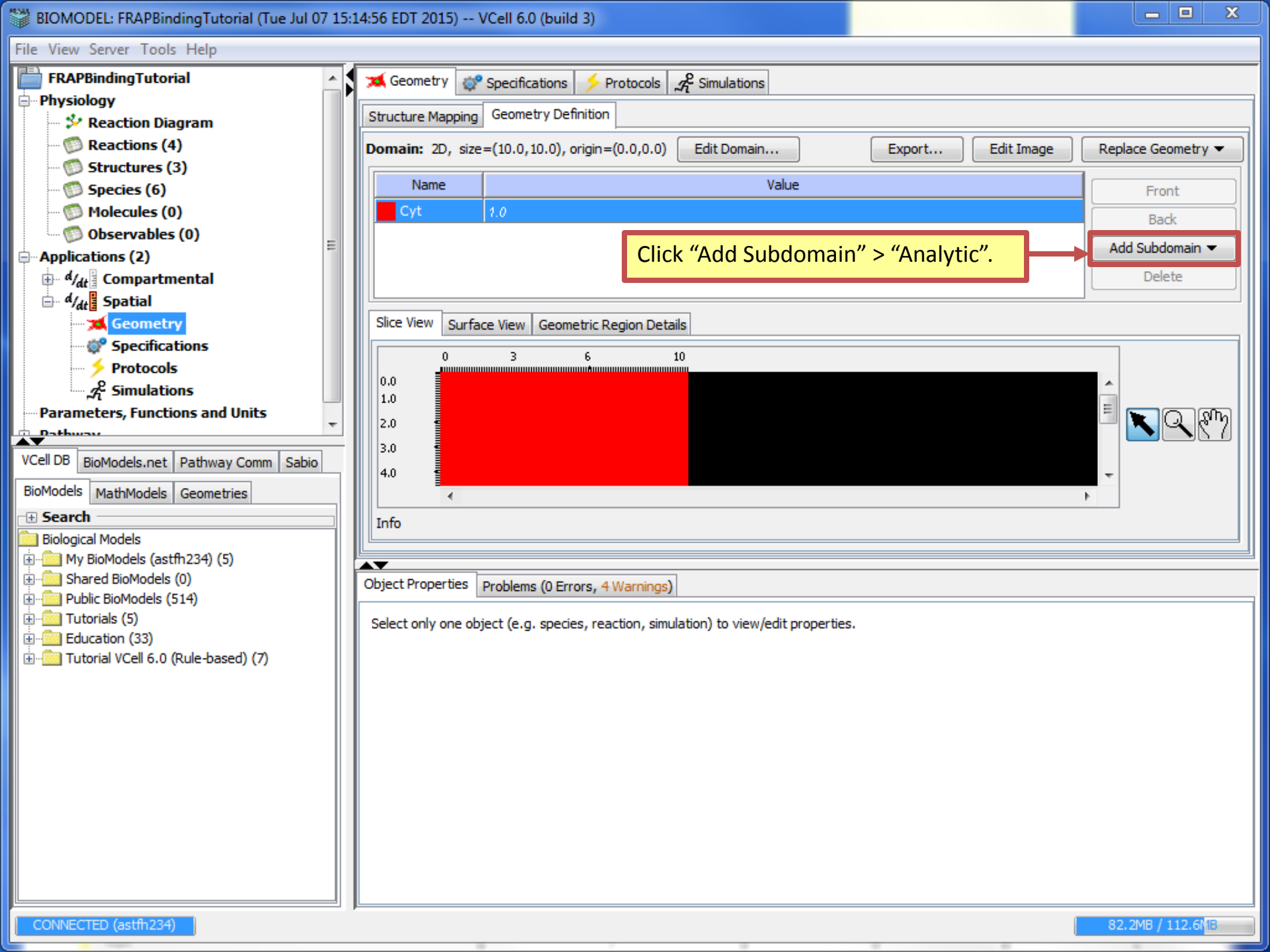
Object Properties
Problems (0 Errors, 4 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
62.2MB / 12.6MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
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Geometry
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Protocols
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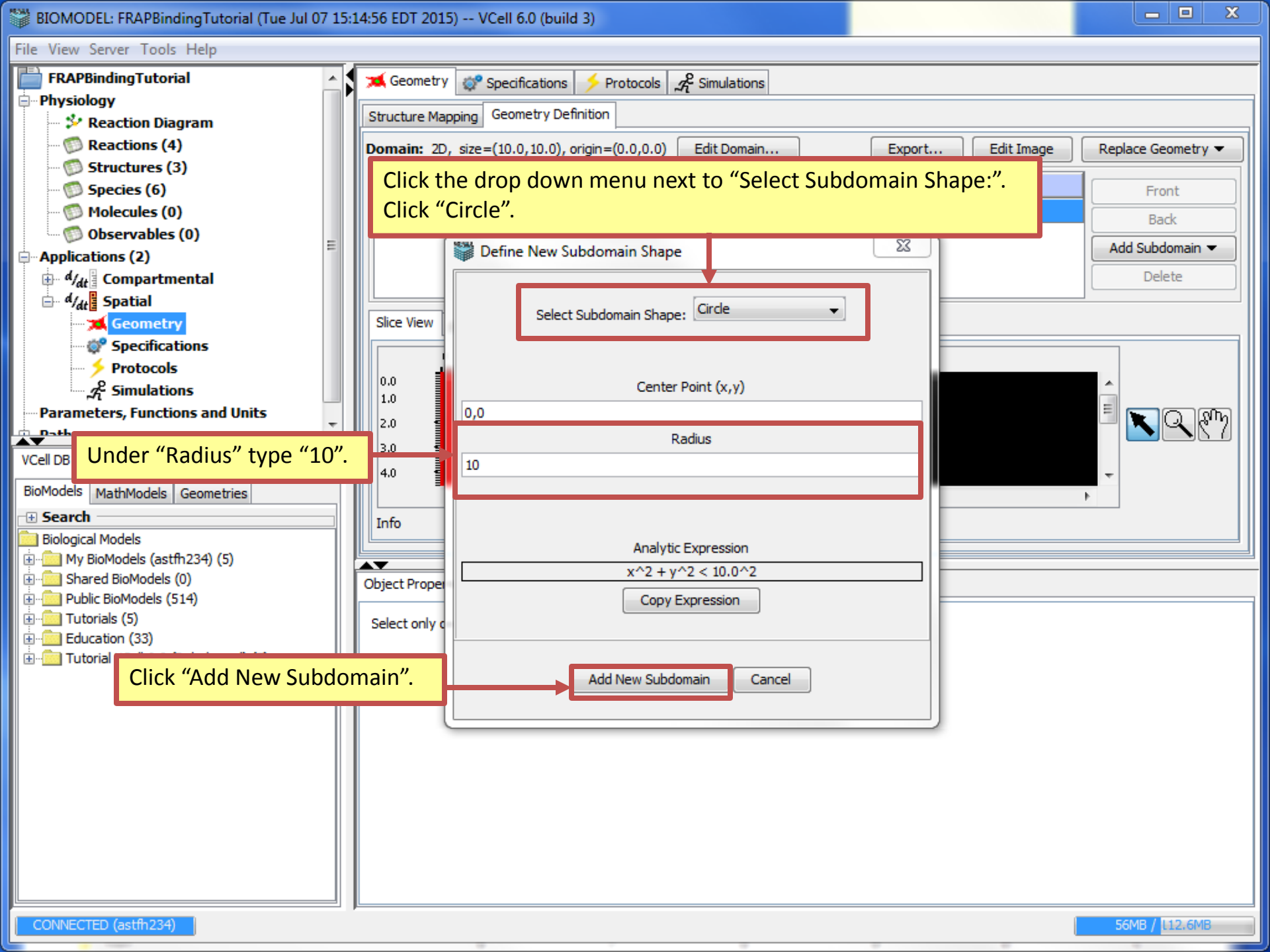
Structure Mapping
Geometry Definition
Domain: 2D, size=(10.0,10.0), origin=(0.0,0.0)
Edit Domain...
Export...
Edit Image
Replace Geometry
Name
Value
Cyt
1.0
Front
Back
Add Subdomain
Delete
Click “Add Subdomain” > “Analytic”.
Slice View
Surface View
Geometric Region Details
0
3
6
10
0.0
1.0
2.0
3.0
4.0
Info
Object Properties
Problems (0 Errors, 4 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
82.2MB / 112.6MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
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Geometry
Specifications
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Structure Mapping
Geometry Definition
Domain: 2D, size=(10.0,10.0), origin=(0.0,0.0)
Edit Domain...
Export...
Edit Image
Replace Geometry
Front
Back
Add Subdomain
Delete
Slice View
Info
Click the drop down menu next to “Select Subdomain Shape:”. Click “Circle”.
Define New Subdomain Shape
Select Subdomain Shape:
Circle
Center Point (x,y)
0,0
Radius
10
Under “Radius” type “10”.
Analytic Expression
x^2 + y^2 < 10.0^2
Copy Expression
Add New Subdomain
Cancel
Click “Add New Subdomain”.
VCell DB
BioModels
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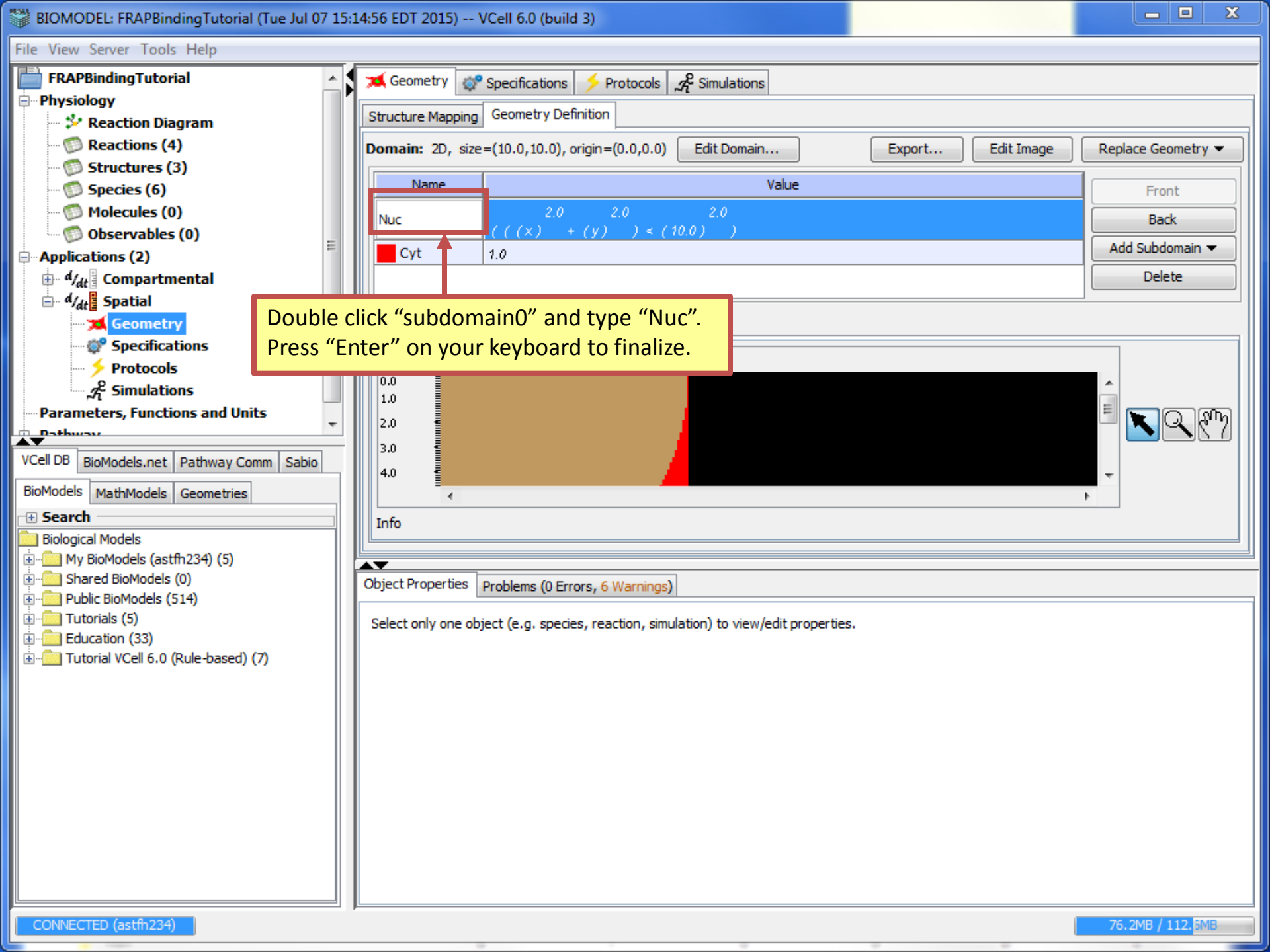
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
CONNECTED (astfh234)
56MB / 112.6MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
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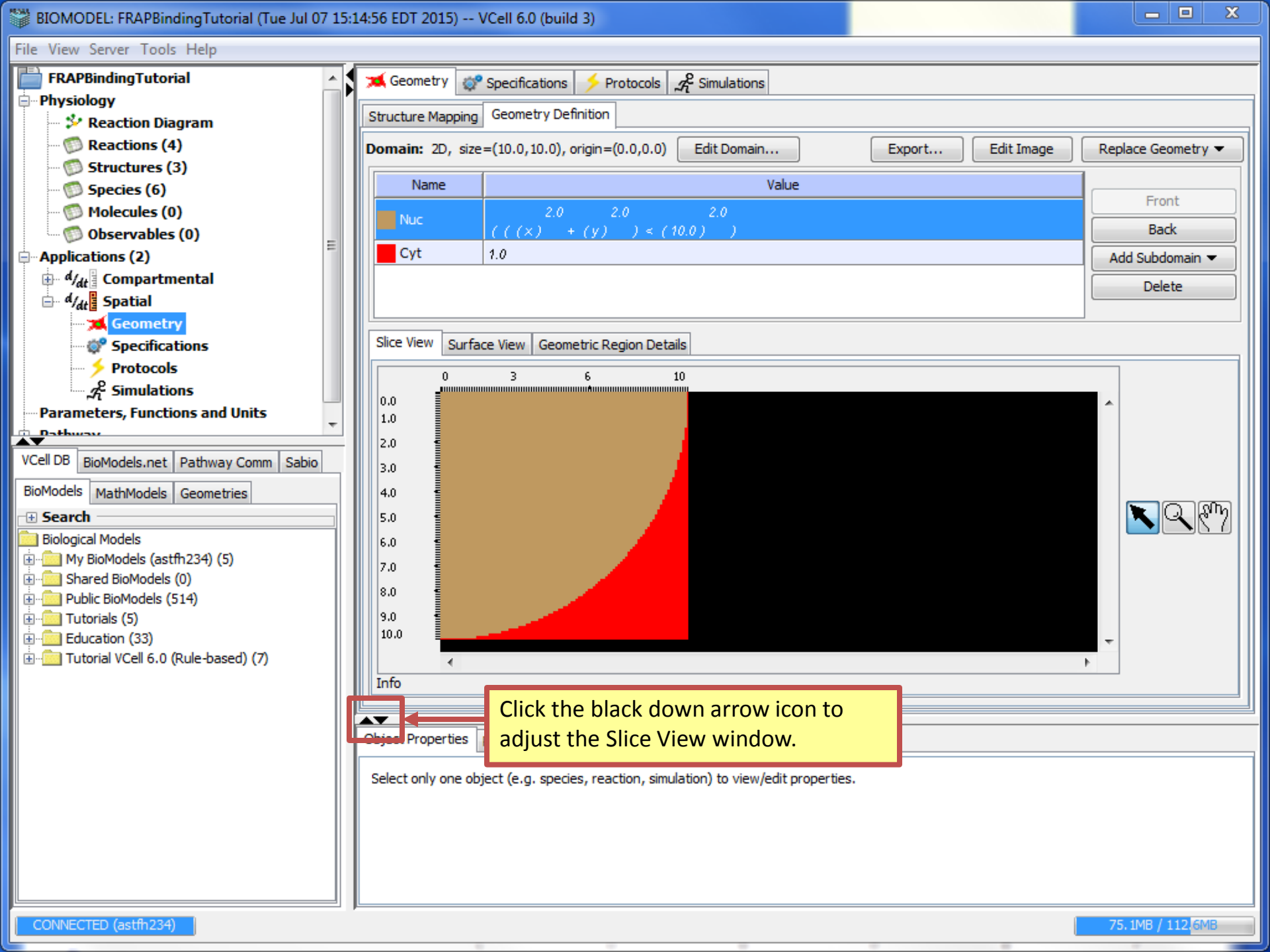
Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
Domain: 2D, size=(10.0,10.0), origin=(0.0,0.0)
Edit Domain...
Export...
Edit Image
Replace Geometry
Name
Value
Nuc
2.0 2.0 2.0
(((x) + (y)) < (10.0))
Cyt
1.0
Front
Back
Add Subdomain
Delete
Double click “subdomain0” and type “Nuc”.
Press “Enter” on your keyboard to finalize.
0.0
1.0
2.0
3.0
4.0
Info
Object Properties
Problems (0 Errors, 6 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
76.2MB / 112.5MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
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Molecules (0)
Observables (0)
Applications (2)
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Pathway Comm
Sabio
BioModels
MathModels
Geometries
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Biological Models
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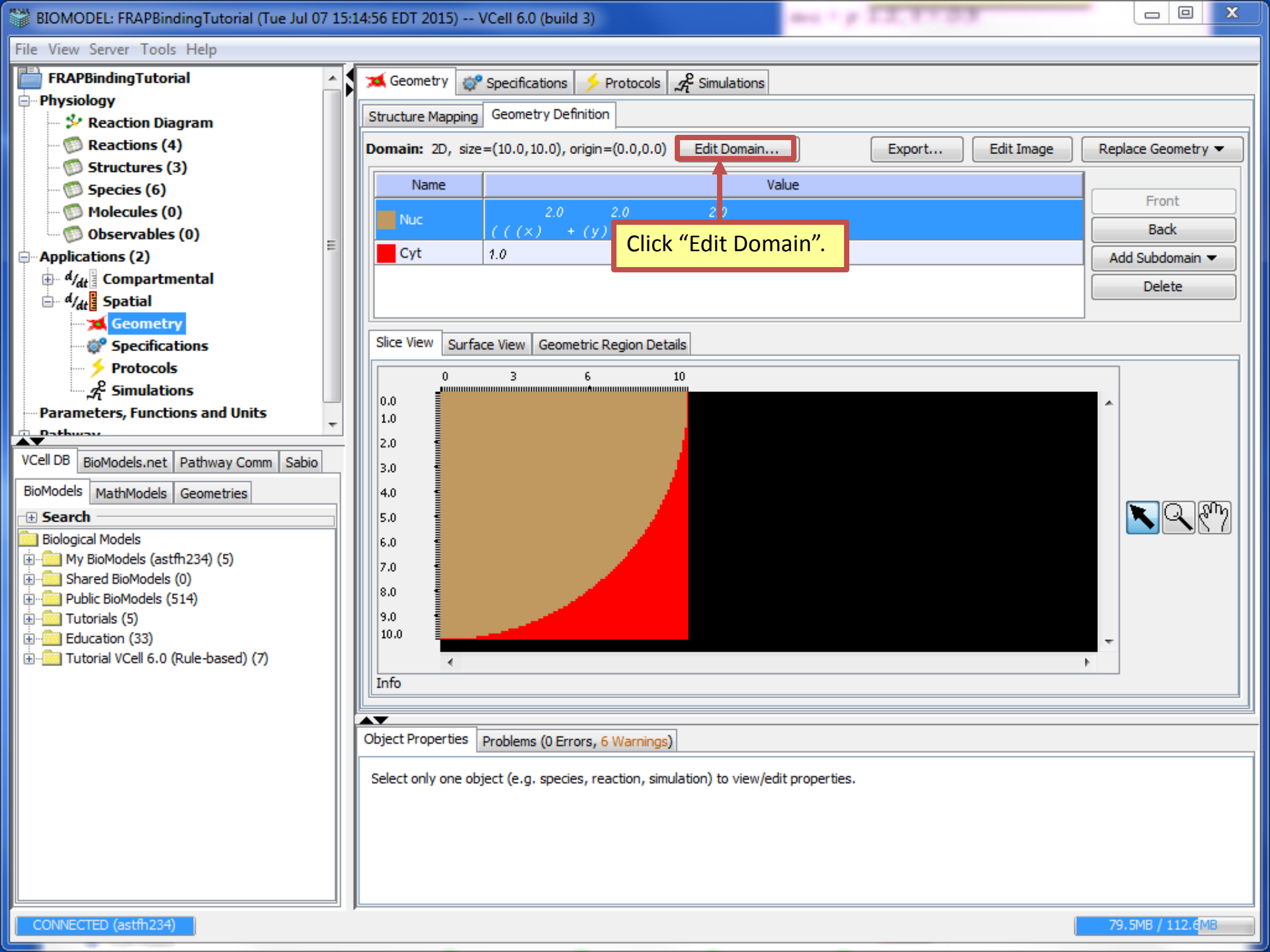
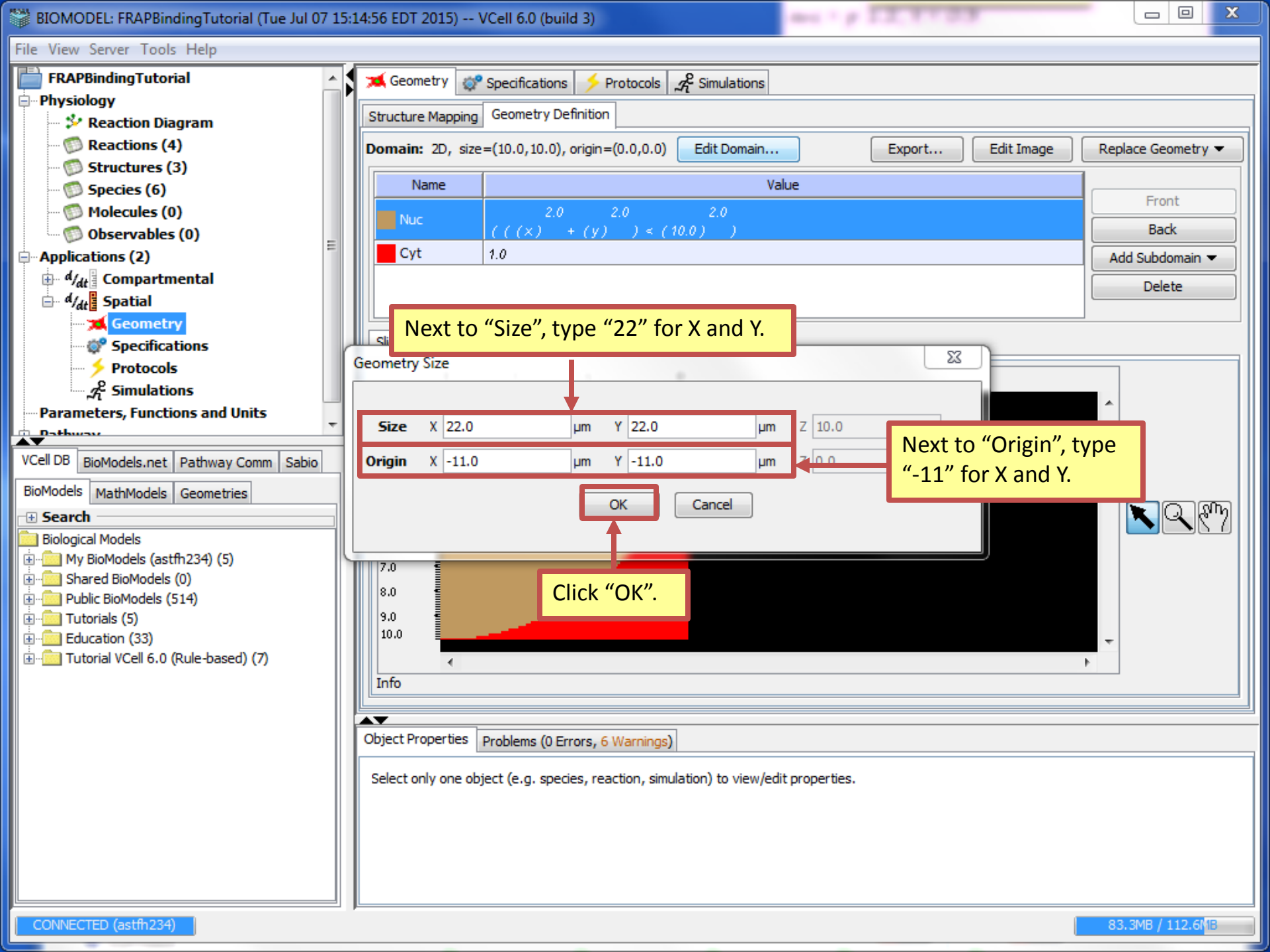
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
Domain: 2D, size=(10.0,10.0), origin=(0.0,0.0)
Edit Domain...
Export...
Edit Image
Replace Geometry
Name
Value
Nuc
2.0 2.0 2.0
(((x) + (y)) < (10.0))
Cyt
1.0
Front
Back
Add Subdomain
Delete
Slice View
Surface View
Geometric Region Details
0
3
6
10
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Info
Click the black down arrow icon to adjust the Slice View window.
Object Properties
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
75.1MB / 112.6MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters, Functions and Units
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
Domain: 2D, size=(10.0,10.0), origin=(0.0,0.0)
Edit Domain...
Export...
Edit Image
Replace Geometry
Name
Value
Nuc
Cyt
1.0
Front
Back
Add Subdomain
Delete
Click “Edit Domain”.
Slice View
Surface View
Geometric Region Details
0
3
6
10
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Info
Object Properties
Problems (0 Errors, 6 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
79.5MB / 112.6MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
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Reaction Diagram
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Species (6)
Molecules (0)
Observables (0)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters, Functions and Units
Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
Domain: 2D, size=(10.0,10.0), origin=(0.0,0.0)
Edit Domain...
Export...
Edit Image
Replace Geometry
Name
Value
Nuc
2.0 2.0 2.0
(((x) + (y)) < (10.0))
Cyt
1.0
Front
Back
Add Subdomain
Delete
Next to “Size”, type “22” for X and Y.
Geometry Size
Size X 22.0 µm Y 22.0 µm Z 10.0
Origin X -11.0 µm Y -11.0 µm
OK
Cancel
Next to “Origin”, type “-11” for X and Y.
Click “OK”.
7.0
8.0
9.0
10.0
Info
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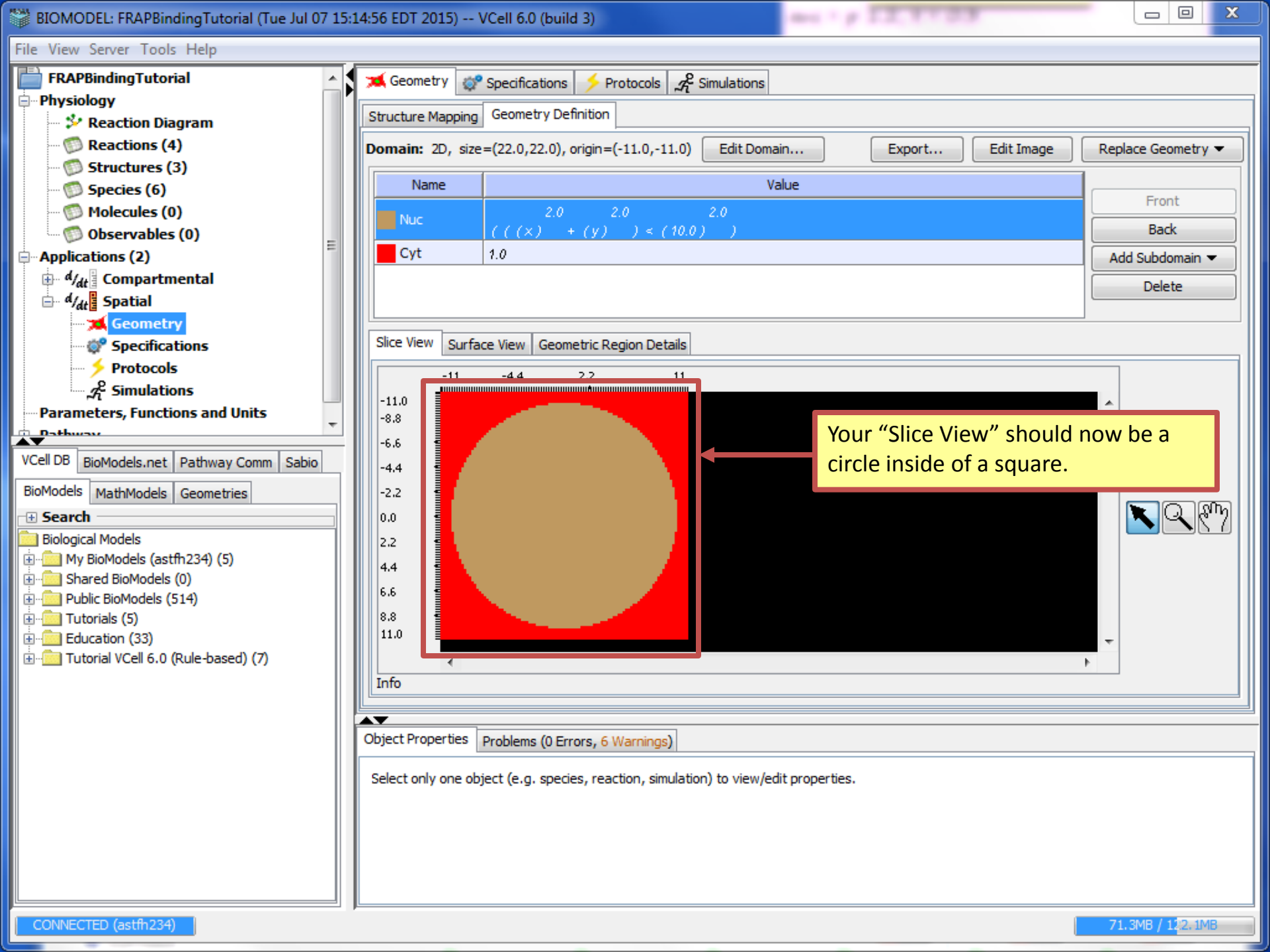
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 6 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
83.3MB / 112.6MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (2)
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Spatial
Geometry
Specifications
Protocols
Simulations
Parameters, Functions and Units
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Pathway Comm
Sabio
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Biological Models
My BioModels (astfh234) (5)
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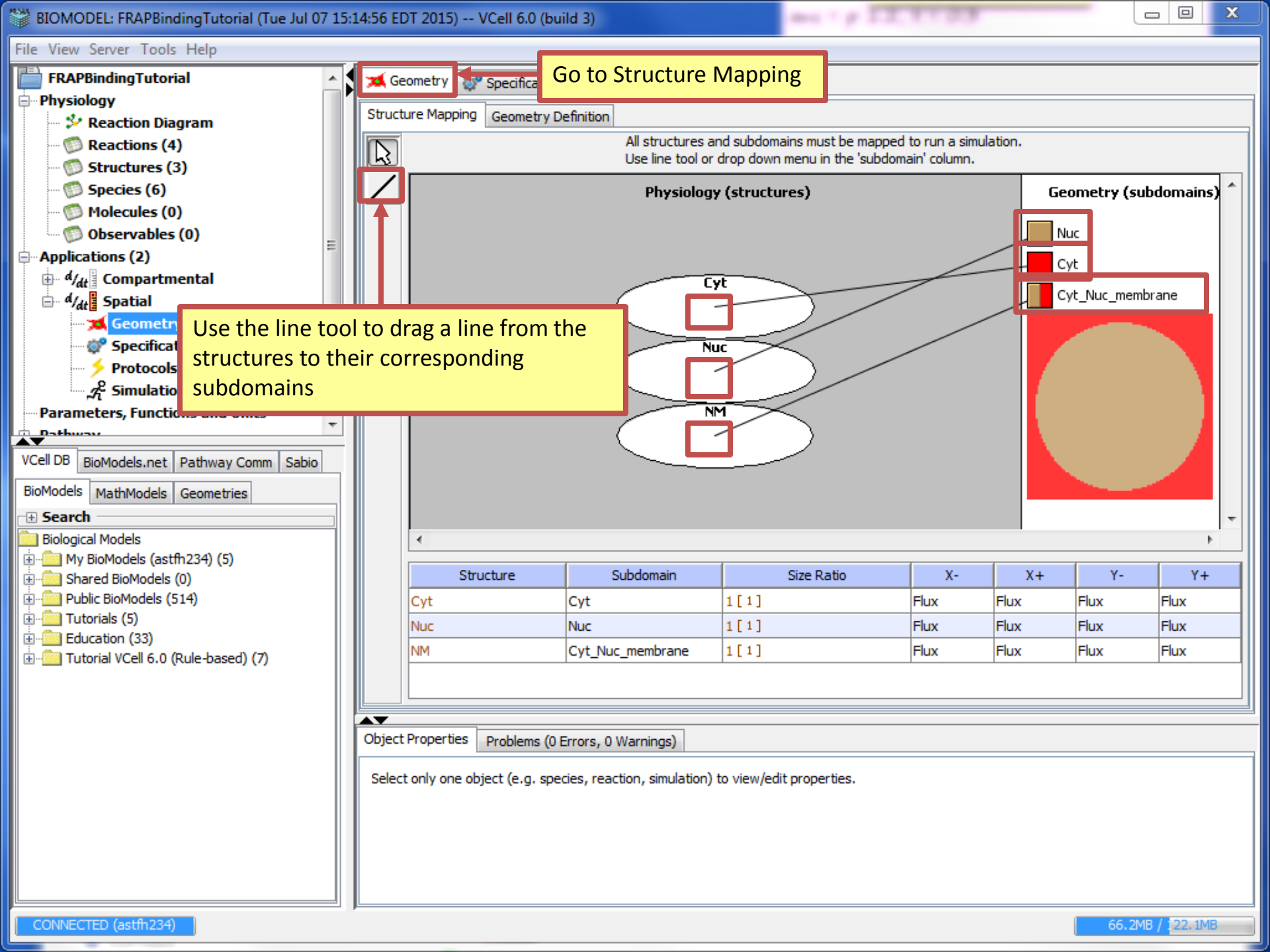
Tutorial VCell 6.0 (Rule-based) (7)
Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
Domain: 2D, size=(22.0,22.0), origin=(-11.0,-11.0)
Edit Domain...
Export...
Edit Image
Replace Geometry
Name
Value
Nuc
2.0 2.0 2.0
(((x) + (y)) < (10.0))
Cyt
1.0
Front
Back
Add Subdomain
Delete
Slice View
Surface View
Geometric Region Details
-11
-4.4
2.2
11
-11.0
-8.8
-6.6
-4.4
-2.2
0.0
2.2
4.4
6.6
8.8
11.0
Info
Your “Slice View” should now be a circle inside of a square.
Object Properties
Problems (0 Errors, 6 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
71.3MB / 122.1MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (2)
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Pathway Comm
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Biological Models
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Shared BioModels (0)
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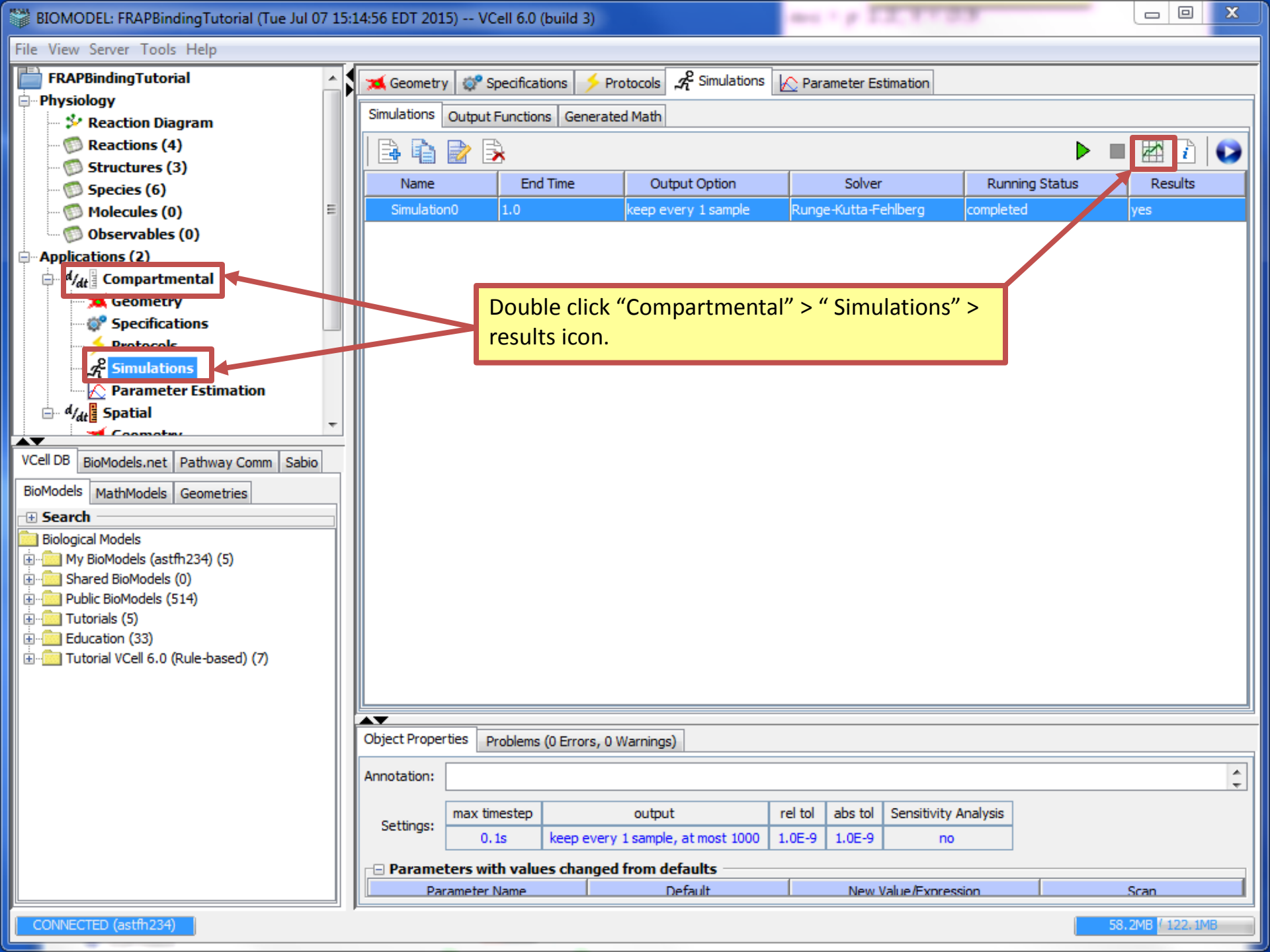
Tutorial VCell 6.0 (Rule-based) (7)
Geometry
Specifications
Go to Structure Mapping
Structure Mapping
Geometry Definition
All structures and subdomains must be mapped to run a simulation.
Use line tool or drop down menu in the 'subdomain' column.
Use the line tool to drag a line from the structures to their corresponding subdomains
Physiology (structures)
Geometry (subdomains)
Cyt
Nuc
NM
Nuc
Cyt
Cyt_Nuc_membrane
Structure
Subdomain
Size Ratio
X-
X+
Y-
Y+
Cyt
Cyt
1 [1]
Flux
Flux
Flux
Flux
Nuc
Nuc
1 [1]
Flux
Flux
Flux
Flux
NM
Cyt_Nuc_membrane
1 [1]
Flux
Flux
Flux
Flux
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
66.2MB / 122.1MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
FRAPBindingTutorial
Physiology
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Reactions (4)
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Species (6)
Molecules (0)
Observables (0)
Applications (2)
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Parameter Estimation
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VCell DB
BioModels.net
Pathway Comm
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BioModels
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Biological Models
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Shared BioModels (0)
Public BioModels (514)
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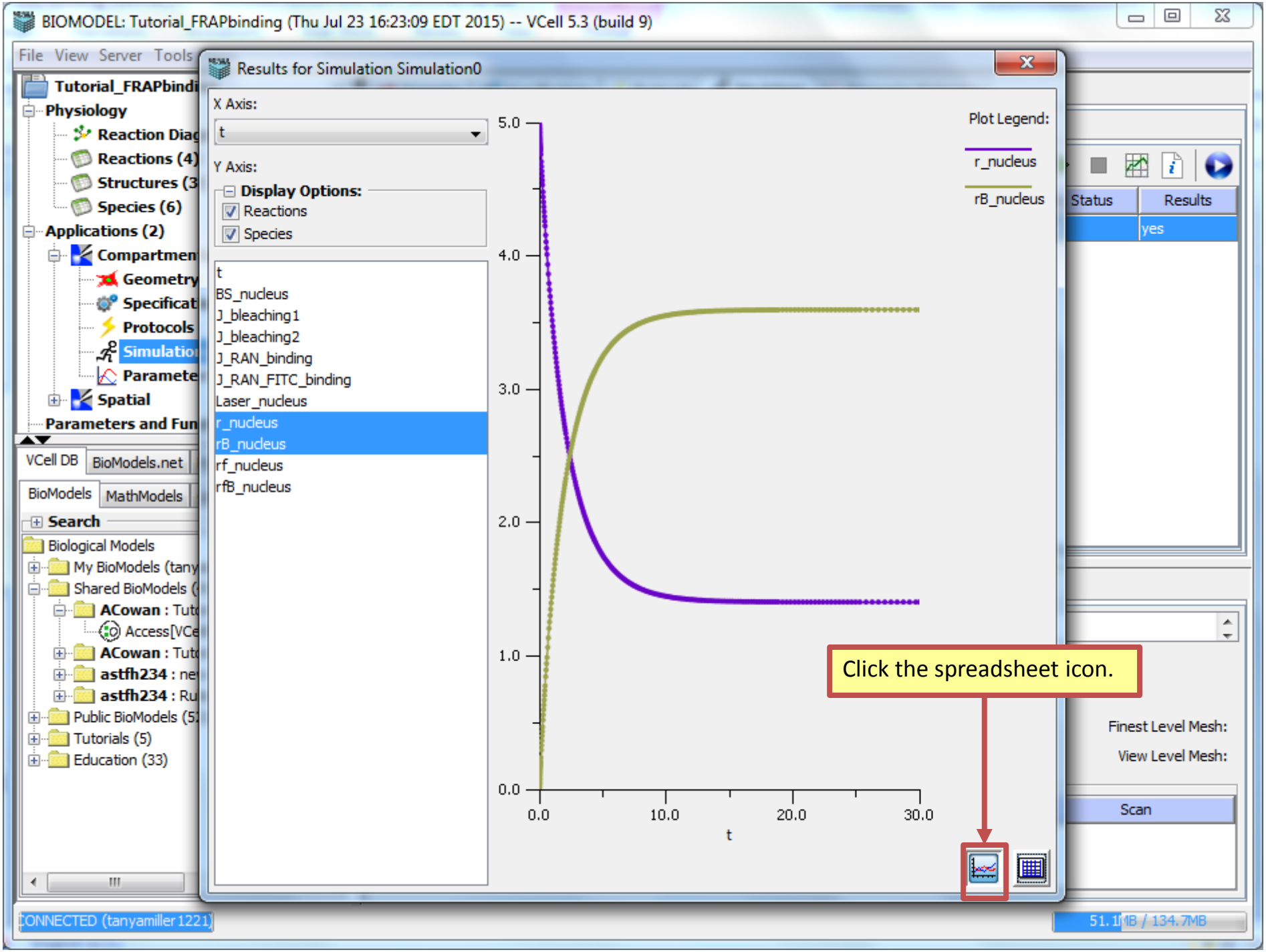
Tutorial VCell 6.0 (Rule-based) (7)
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation0
1.0
keep every 1 sample
Runge-Kutta-Fehlberg
completed
yes
Double click “Compartmental” > “ Simulations” > results icon.
Object Properties
Problems (0 Errors, 0 Warnings)
Annotation:
Settings:
max timestep
output
rel tol
abs tol
Sensitivity Analysis
0.1s
keep every 1 sample, at most 1000
1.0E-9
1.0E-9
no
Parameters with values changed from defaults
Parameter Name
Default
New Value/Expression
Scan
CONNECTED (astfh234)
58.2MB
122.1MB


BIOMODEL: Tutorial_FRAPbinding (Thu Jul 23 16:23:09 EDT 2015) -- VCell 5.3 (build 9)
File View Server Tools
Tutorial_FRAPbindi
Physiology
Reaction Diag
Reactions (4)
Structures (3
Species (6)
Applications (2)
Compartmen
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Parameters and Fun
VCell DB
BioModels.net
BioModels
MathModels
Search
Biological Models
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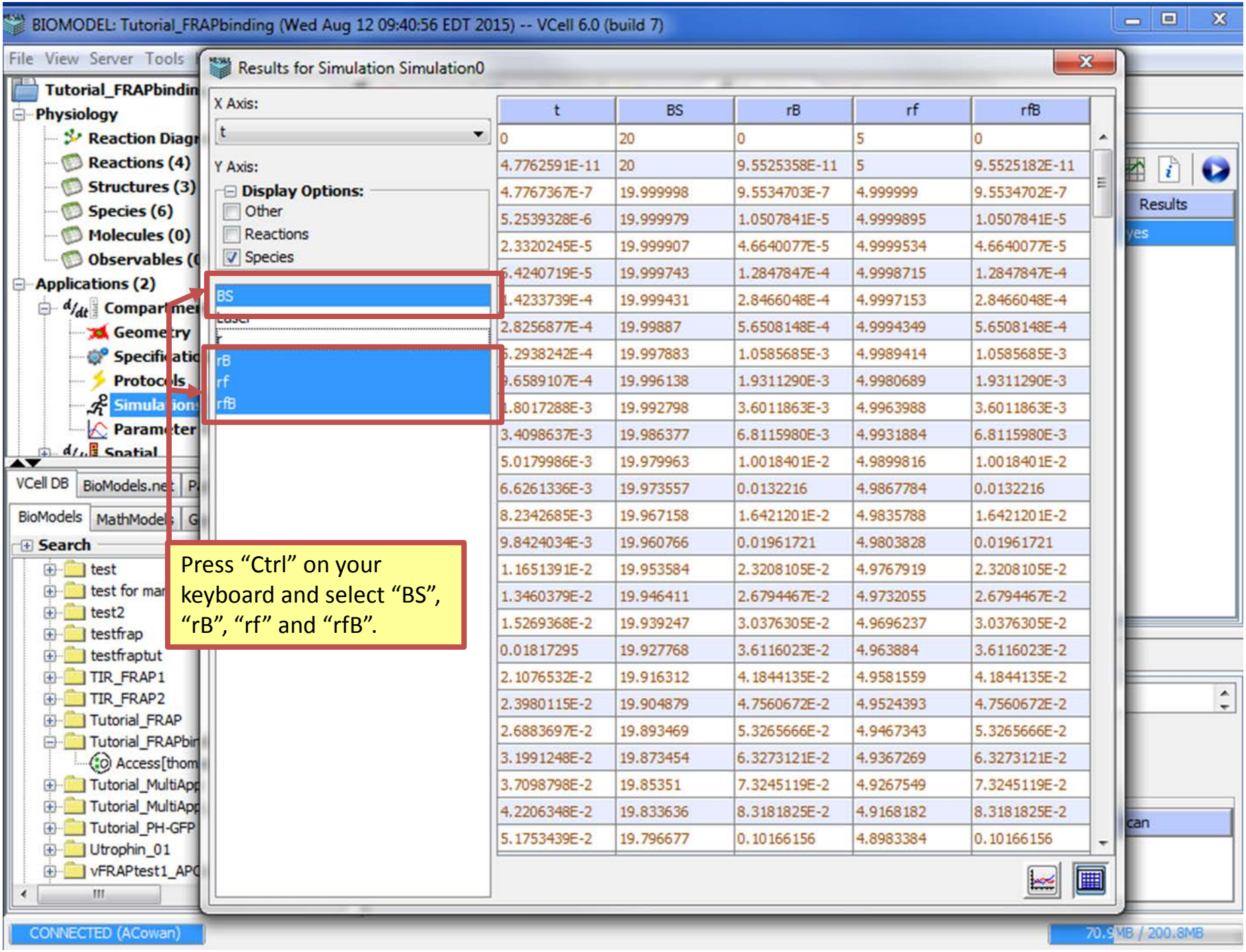
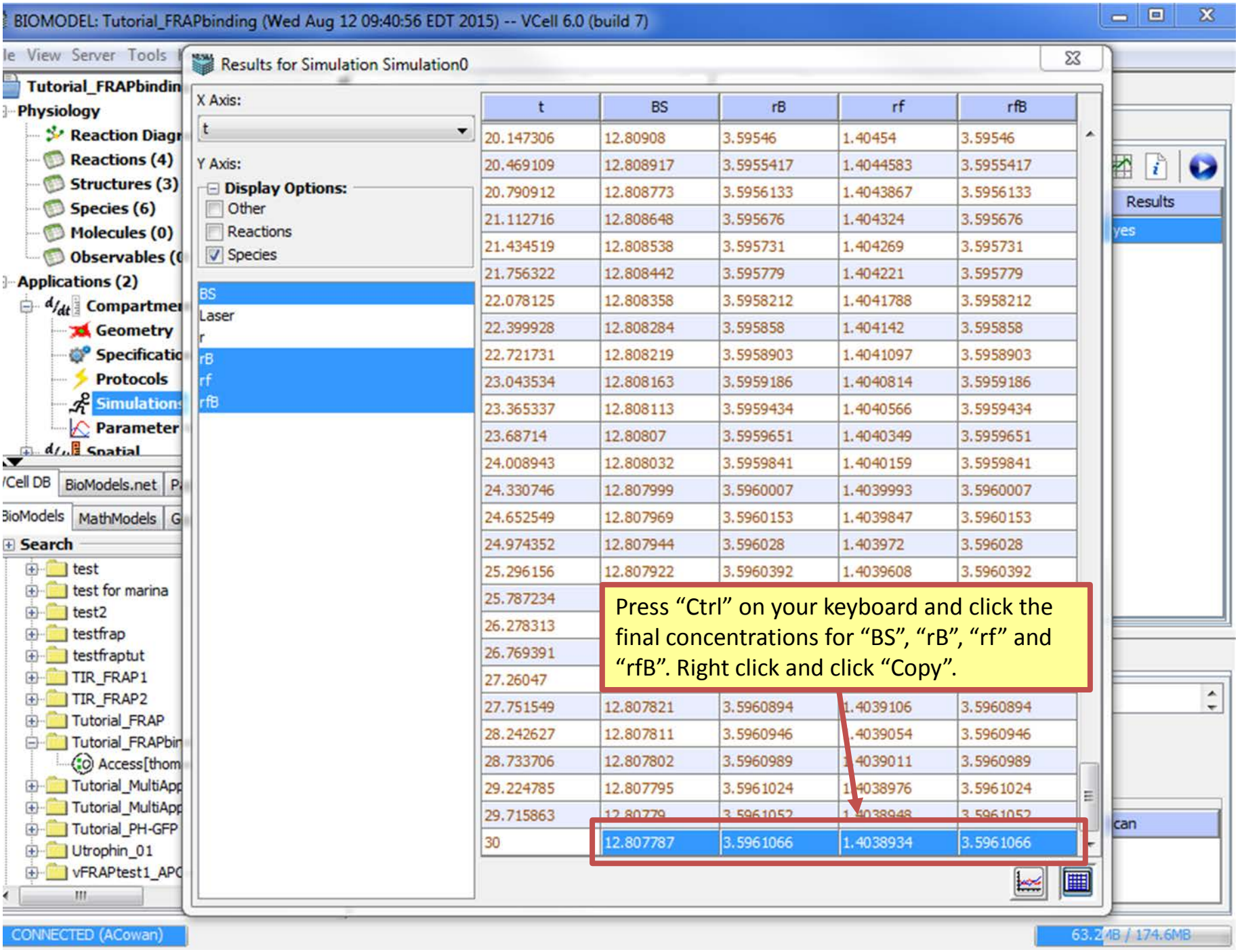
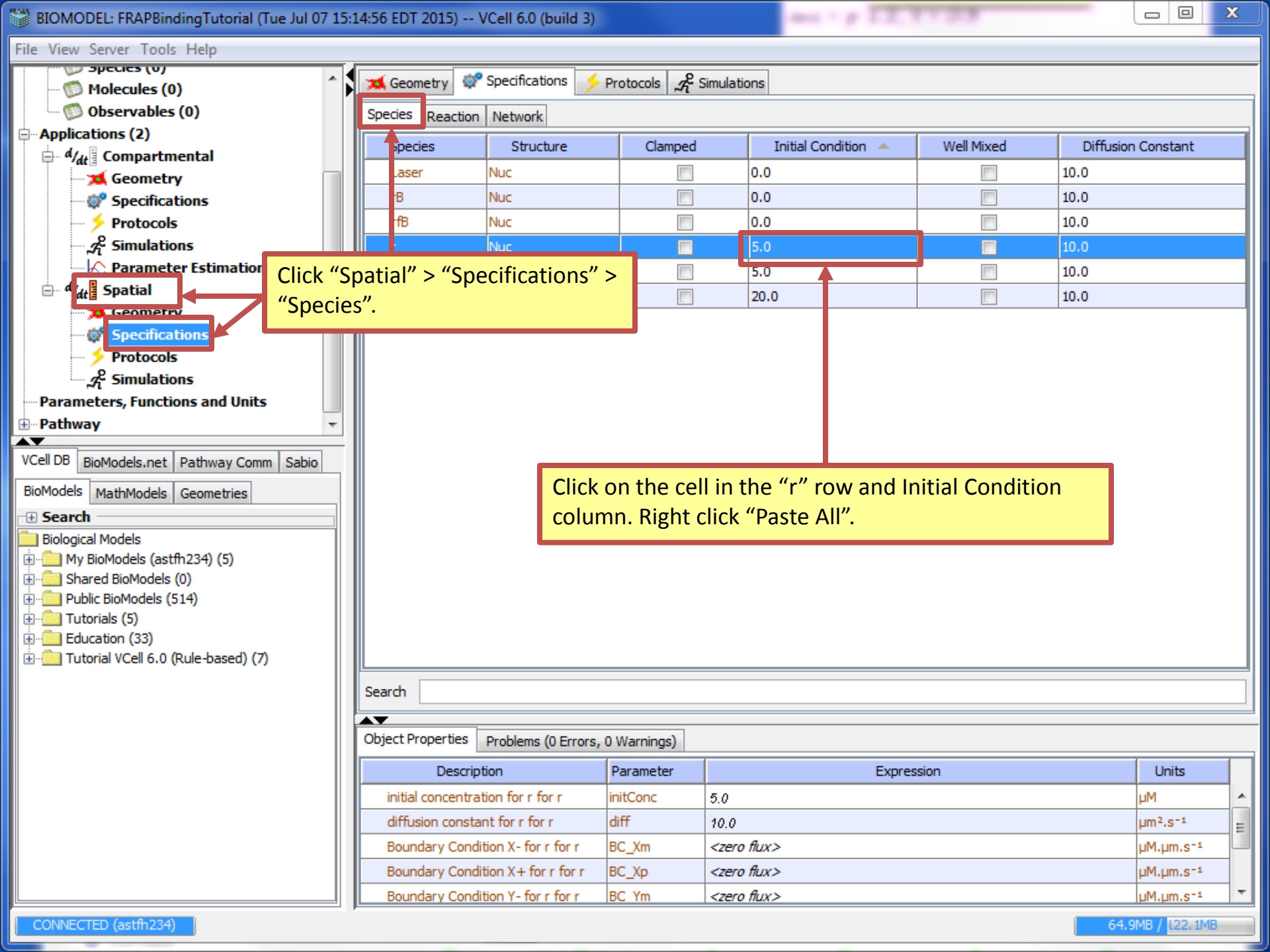
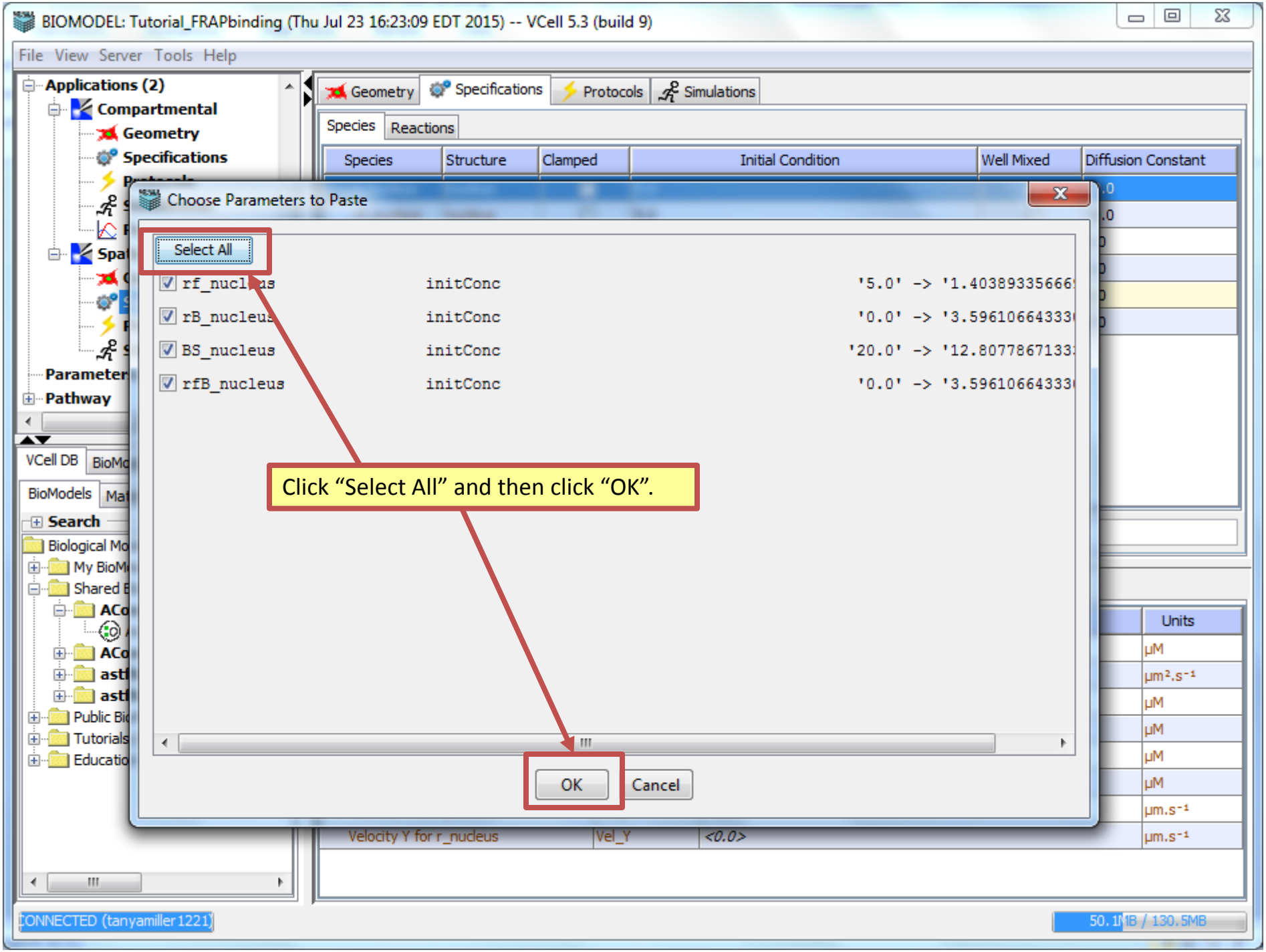
ACowan : Tut
astfh234 : ne
astfh234 : Ru
Public BioModels (5
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
Results for Simulation Simulation0
X Axis:
t
Y Axis:
Display Options:
Reactions
Species
t
BS_nucleus
J_bleaching1
J_bleaching2
J_RAN_binding
J_RAN_FITC_binding
Laser_nucleus
r_nucleus
rB_nucleus
rf_nucleus
rfB_nucleus
5.0
4.0
3.0
2.0
1.0
0.0
0.0
10.0
20.0
30.0
t
Plot Legend:
r_nucleus
rB_nucleus
Click the spreadsheet icon.
Status
Results
yes
Finest Level Mesh:
View Level Mesh:
Scan
51.1MB / 134.7MB

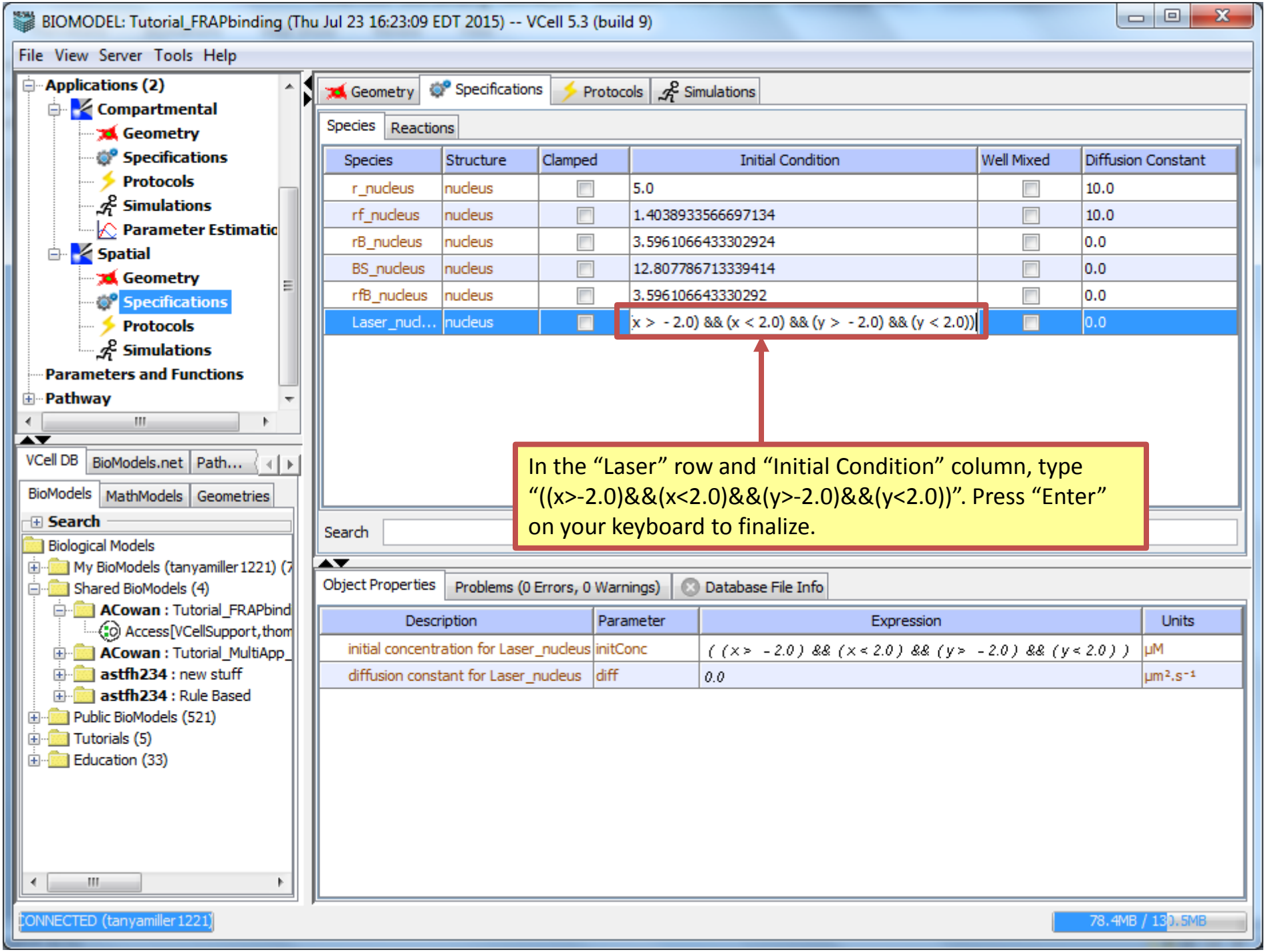


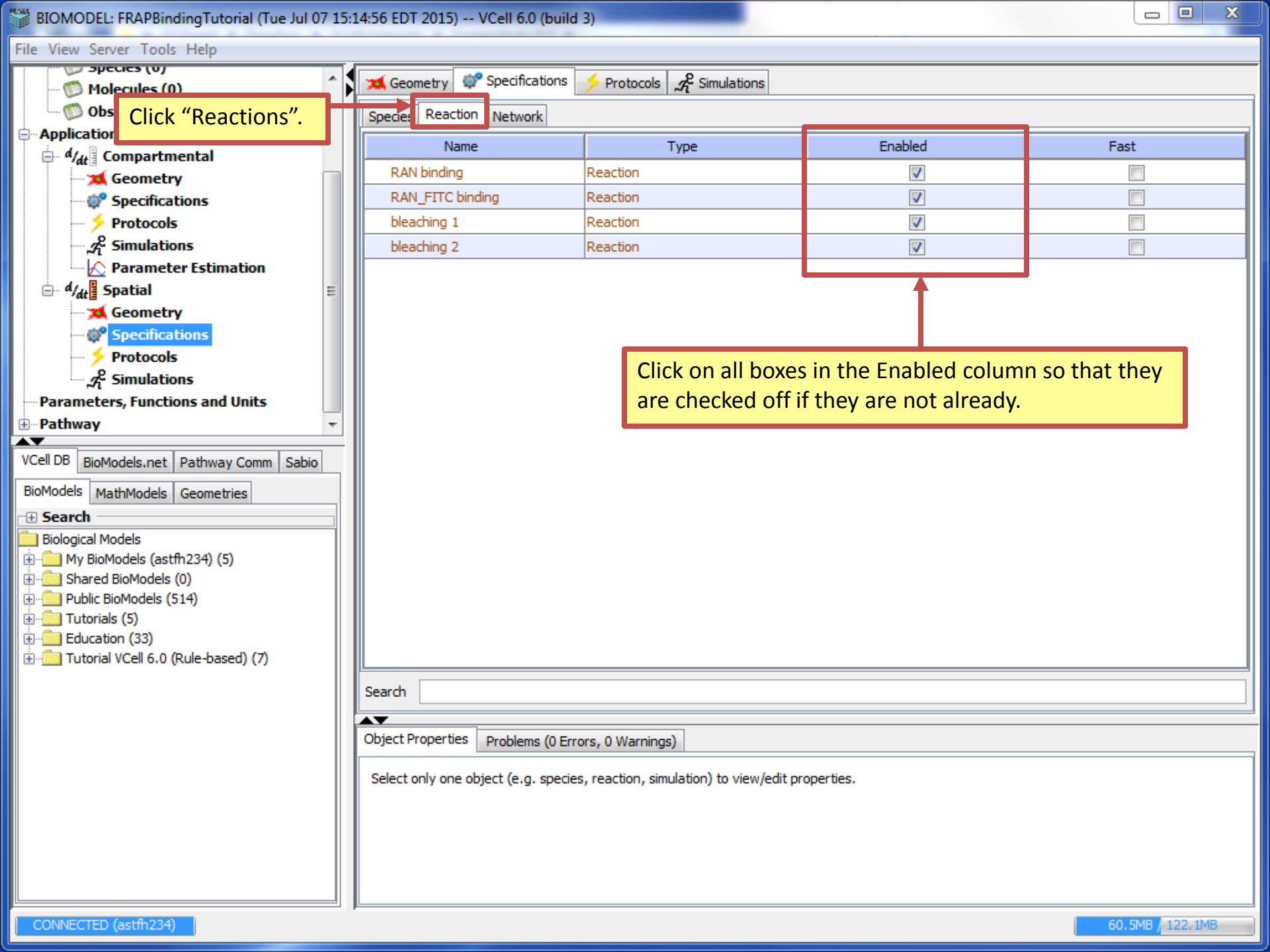
t	BS	rB	rf	rfB
0	20	0	5	0
4.7762591E-11	20	9.5525358E-11	5	9.5525182E-11
4.7767367E-7	19.999998	9.5534703E-7	4.999999	9.5534702E-7
5.2539328E-6	19.999979	1.0507841E-5	4.9999895	1.0507841E-5
2.3320245E-5	19.999907	4.6640077E-5	4.9999534	4.6640077E-5
5.4240719E-5	19.999743	1.2847847E-4	4.9998715	1.2847847E-4
1.4233739E-4	19.999431	2.8466048E-4	4.9997153	2.8466048E-4
2.8256877E-4	19.99887	5.6508148E-4	4.9994349	5.6508148E-4
5.2938242E-4	19.997883	1.0585685E-3	4.9989414	1.0585685E-3
9.6589107E-4	19.996138	1.9311290E-3	4.9980689	1.9311290E-3
1.8017288E-3	19.992798	3.6011863E-3	4.9963988	3.6011863E-3
3.4098637E-3	19.986377	6.8115980E-3	4.9931884	6.8115980E-3
5.0179986E-3	19.979963	1.0018401E-2	4.9899816	1.0018401E-2
6.6261336E-3	19.973557	0.0132216	4.9867784	0.0132216
8.2342685E-3	19.967158	1.6421201E-2	4.9835788	1.6421201E-2
9.8424034E-3	19.960766	0.01961721	4.9803828	0.01961721
1.1651391E-2	19.953584	2.3208105E-2	4.9767919	2.3208105E-2
1.3460379E-2	19.946411	2.6794467E-2	4.9732055	2.6794467E-2
1.5269368E-2	19.939247	3.0376305E-2	4.9696237	3.0376305E-2
0.01817295	19.927768	3.6116023E-2	4.963884	3.6116023E-2
2.1076532E-2	19.916312	4.1844135E-2	4.9581559	4.1844135E-2
2.3980115E-2	19.904879	4.7560672E-2	4.9524393	4.7560672E-2
2.6883697E-2	19.893469	5.3265666E-2	4.9467343	5.3265666E-2
3.1991248E-2	19.873454	6.3273121E-2	4.9367269	6.3273121E-2
3.7098798E-2	19.85351	7.3245119E-2	4.9267549	7.3245119E-2
4.2206348E-2	19.833636	8.3181825E-2	4.9168182	8.3181825E-2
5.1753439E-2	19.796677	0.10166156	4.8983384	0.10166156

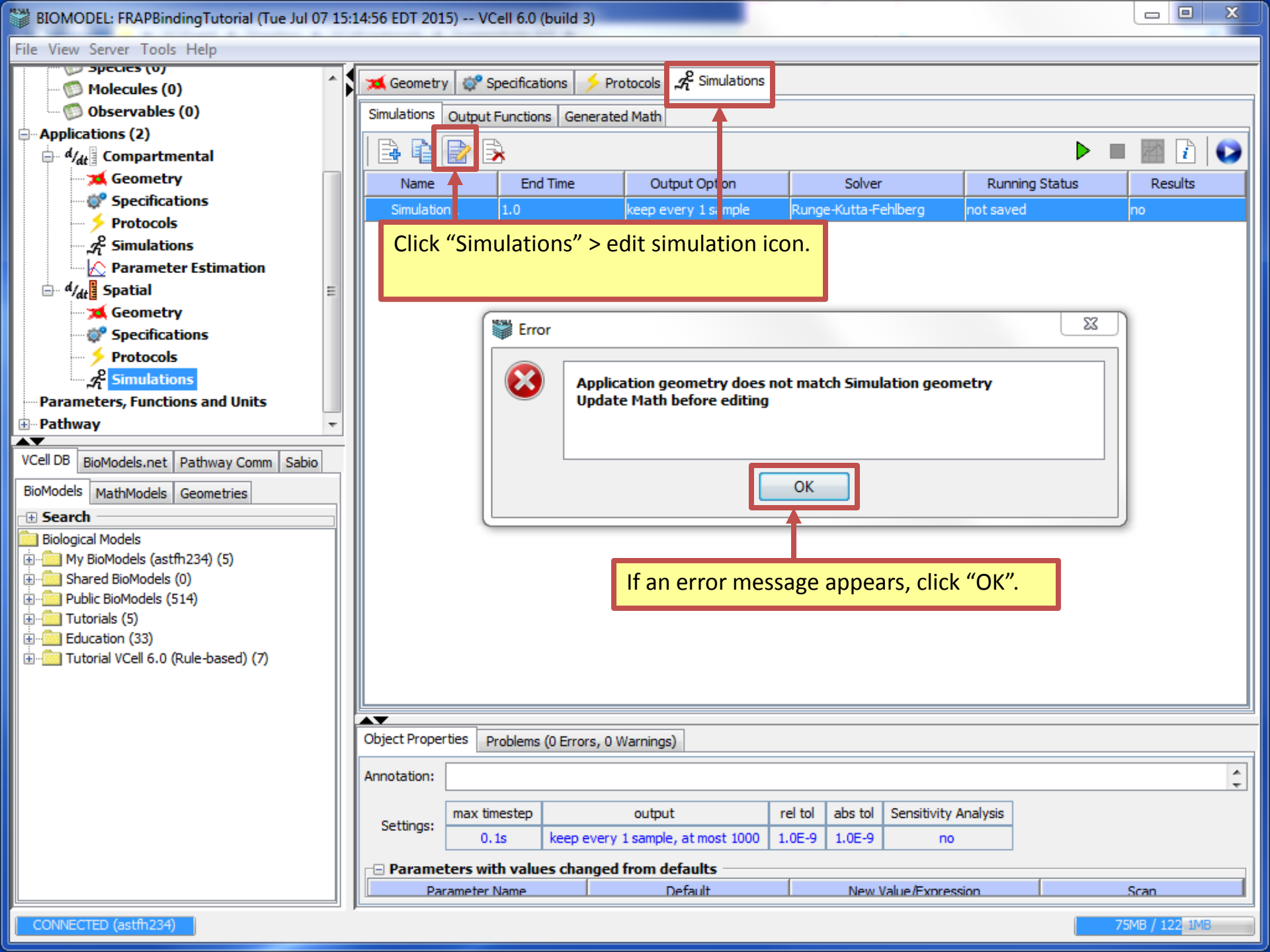

BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 6.0 (build 7)
Results for Simulation Simulation0
X Axis:
t
Y Axis:
Display Options:
Other
Reactions
Species
BS
Laser
r
rB
rf
rfB
t | BS | rB | rf | rfB
20.147306 | 12.80908 | 3.59546 | 1.40454 | 3.59546
20.469109 | 12.808917 | 3.5955417 | 1.4044583 | 3.5955417
20.790912 | 12.808773 | 3.5956133 | 1.4043867 | 3.5956133
21.112716 | 12.808648 | 3.595676 | 1.404324 | 3.595676
21.434519 | 12.808538 | 3.595731 | 1.404269 | 3.595731
21.756322 | 12.808442 | 3.595779 | 1.404221 | 3.595779
22.078125 | 12.808358 | 3.5958212 | 1.4041788 | 3.5958212
22.399928 | 12.808284 | 3.595858 | 1.404142 | 3.595858
22.721731 | 12.808219 | 3.5958903 | 1.4041097 | 3.5958903
23.043534 | 12.808163 | 3.5959186 | 1.4040814 | 3.5959186
23.365337 | 12.808113 | 3.5959434 | 1.4040566 | 3.5959434
23.68714 | 12.80807 | 3.5959651 | 1.4040349 | 3.5959651
24.008943 | 12.808032 | 3.5959841 | 1.4040159 | 3.5959841
24.330746 | 12.807999 | 3.5960007 | 1.4039993 | 3.5960007
24.652549 | 12.807969 | 3.5960153 | 1.4039847 | 3.5960153
24.974352 | 12.807944 | 3.596028 | 1.403972 | 3.596028
25.296156 | 12.807922 | 3.5960392 | 1.4039608 | 3.5960392
25.787234
26.278313
26.769391
27.26047
27.751549 | 12.807821 | 3.5960894 | 1.4039106 | 3.5960894
28.242627 | 12.807811 | 3.5960946 | .4039054 | 3.5960946
28.733706 | 12.807802 | 3.5960989 | 1.4039011 | 3.5960989
29.224785 | 12.807795 | 3.5961024 | 1.4038976 | 3.5961024
29.715863
30 | 12.807787 | 3.5961066 | 1.4038934 | 3.5961066
Press “Ctrl” on your keyboard and click the final concentrations for “BS”, “rB”, “rf” and “rfB”. Right click and click “Copy”.
Tutorial_FRAPbindin
Physiology
Reaction Diagr
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (
Applications (2)
Compartmer
Geometry
Specificatio
Protocols
Simulations
Parameter
Spatial
VCell DB
BioModels.net
BioModels
MathModels
Search
test
test for marina
test2
testfrap
testfraptut
TIR_FRAP1
TIR_FRAP2
Tutorial_FRAP
Tutorial_FRAPbir
Access[thom
Tutorial_MultiApp
Tutorial_MultiApp
Tutorial_PH-GFP
Utrophin_01
vFRAPtest1_APC
Results
yes
can
CONNECTED (ACowan)
63.2MB / 174.6MB

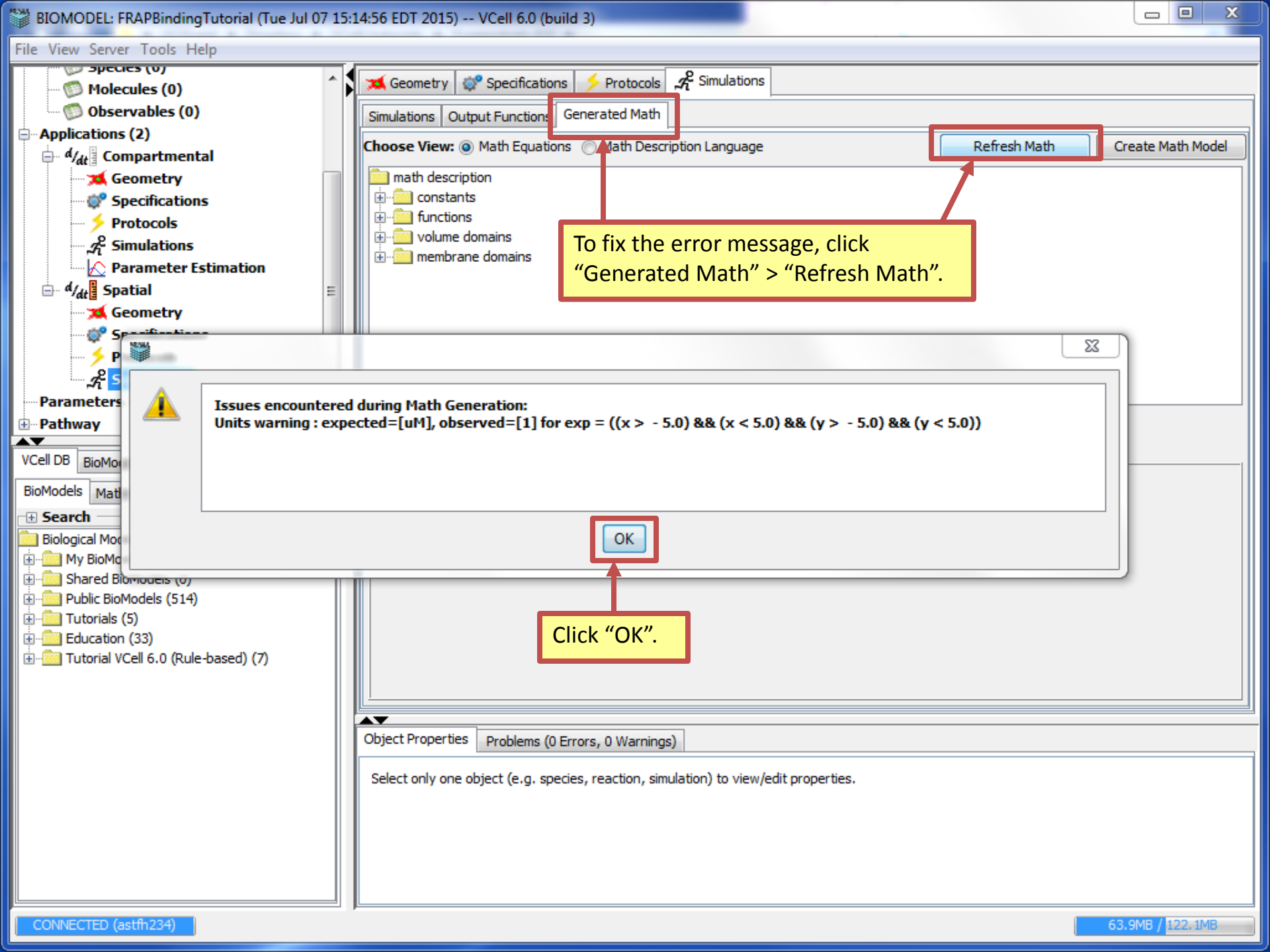

BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
Molecules (0)
Observables (0)
Applications (2)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters, Functions and Units
Pathway
Click “Spatial” > “Specifications” > “Species”.
Geometry
Specifications
Protocols
Simulations
Species
Reaction
Network
Species
Structure
Clamped
Initial Condition
Well Mixed
Diffusion Constant
Laser
Nuc
0.0
10.0
fB
Nuc
0.0
10.0
fB
Nuc
0.0
10.0
Nuc
5.0
10.0
5.0
10.0
20.0
10.0
Click on the cell in the “r” row and Initial Condition column. Right click “Paste All”.
Search
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Description
Parameter
Expression
Units
initial concentration for r for r
initConc
5.0
μM
diffusion constant for r for r
diff
10.0
μm².s⁻¹
Boundary Condition X- for r for r
BC_Xm
<zero flux>
μM.μm.s⁻¹
Boundary Condition X+ for r for r
BC_Xp
<zero flux>
μM.μm.s⁻¹
Boundary Condition Y- for r for r
BC_Ym
<zero flux>
μM.μm.s⁻¹
CONNECTED (astfh234)
64.9MB / 122.1MB

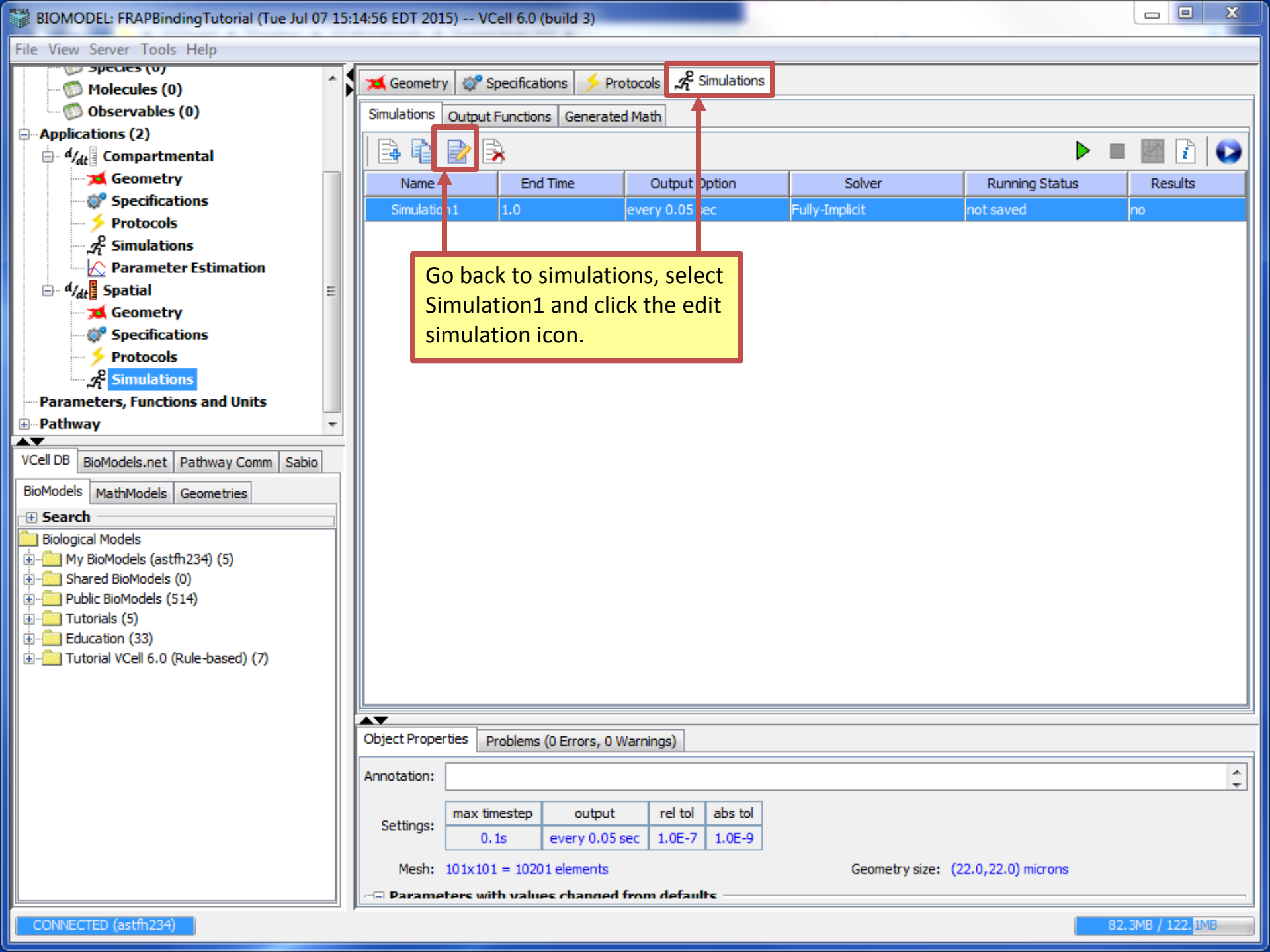

BIOMODEL: Tutorial_FRAPbinding (Thu Jul 23 16:23:09 EDT 2015) -- VCell 5.3 (build 9)
File View Server Tools Help
Applications (2)
Compartmental
Geometry
Specifications
Pathway
Geometry
Specifications
Protocols
Simulations
Species
Reactions
Species
Structure
Clamped
Initial Condition
Well Mixed
Diffusion Constant
Choose Parameters to Paste
Select All
rf_nucleus initConc '5.0' -> '1.40389335666
rB_nucleus initConc '0.0' -> '3.59610664333
BS_nucleus initConc '20.0' -> '12.8077867133
rfB_nucleus initConc '0.0' -> '3.59610664333
Click “Select All” and then click “OK”.
OK
Cancel
Units
µM
µm².s⁻¹
µM
µM
µM
µM
µm.s⁻¹
Velocity Y for r_nucleus
Vel_Y
<0.0>
µm.s⁻¹
VCell DB
BioModels
Search
Biological Mo
My BioM
Shared B
Public Bio
Tutorials
Educatio
CONNECTED (tanyamiller1221)
50.1MB / 130.5MB


BIOMODEL: Tutorial_FRAPbinding (Thu Jul 23 16:23:09 EDT 2015) -- VCell 5.3 (build 9)
File View Server Tools Help
Applications (2)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimatic
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
Geometry
Specifications
Protocols
Simulations
Species
Reactions
Species
Structure
Clamped
Initial Condition
Well Mixed
Diffusion Constant
r_nucleus
nucleus
5.0
10.0
rf_nucleus
nucleus
1.4038933566697134
10.0
rB_nucleus
nucleus
3.5961066433302924
0.0
BS_nucleus
nucleus
12.807786713339414
0.0
rfB_nucleus
nucleus
3.596106643330292
0.0
Laser_nucl...
nucleus
(x > - 2.0) && (x < 2.0) && (y > - 2.0) && (y < 2.0))
0.0
Search
In the “Laser” row and “Initial Condition” column, type “((x>-2.0)&&(x<2.0)&&(y>-2.0)&&(y<2.0))”. Press “Enter” on your keyboard to finalize.
VCell DB
BioModels.net
Path...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (7
Shared BioModels (4)
ACowan : Tutorial_FRAPbind
Access[VCellSupport,thom
ACowan : Tutorial_MultiApp_
astfh234 : new stuff
astfh234 : Rule Based
Public BioModels (521)
Tutorials (5)
Education (33)
Object Properties
Problems (0 Errors, 0 Warnings)
Database File Info
Description
Parameter
Expression
Units
initial concentration for Laser_nucleus
initConc
((x > - 2.0) && (x < 2.0) && (y > - 2.0) && (y < 2.0))
µM
diffusion constant for Laser_nucleus
diff
0.0
µm².s⁻¹
CONNECTED (tanyamiller1221)
78.4MB / 130.5MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
Molecules (0)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters, Functions and Units
Pathway
Click “Reactions”.
Geometry
Specifications
Protocols
Simulations
Species
Reaction
Network
Name
Type
Enabled
Fast
RAN binding
Reaction
RAN_FITC binding
Reaction
bleaching 1
Reaction
bleaching 2
Reaction
Click on all boxes in the Enabled column so that they are checked off if they are not already.
Search
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
60.5MB / 122.1MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
Molecules (0)
Observables (0)
Applications (2)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Geometry
Specifications
Protocols
Simulations
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation
1.0
keep every 1 sample
Runge-Kutta-Fehlberg
not saved
no
Click “Simulations” > edit simulation icon.
Error
Application geometry does not match Simulation geometry
Update Math before editing
OK
If an error message appears, click “OK”.
Object Properties
Problems (0 Errors, 0 Warnings)
Annotation:
Settings:
max timestep
output
rel tol
abs tol
Sensitivity Analysis
0.1s
keep every 1 sample, at most 1000
1.0E-9
1.0E-9
no
Parameters with values changed from defaults
Parameter Name
Default
New Value/Expression
Scan
CONNECTED (astfh234)
75MB / 122 1MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
Molecules (0)
Observables (0)
Applications (2)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Spatial
Geometry
Parameters
Pathway
Geometry
Specifications
Protocols
Simulations
Simulations
Output Functions
Generated Math
Choose View: Math Equations Math Description Language
Refresh Math
Create Math Model
math description
constants
functions
volume domains
membrane domains
To fix the error message, click "Generated Math" > "Refresh Math".
Issues encountered during Math Generation:
Units warning : expected=[uM], observed=[1] for exp = ((x > - 5.0) && (x < 5.0) && (y > - 5.0) && (y < 5.0))
OK
Click "OK".
VCell DB
BioModels
Search
Biological Mo
My BioMo
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (astfh234)
63.9MB / 122.1MB


BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
Molecules (0)
Observables (0)
Applications (2)
Compartmental
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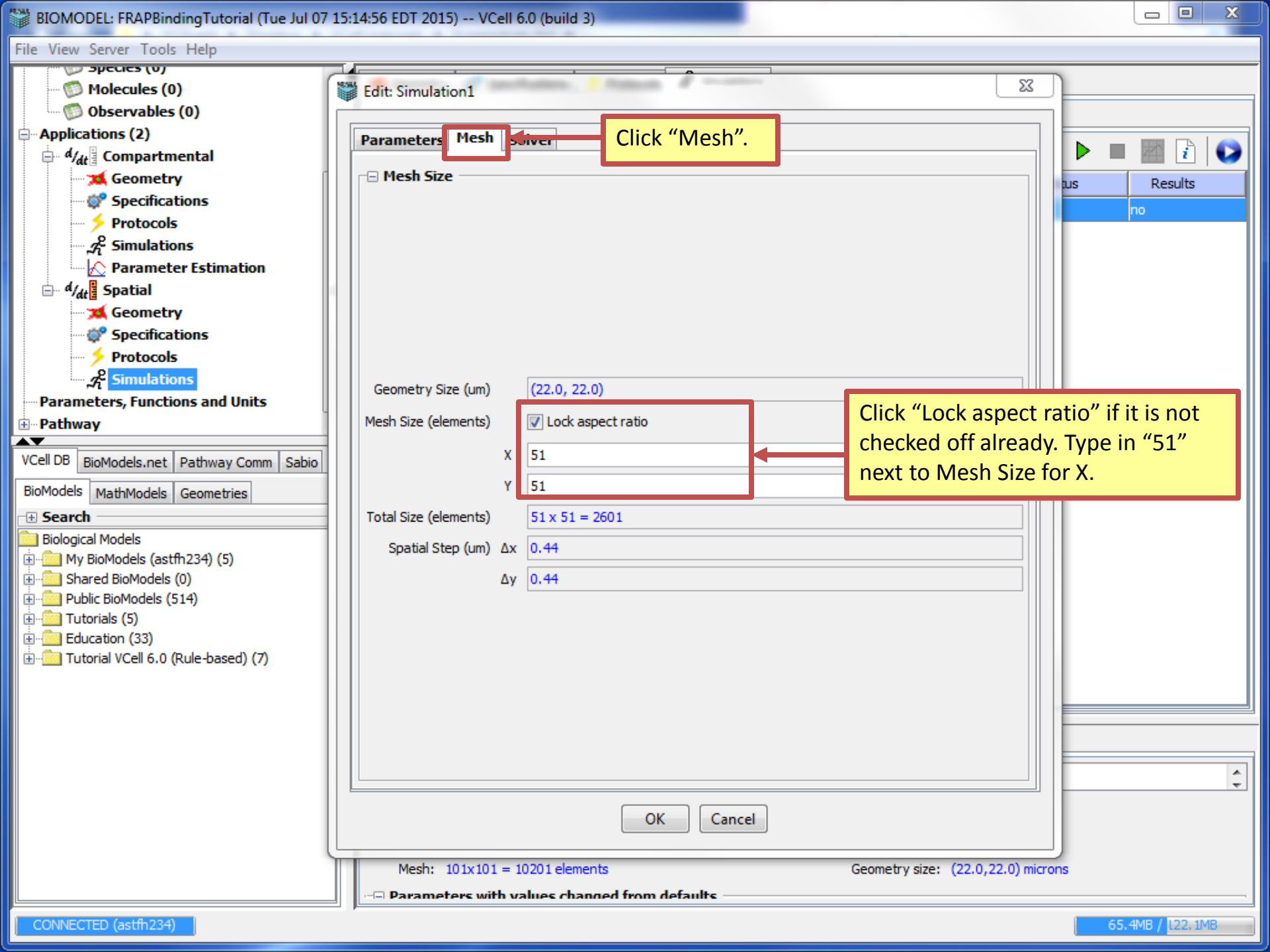
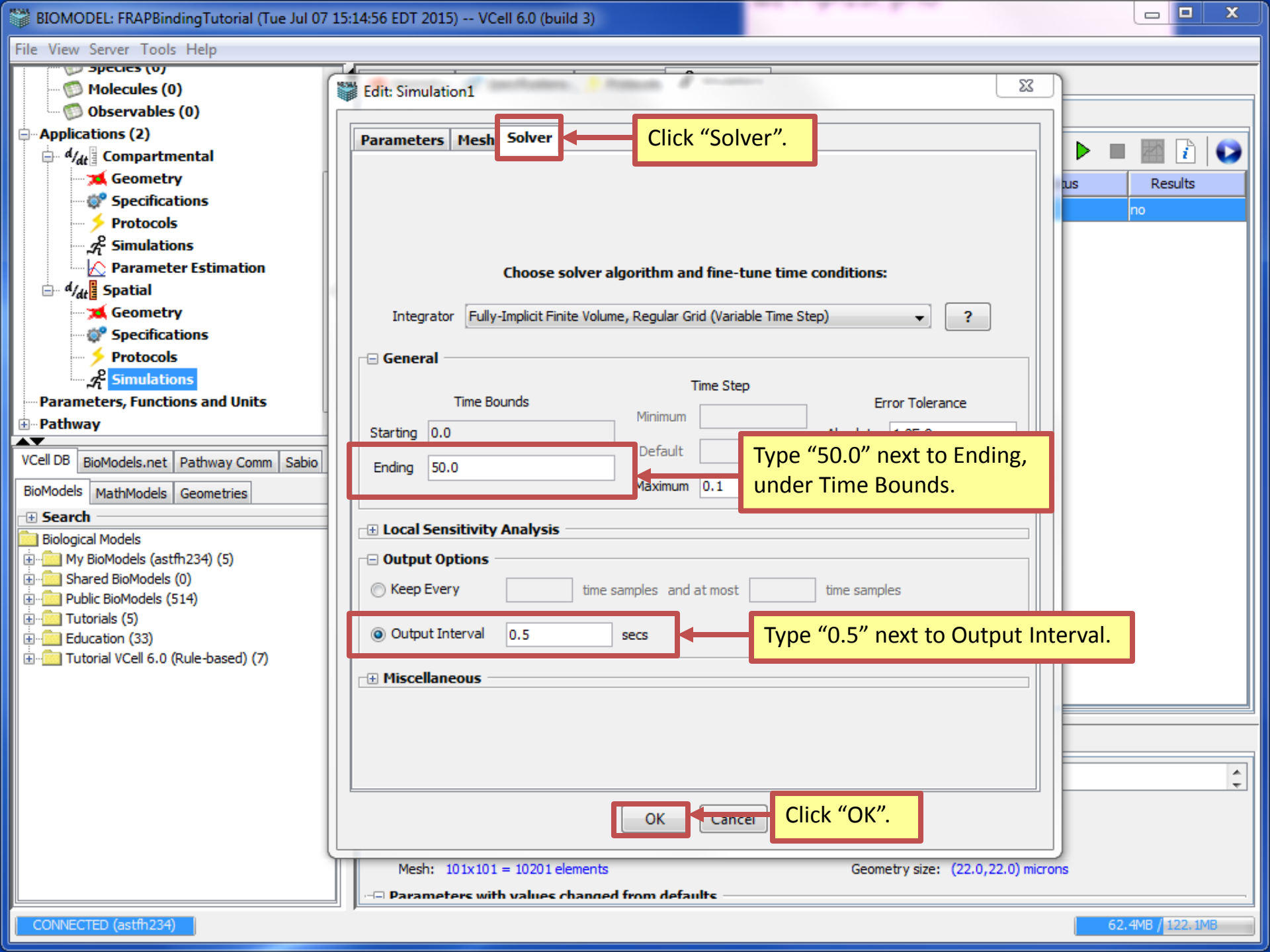
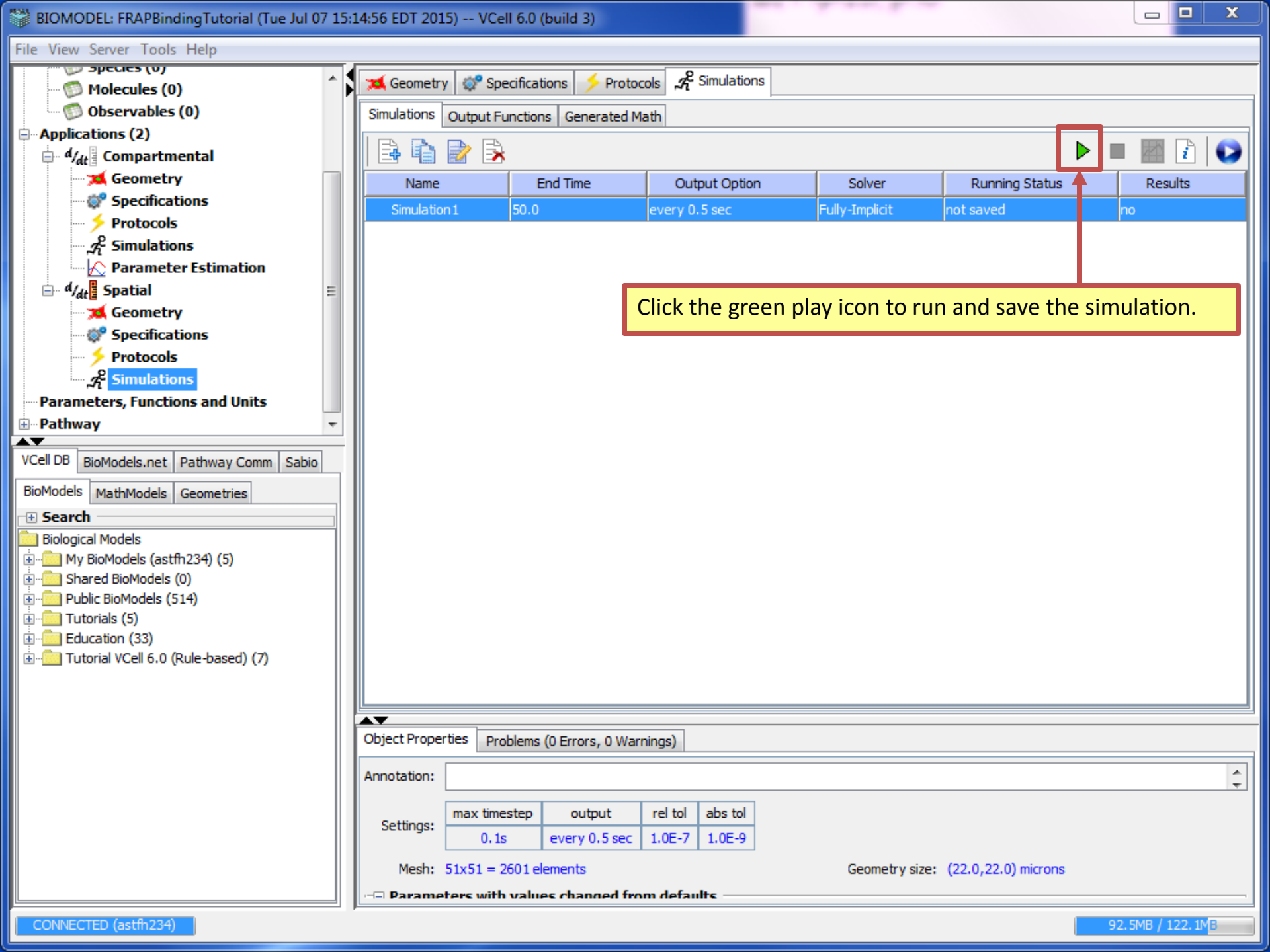
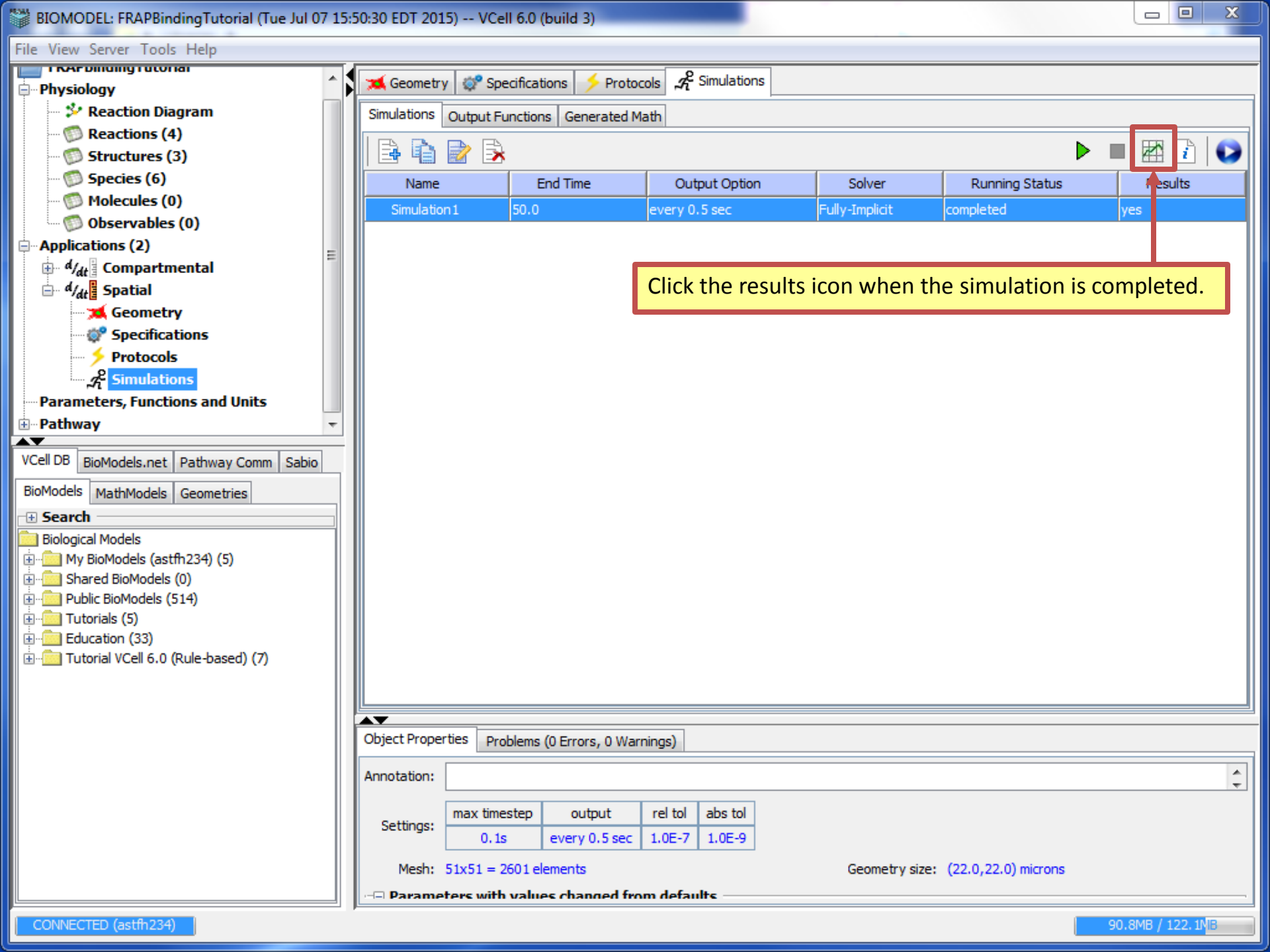
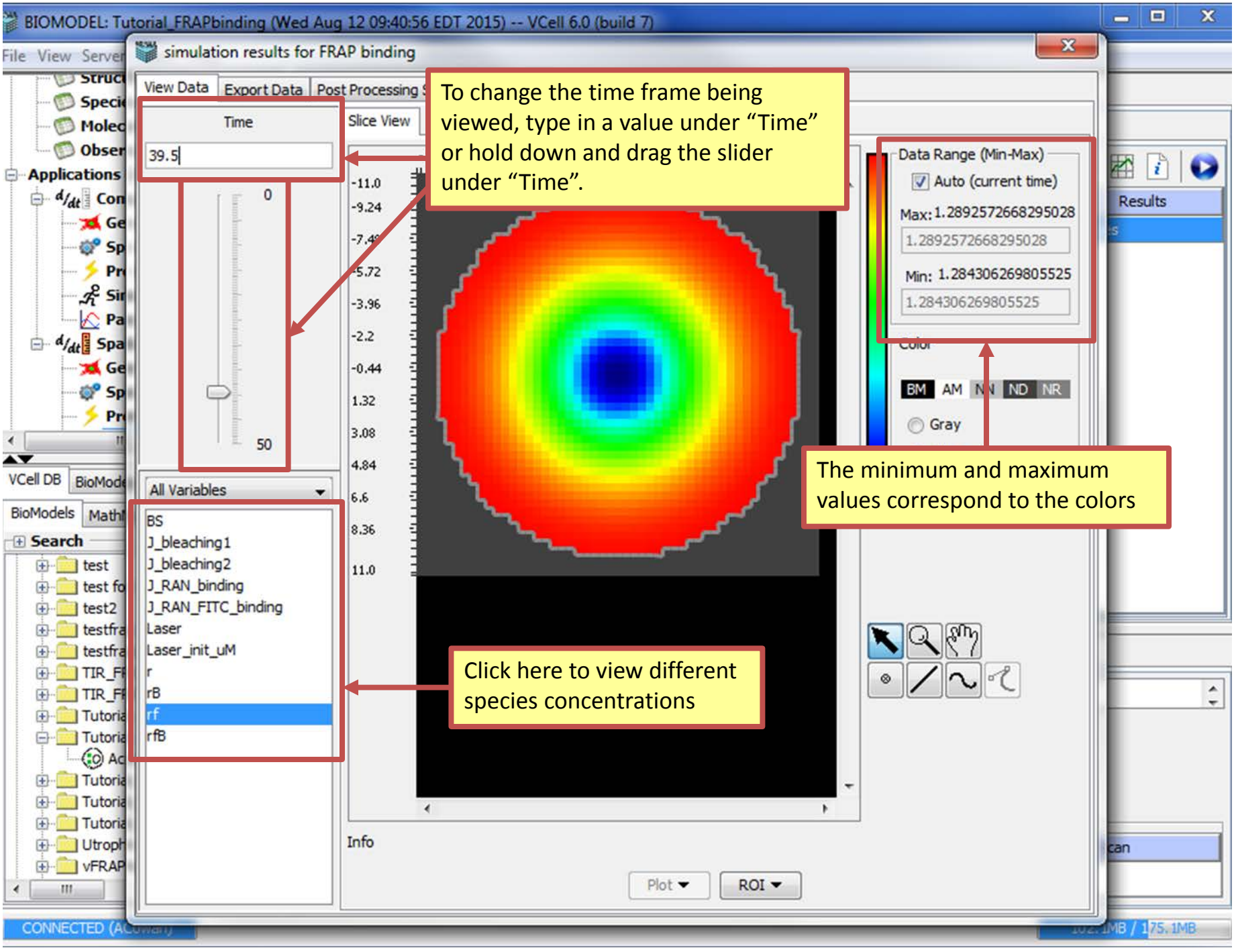
Parameter Estimation
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Geometry
Specifications
Protocols
Simulations
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation1
1.0
every 0.05 sec
Fully-Implicit
not saved
no
Go back to simulations, select Simulation1 and click the edit simulation icon.
Object Properties
Problems (0 Errors, 0 Warnings)
Annotation:
Settings:
max timestep
output
rel tol
abs tol
0.1s
every 0.05 sec
1.0E-7
1.0E-9
Mesh: 101x101 = 10201 elements
Geometry size: (22.0,22.0) microns
Parameters with values changed from defaults
CONNECTED (astfh234)
82.3MB / 122.1MB

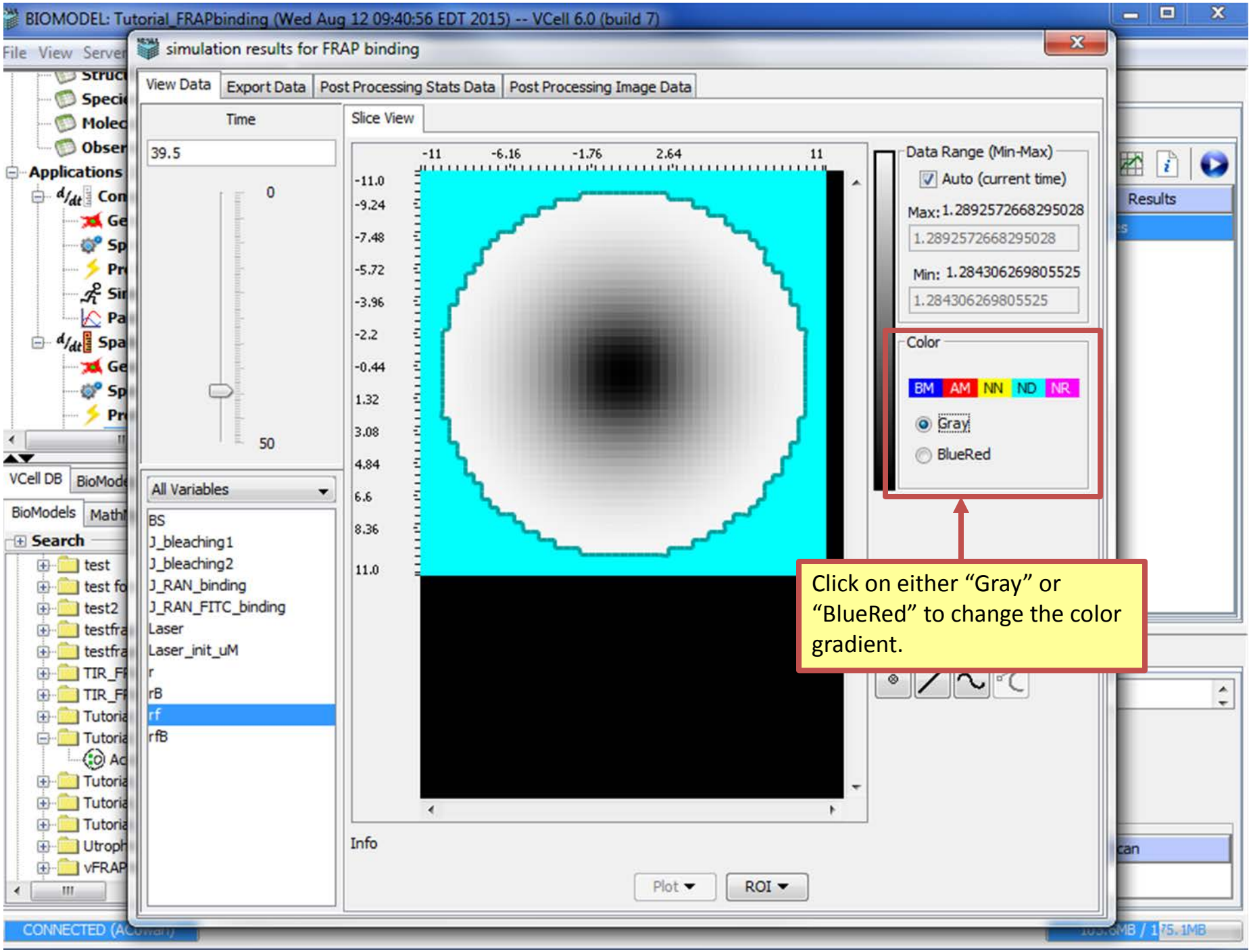

BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
Molecules (0)
Observables (0)
Applications (2)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Edit: Simulation1
Parameters
Mesh
Solver
Click “Mesh”.
Mesh Size
Geometry Size (um)
(22.0, 22.0)
Mesh Size (elements)
Lock aspect ratio
X
51
Y
51
Click “Lock aspect ratio” if it is not checked off already. Type in “51” next to Mesh Size for X.
Total Size (elements)
51 x 51 = 2601
Spatial Step (um)
Δx
0.44
Δy
0.44
OK
Cancel
Results
no
Mesh: 101x101 = 10201 elements
Geometry size: (22.0,22.0) microns
Parameters with values changed from defaults
CONNECTED (astfh234)
65.4MB / 122.1MB

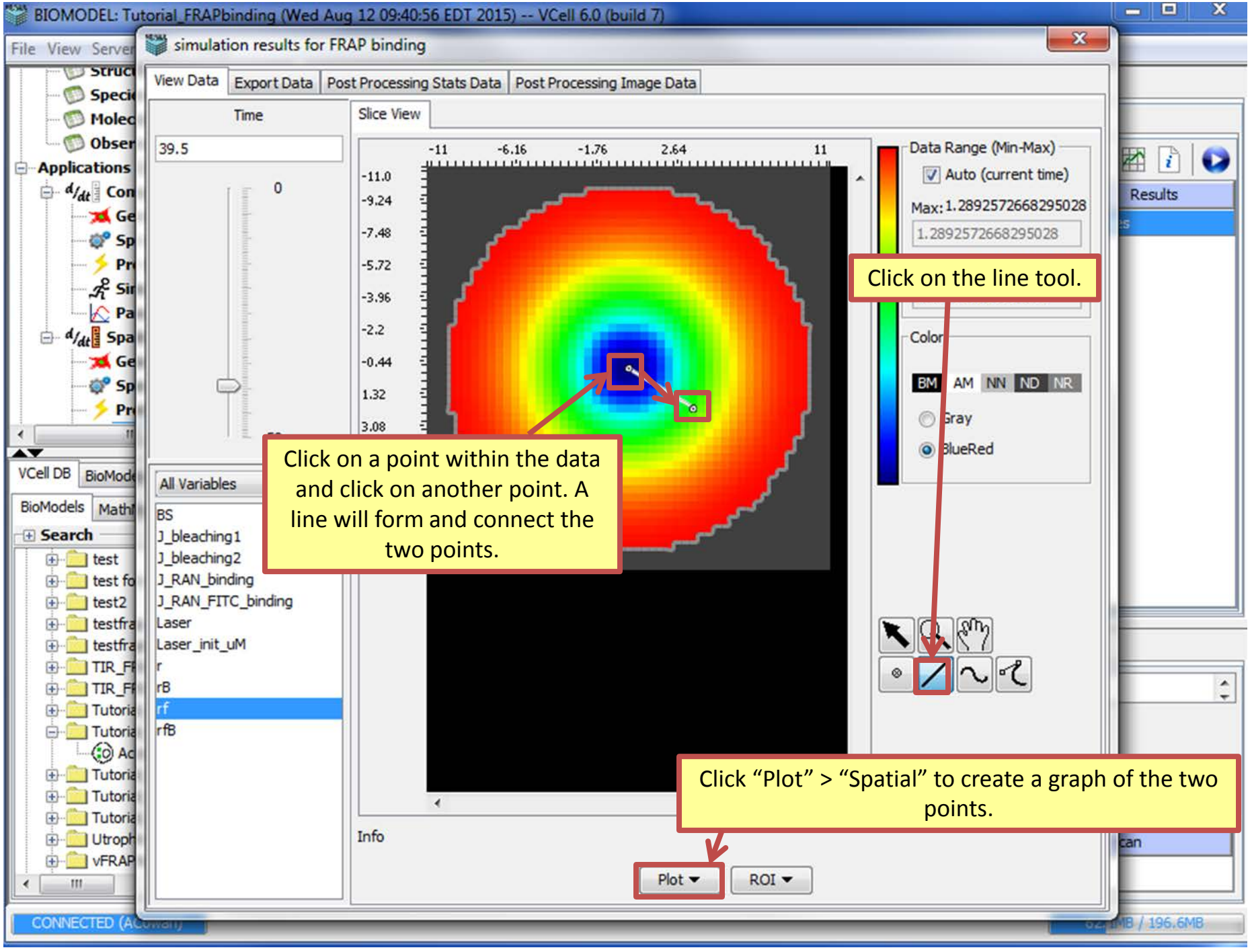

BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
Molecules (0)
Observables (0)
Applications (2)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Edit: Simulation1
Parameters
Mesh
Solver
Click “Solver”.
Choose solver algorithm and fine-tune time conditions:
Integrator
Fully-Implicit Finite Volume, Regular Grid (Variable Time Step)
?
General
Time Bounds
Starting
0.0
Ending
50.0
Time Step
Minimum
Default
Maximum
0.1
Error Tolerance
Type “50.0” next to Ending, under Time Bounds.
Local Sensitivity Analysis
Output Options
Keep Every
time samples
and at most
time samples
Output Interval
0.5
secs
Type “0.5” next to Output Interval.
Miscellaneous
OK
Cancel
Click “OK”.
Results
no
Mesh: 101x101 = 10201 elements
Geometry size: (22.0,22.0) microns
Parameters with values changed from defaults
CONNECTED (astfh234)
62.4MB / 122.1MB

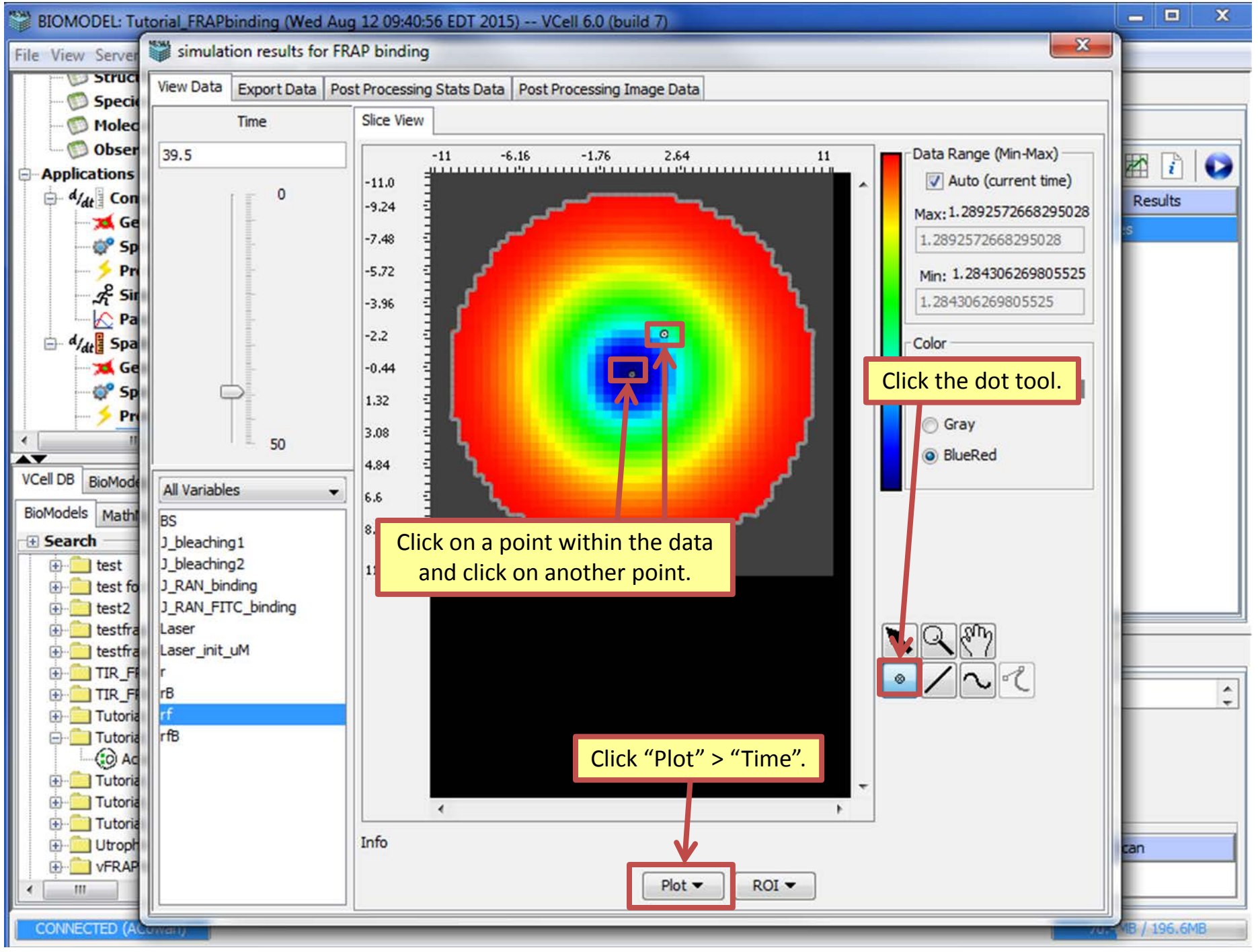

BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:14:56 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
Molecules (0)
Observables (0)
Applications (2)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Geometry
Specifications
Protocols
Simulations
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation1
50.0
every 0.5 sec
Fully-Implicit
not saved
no
Click the green play icon to run and save the simulation.
Object Properties
Problems (0 Errors, 0 Warnings)
Annotation:
Settings:
max timestep
output
rel tol
abs tol
0.1s
every 0.5 sec
1.0E-7
1.0E-9
Mesh: 51x51 = 2601 elements
Geometry size: (22.0,22.0) microns
Parameters with values changed from defaults
CONNECTED (astfh234)
92.5MB / 122.1MB

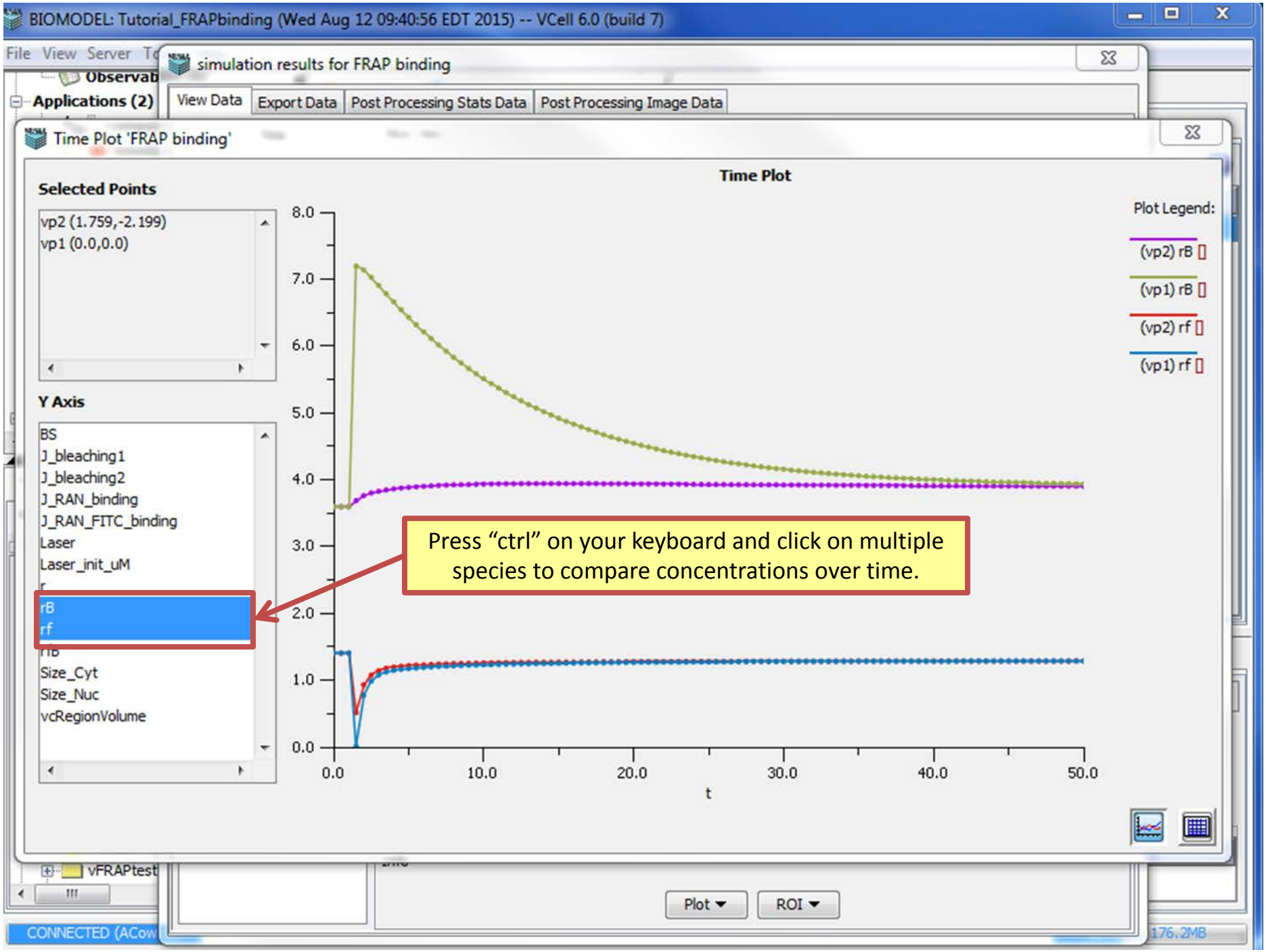

BIOMODEL: FRAPBindingTutorial (Tue Jul 07 15:50:30 EDT 2015) -- VCell 6.0 (build 3)
File View Server Tools Help
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Molecules (0)
Observables (0)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters, Functions and Units
Pathway
VCell DB
BioModels.net
Pathway Comm
Sabio
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (astfh234) (5)
Shared BioModels (0)
Public BioModels (514)
Tutorials (5)
Education (33)
Tutorial VCell 6.0 (Rule-based) (7)
Geometry
Specifications
Protocols
Simulations
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation1
50.0
every 0.5 sec
Fully-Implicit
completed
yes
Click the results icon when the simulation is completed.
Object Properties
Problems (0 Errors, 0 Warnings)
Annotation:
Settings:
max timestep
output
rel tol
abs tol
0.1s
every 0.5 sec
1.0E-7
1.0E-9
Mesh: 51x51 = 2601 elements
Geometry size: (22.0,22.0) microns
Parameters with values changed from defaults
CONNECTED (astfh234)
90.8MB / 122.1MB


BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 6.0 (build 7)
simulation results for FRAP binding
View Data
Export Data
Post Processing
Time
39.5
0
50
To change the time frame being viewed, type in a value under "Time" or hold down and drag the slider under "Time".
Slice View
-11.0
-9.24
-7.48
-5.72
-3.96
-2.2
-0.44
1.32
3.08
4.84
6.6
8.36
11.0
Data Range (Min-Max)
Auto (current time)
Max: 1.2892572668295028
1.2892572668295028
Min: 1.284306269805525
1.284306269805525
BM
AM
NN
ND
NR
Gray
The minimum and maximum values correspond to the colors
All Variables
BS
J_bleaching1
J_bleaching2
J_RAN_binding
J_RAN_FITC_binding
Laser
Laser_init_uM
r
rB
rf
rfB
Click here to view different species concentrations
Info
Plot
ROI
VCell DB
BioModels
Search
Results
CONNECTED


BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 6.0 (build 7)
simulation results for FRAP binding
View Data
Export Data
Post Processing Stats Data
Post Processing Image Data
Time
39.5
0
50
Slice View
-11
-6.16
-1.76
2.64
11
-11.0
-9.24
-7.48
-5.72
-3.96
-2.2
-0.44
1.32
3.08
4.84
6.6
8.36
11.0
Data Range (Min-Max)
Auto (current time)
Max: 1.2892572668295028
1.2892572668295028
Min: 1.284306269805525
1.284306269805525
Color
BM
AM
NN
ND
NR
Gray
BlueRed
All Variables
BS
J_bleaching1
J_bleaching2
J_RAN_binding
J_RAN_FITC_binding
Laser
Laser_init_uM
r
rB
rf
rfB
Info
Plot
ROI
Click on either “Gray” or “BlueRed” to change the color gradient.


BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 6.0 (build 7)
simulation results for FRAP binding
View Data
Export Data
Post Processing Stats Data
Post Processing Image Data
Time
39.5
Slice View
Data Range (Min-Max)
Auto (current time)
Max: 1.2892572668295028
1.2892572668295028
Color
BM
AM
NN
ND
NR
Gray
BlueRed
All Variables
BS
J_bleaching1
J_bleaching2
J_RAN_binding
J_RAN_FITC_binding
Laser
Laser_init_uM
r
rB
rf
rfB
Info
Plot
ROI
Click on the line tool.
Click on a point within the data and click on another point. A line will form and connect the two points.
Click “Plot” > “Spatial” to create a graph of the two points.


BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 6.0 (build 7)
simulation results for FRAP binding
View Data
Export Data
Post Processing Stats Data
Post Processing Image Data
Time
39.5
0
50
Slice View
All Variables
BS
J_bleaching1
J_bleaching2
J_RAN_binding
J_RAN_FITC_binding
Laser
Laser_init_uM
r
rB
rf
rfB
Data Range (Min-Max)
Auto (current time)
Max: 1.2892572668295028
1.2892572668295028
Min: 1.284306269805525
1.284306269805525
Color
Gray
BlueRed
Click the dot tool.
Click on a point within the data and click on another point.
Click “Plot” > “Time”.
Info
Plot
ROI


BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 6.0 (build 7)
simulation results for FRAP binding
View Data
Export Data
Post Processing Stats Data
Post Processing Image Data
Time Plot 'FRAP binding'
Time Plot
Selected Points
vp2 (1.759,-2.199)
vp1 (0.0,0.0)
Y Axis
BS
J_bleaching1
J_bleaching2
J_RAN_binding
J_RAN_FITC_binding
Laser
Laser_init_uM
r
rB
rf
Size_Cyt
Size_Nuc
vcRegionVolume
Plot Legend:
(vp2) rB
(vp1) rB
(vp2) rf
(vp1) rf
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
10.0
20.0
30.0
40.0
50.0
t
Press “ctrl” on your keyboard and click on multiple species to compare concentrations over time.
Plot
ROI
vFRAPtest
CONNECTED (ACow
176.2MB

Next: VCell PIP2 to IP3 Tutorial