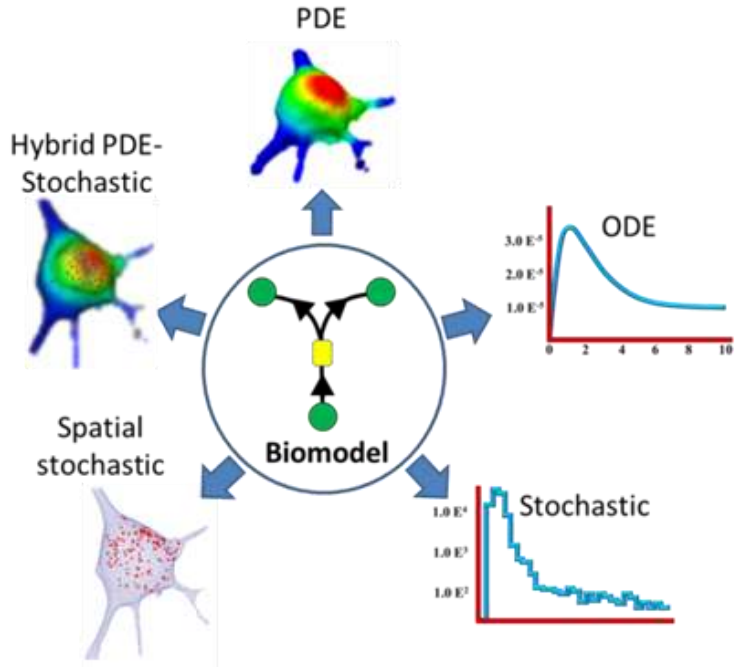
Virtual Cell Tutorials

VCell

modeling environment for mathematical simulation of cellular events.

To run VCell go to:

vcell.org



Virtual Cell is developed by the Center for Cell Analysis and Modeling at the University of Connecticut Health Center. It is funded as a Biomedical Technology Research Resource by the National Institute of General Medical Sciences (NIGMS)

Contents

VCell Tutorial

FRAP with binding

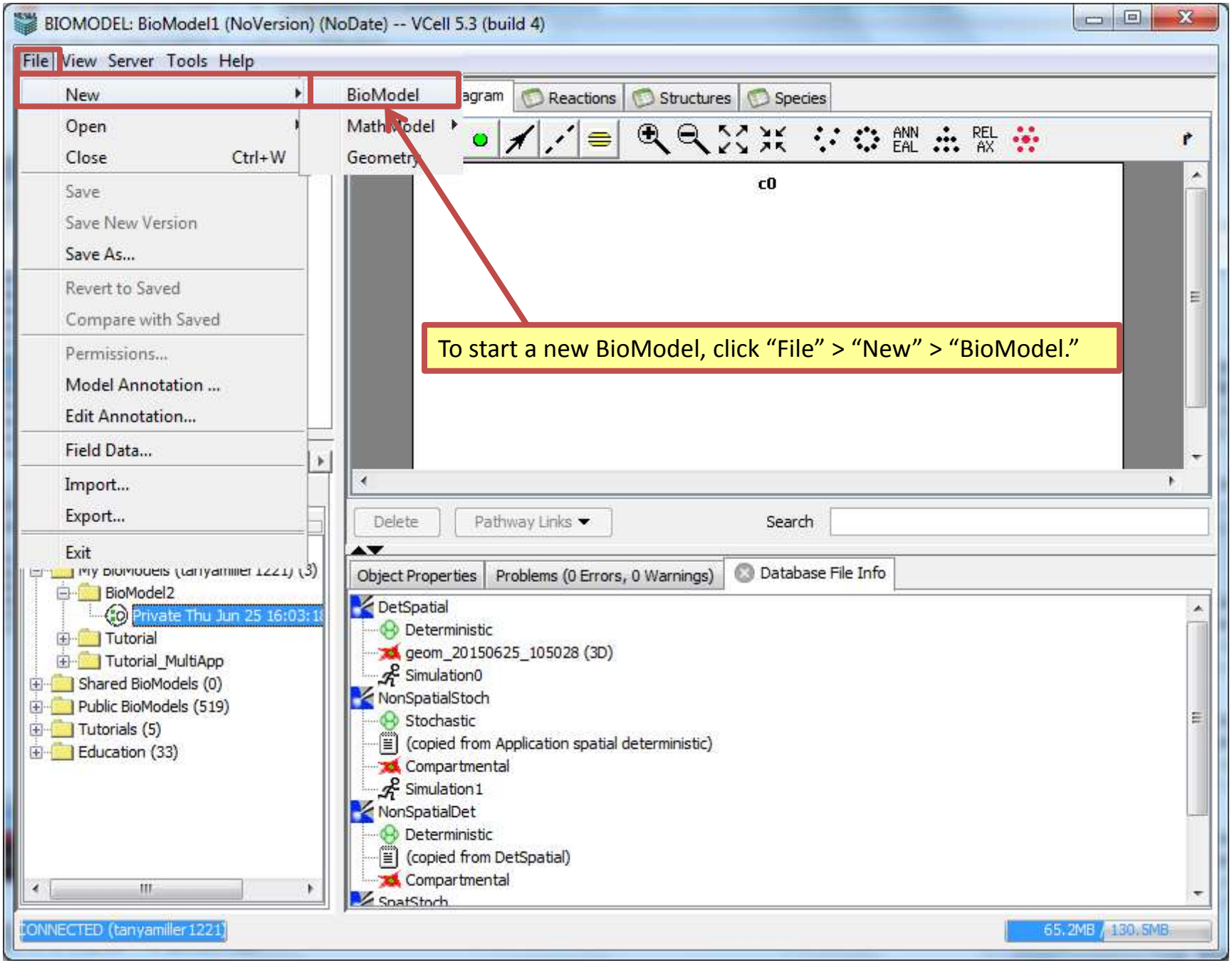
Create a simple biomodel and spatial (PDE) application to simulate a photobleaching experiment with both diffusion and binding .

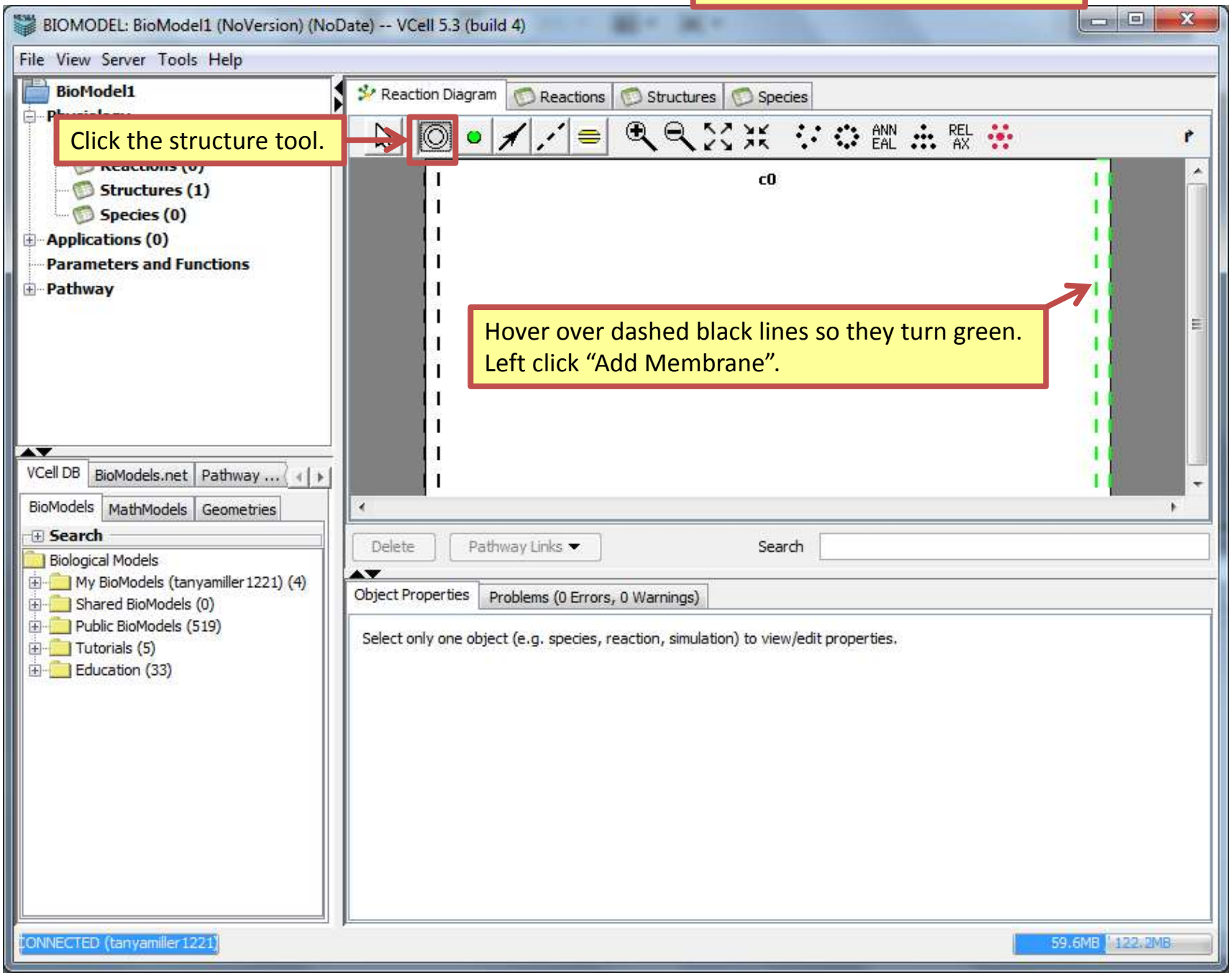
Contents

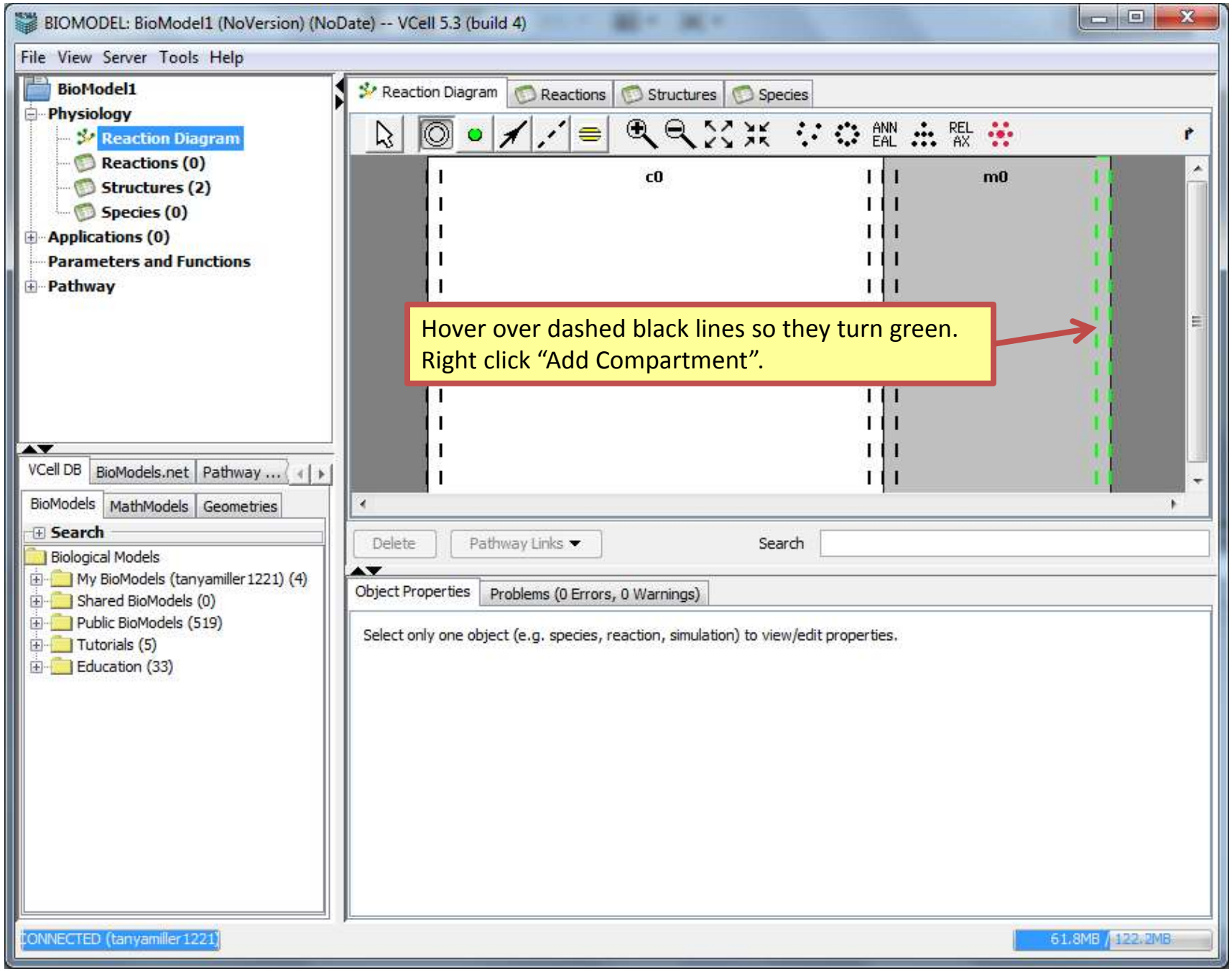
In this tutorial…

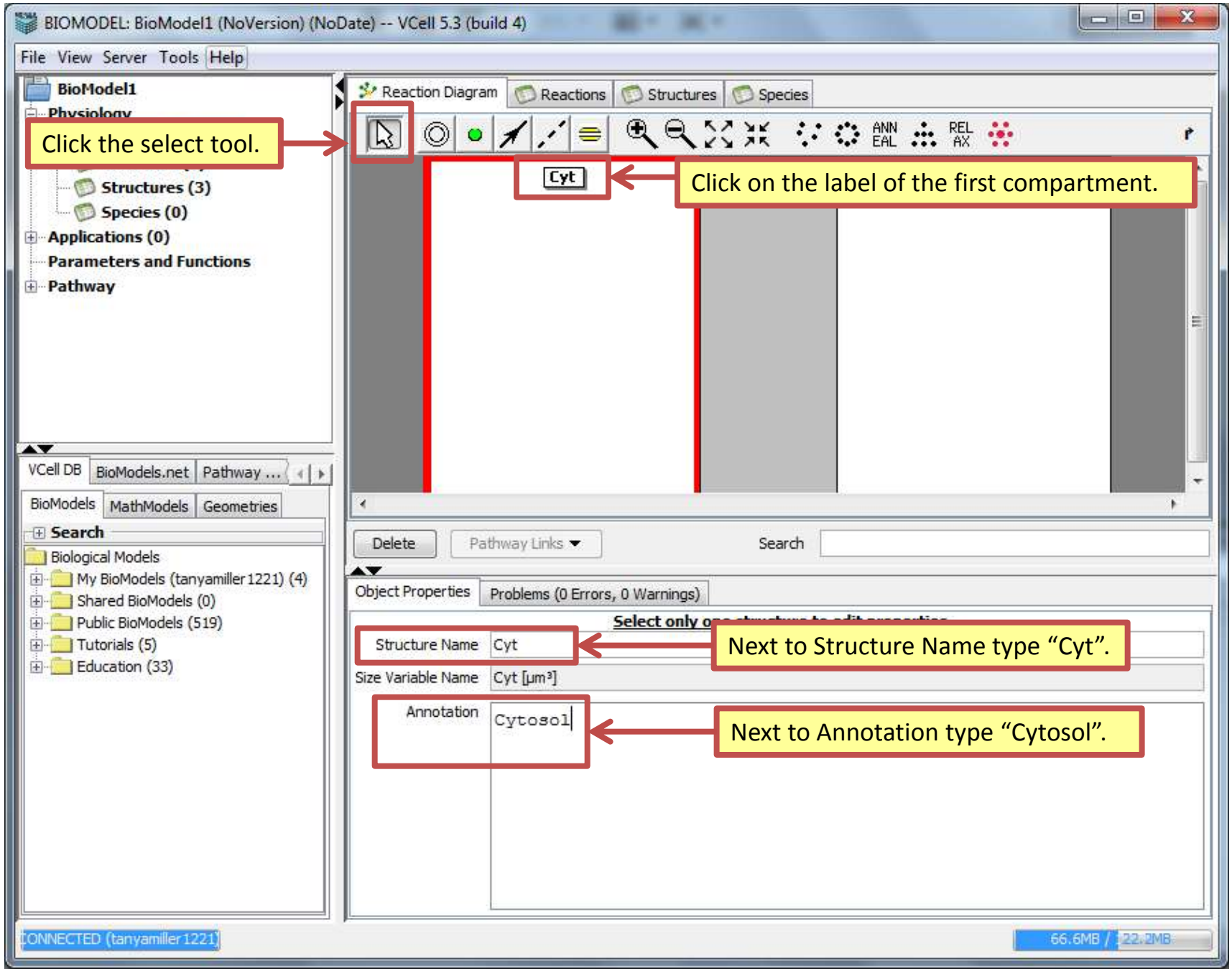
- Gain a basic introduction to the Virtual Cell interface
- Create a simple biomodel with species and reactions
- Create a compartmental (ODE) application of the model to determine steady state binding conditions.
- Create a spatial deterministic (PDE) application using analytic equations to create a 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.

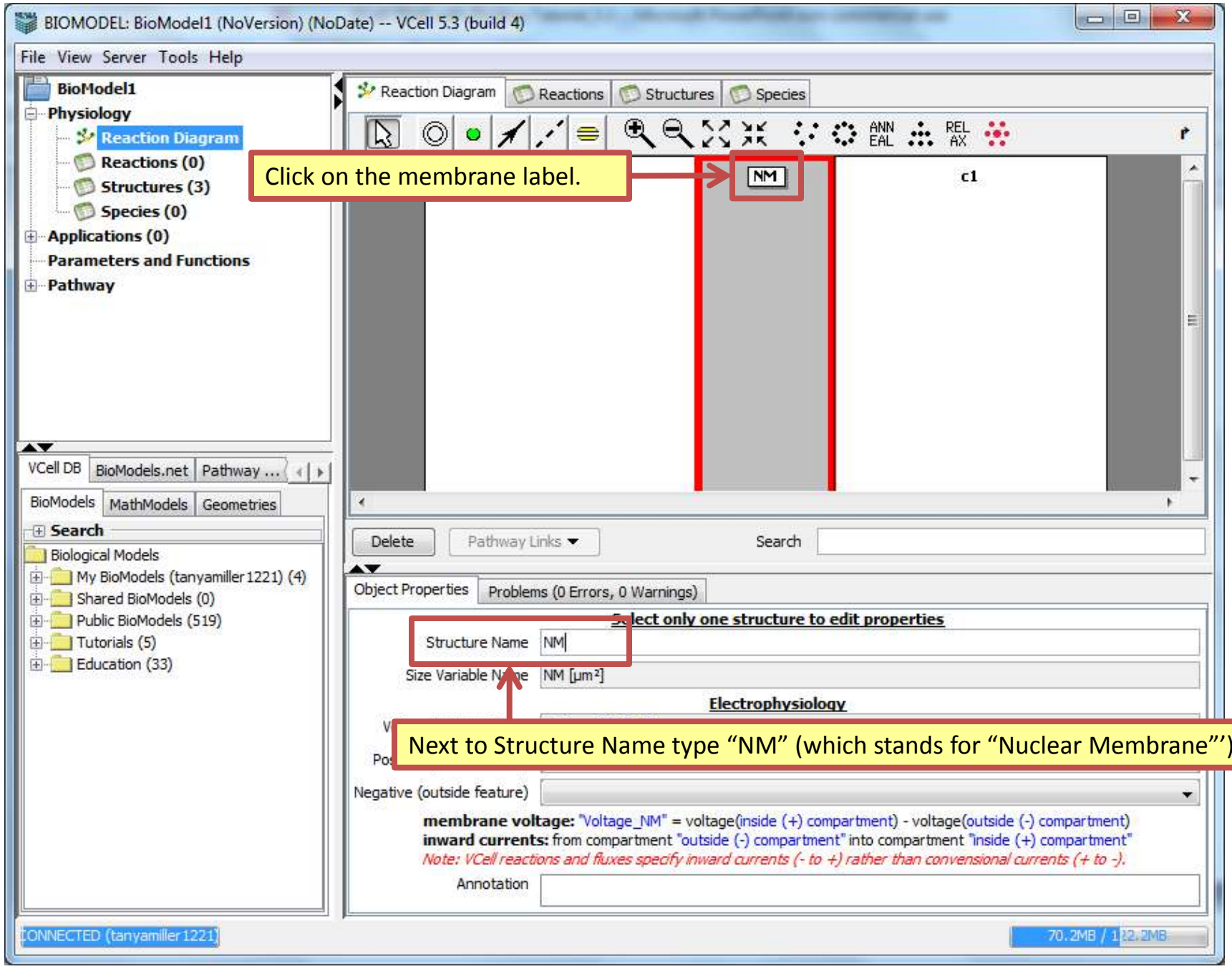
Table of contents

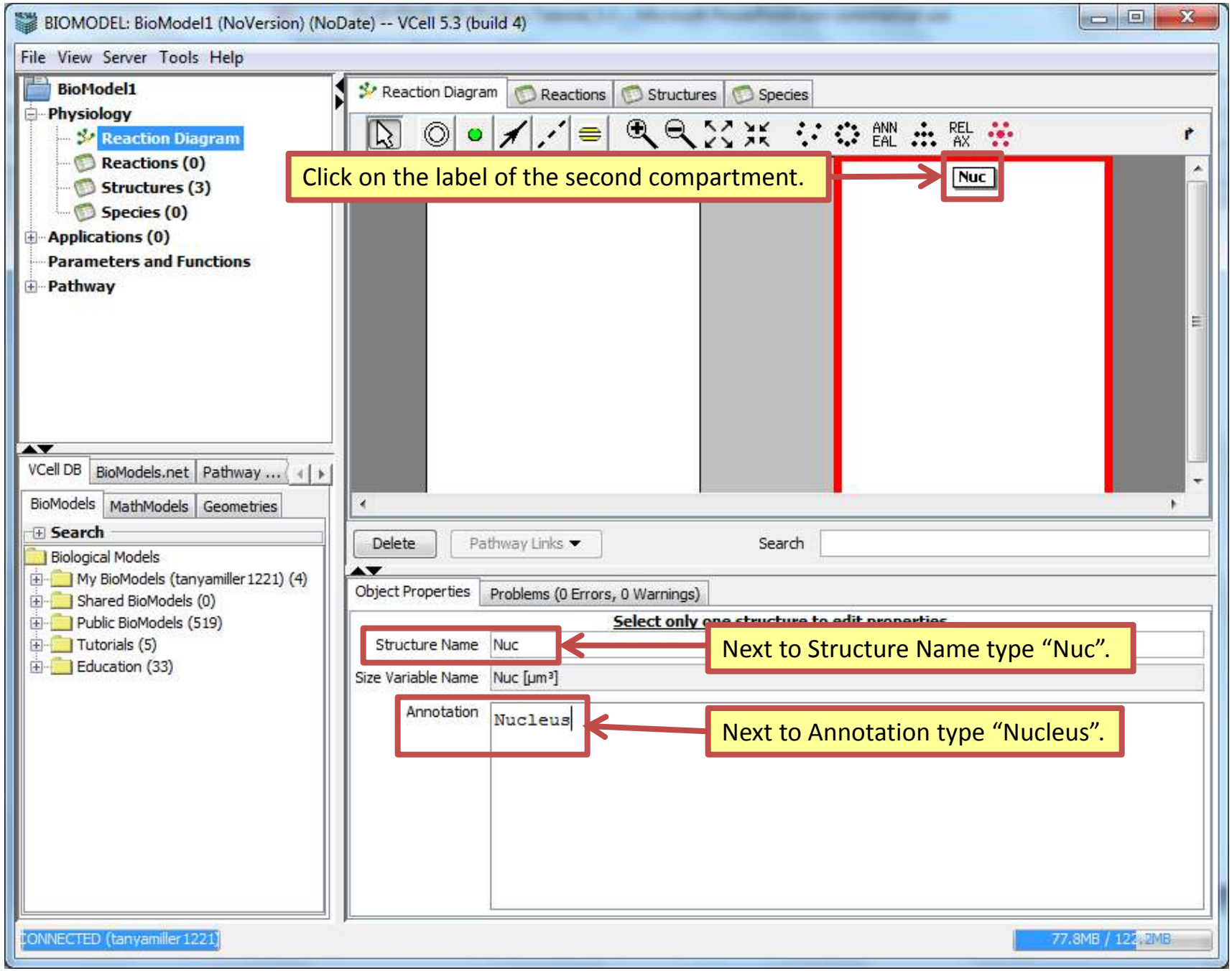

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
New
Open
Close Ctrl+W
Save
Save New Version
Save As...
Revert to Saved
Compare with Saved
Permissions...
Model Annotation ...
Edit Annotation...
Field Data...
Import...
Export...
Exit
BioModel
MathModel
Geometry
Reactions
Structures
Species
c0
To start a new BioModel, click “File” > “New” > “BioModel.”
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Database File Info
BioModel2
Tutorial
Tutorial_MultiApp
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
DetSpatial
Deterministic
geom_20150625_105028 (3D)
Simulation0
NonSpatialStoch
Stochastic
(copied from Application spatial deterministic)
Compartmental
Simulation1
NonSpatialDet
Deterministic
(copied from DetSpatial)
Compartmental
CONNECTED (tanyamiller1221)
65.2MB
130.5MB

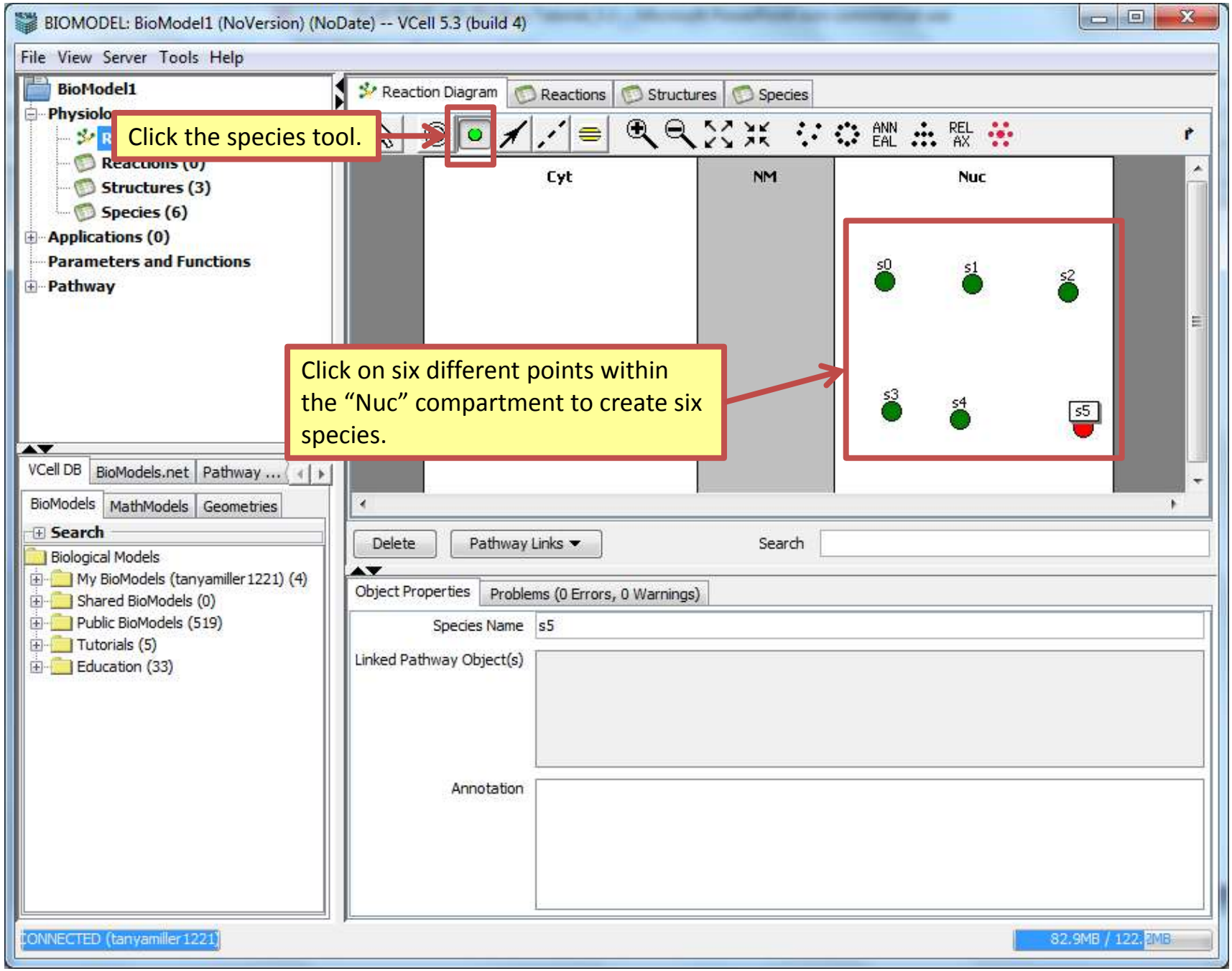

Starting from a new model…
BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Structures (1)
Species (0)
Applications (0)
Parameters and Functions
Pathway
Click the structure tool.
Reaction Diagram
Reactions
Structures
Species
c0
Hover over dashed black lines so they turn green.
Left click “Add Membrane”.
VCell DB
BioModels.net
Pathway …
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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 (tanyamiller1221)
59.6MB
122.2MB

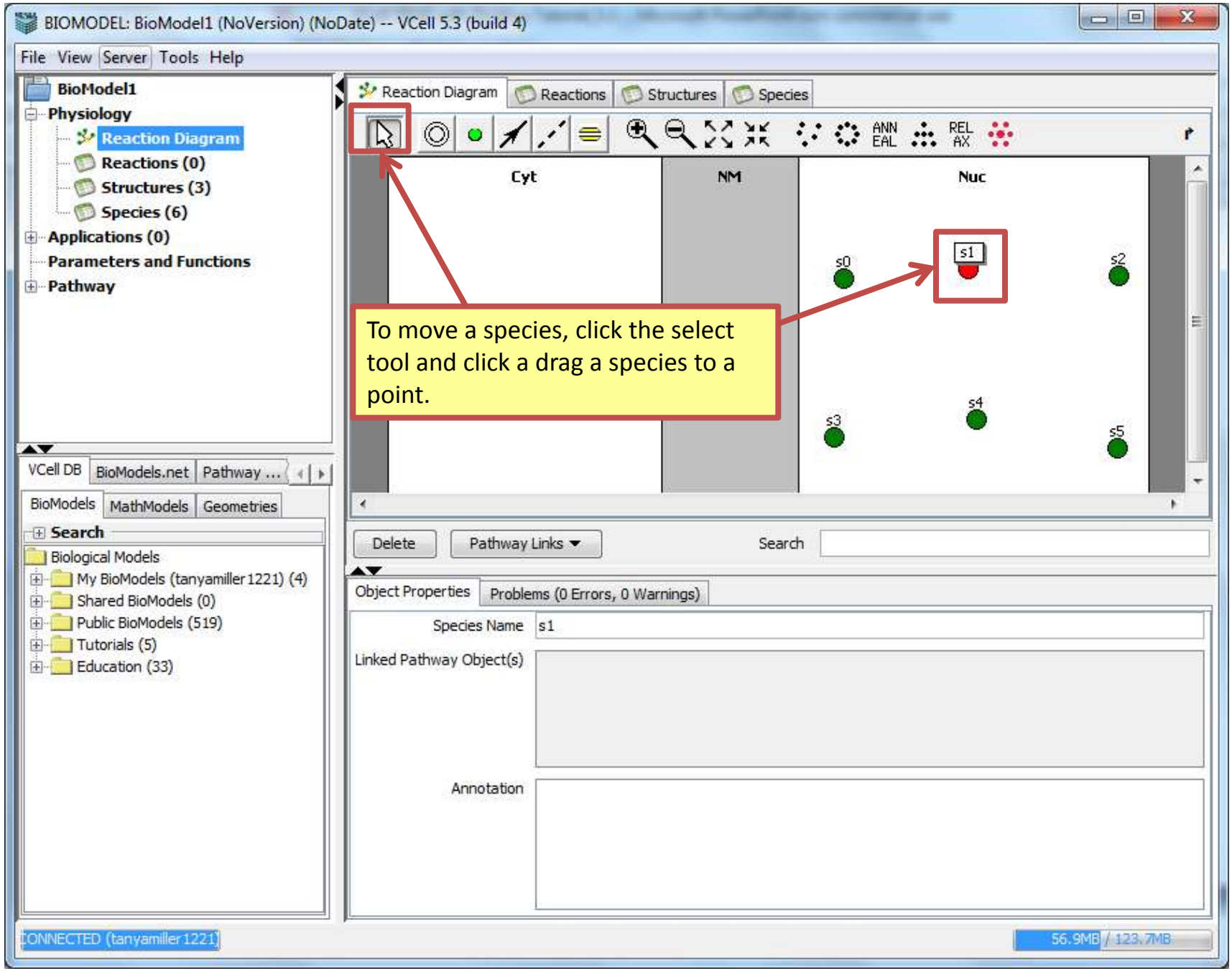

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (2)
Species (0)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
c0
m0
Hover over dashed black lines so they turn green.
Right click "Add Compartment".
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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 (tanyamiller1221)
61.8MB / 122.2MB

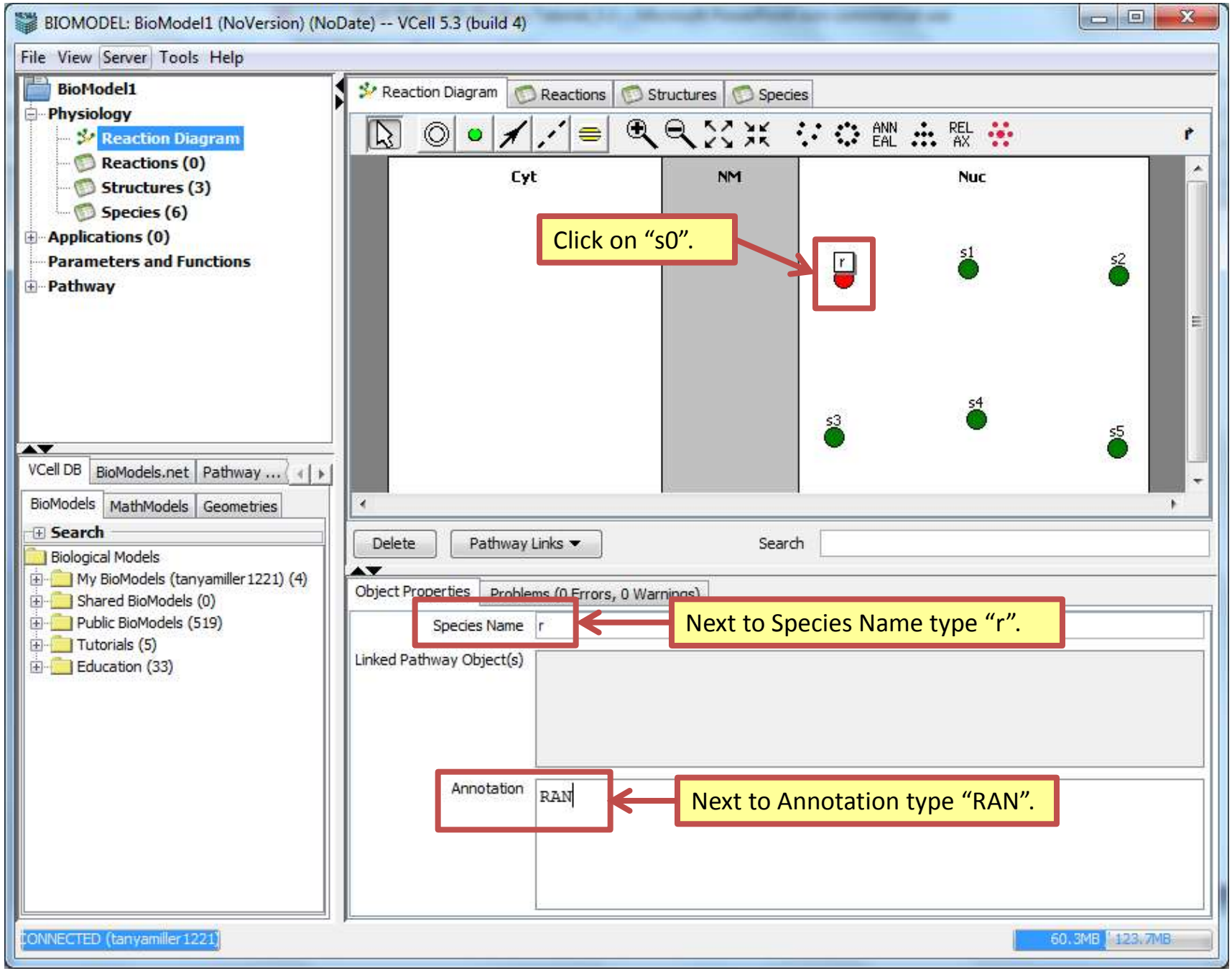

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Structures (3)
Species (0)
Applications (0)
Parameters and Functions
Pathway
Click the select tool.
Reaction Diagram
Reactions
Structures
Species
Cyt
Click on the label of the first compartment.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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 (tanyamiller1221)
66.6MB / 22.2MB

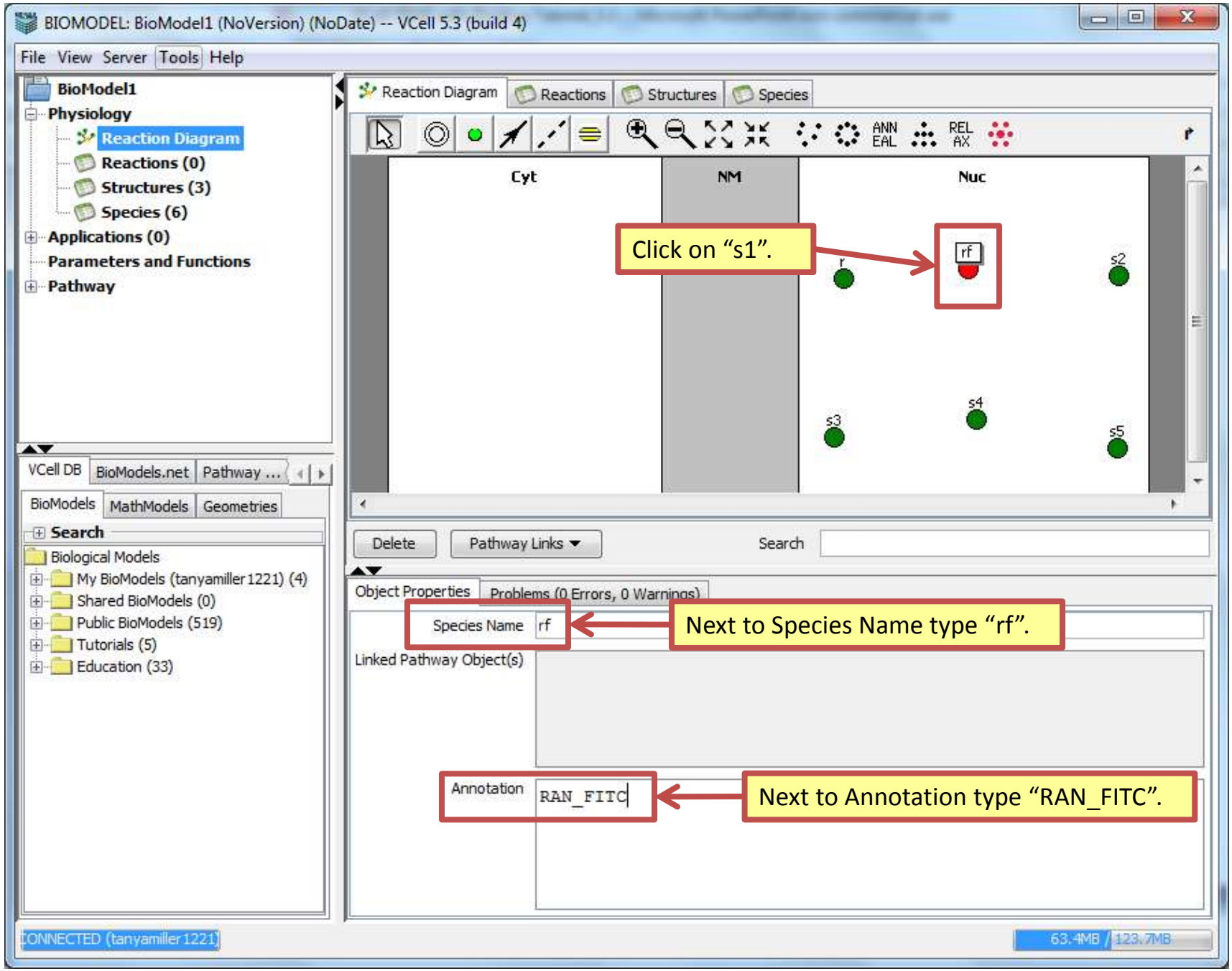

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (0)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Click on the membrane label.
NM
c1
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Delete
Pathway Links
Search
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 convensional currents (+ to -).
Annotation
CONNECTED (tanyamiller1221)

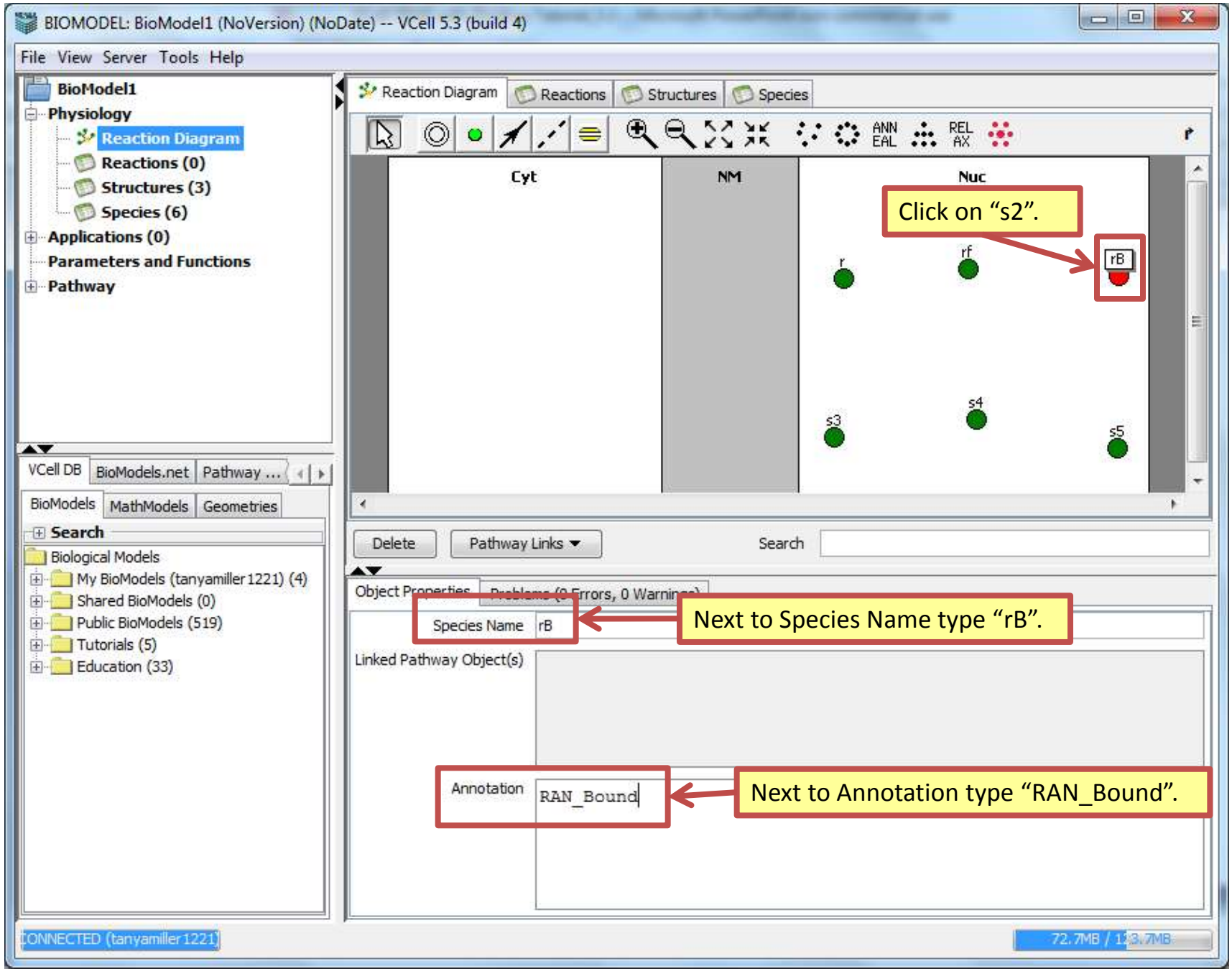

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (0)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Click on the label of the second compartment.
Nuc
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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 (tanyamiller1221)

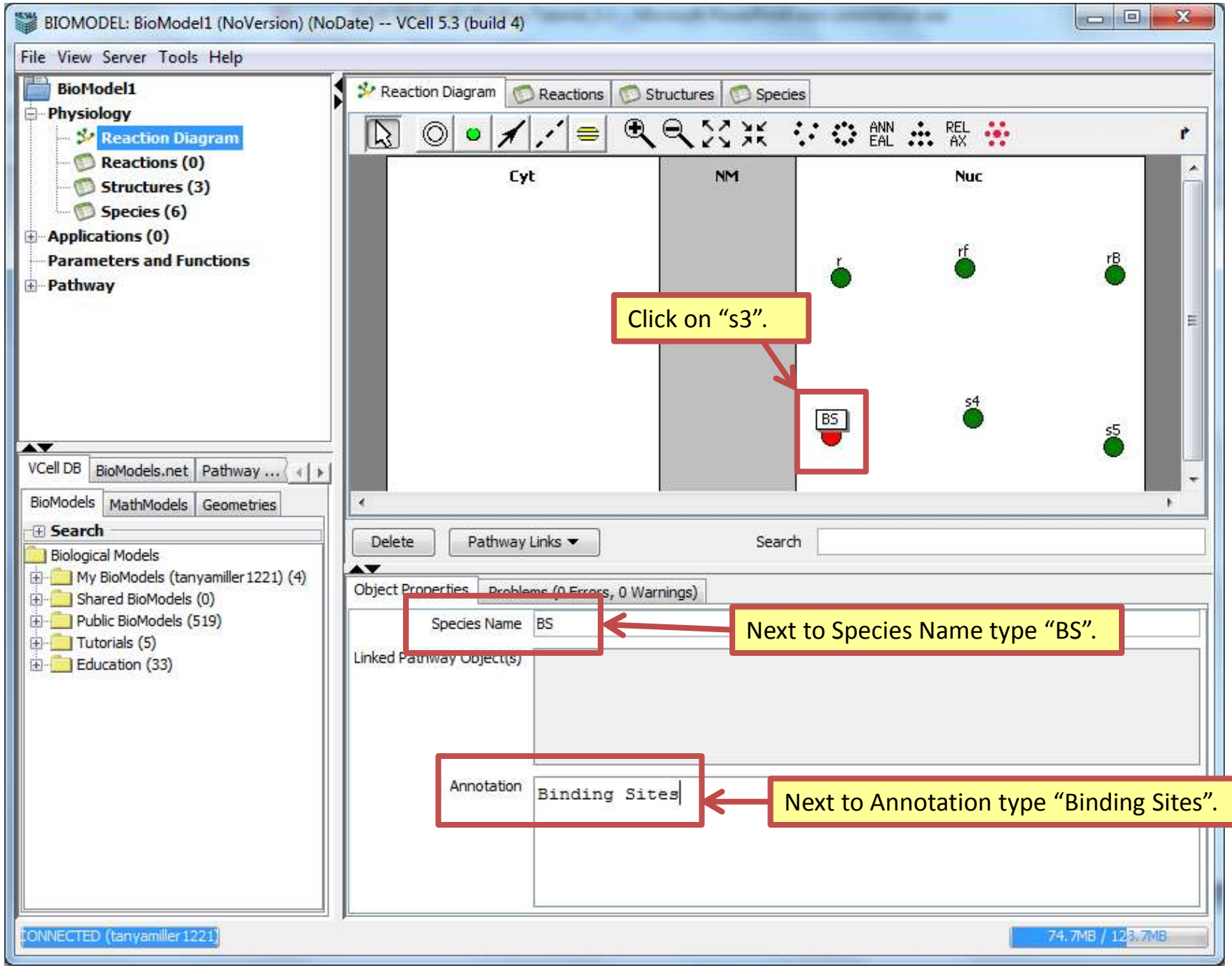

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiolo
Reactions (0)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Click the species tool.
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
s0
s1
s2
s3
s4
s5
Click on six different points within the "Nuc" compartment to create six species.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
s5
Linked Pathway Object(s)
Annotation
CONNECTED (tanyamiller1221)
82.9MB / 122.2MB

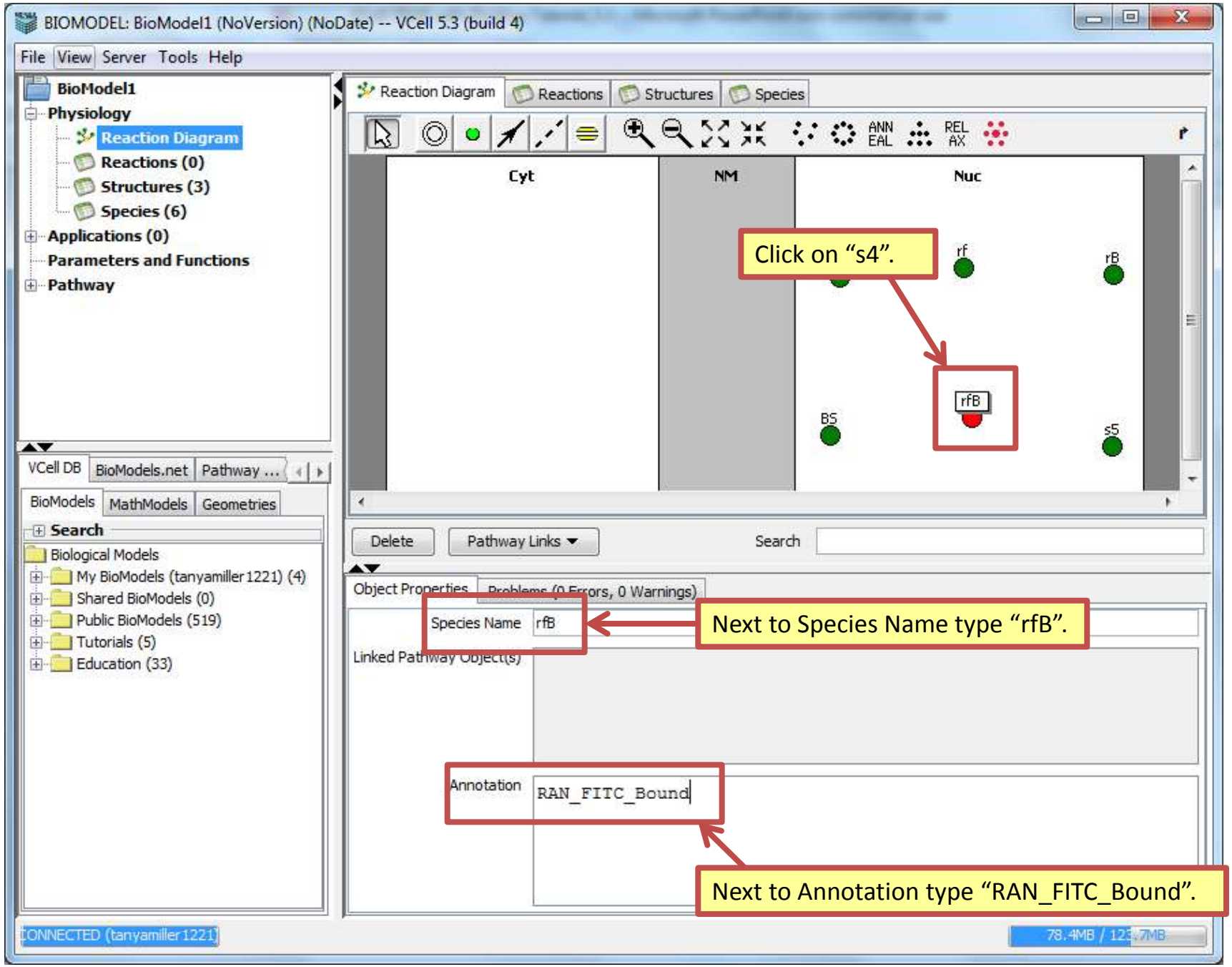

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
s0
s1
s2
s3
s4
s5
To move a species, click the select tool and click a drag a species to a point.
Delete
Pathway Links
Search
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
s1
Linked Pathway Object(s)
Annotation
CONNECTED (tanyamiller1221)
56.9MB / 123.7MB

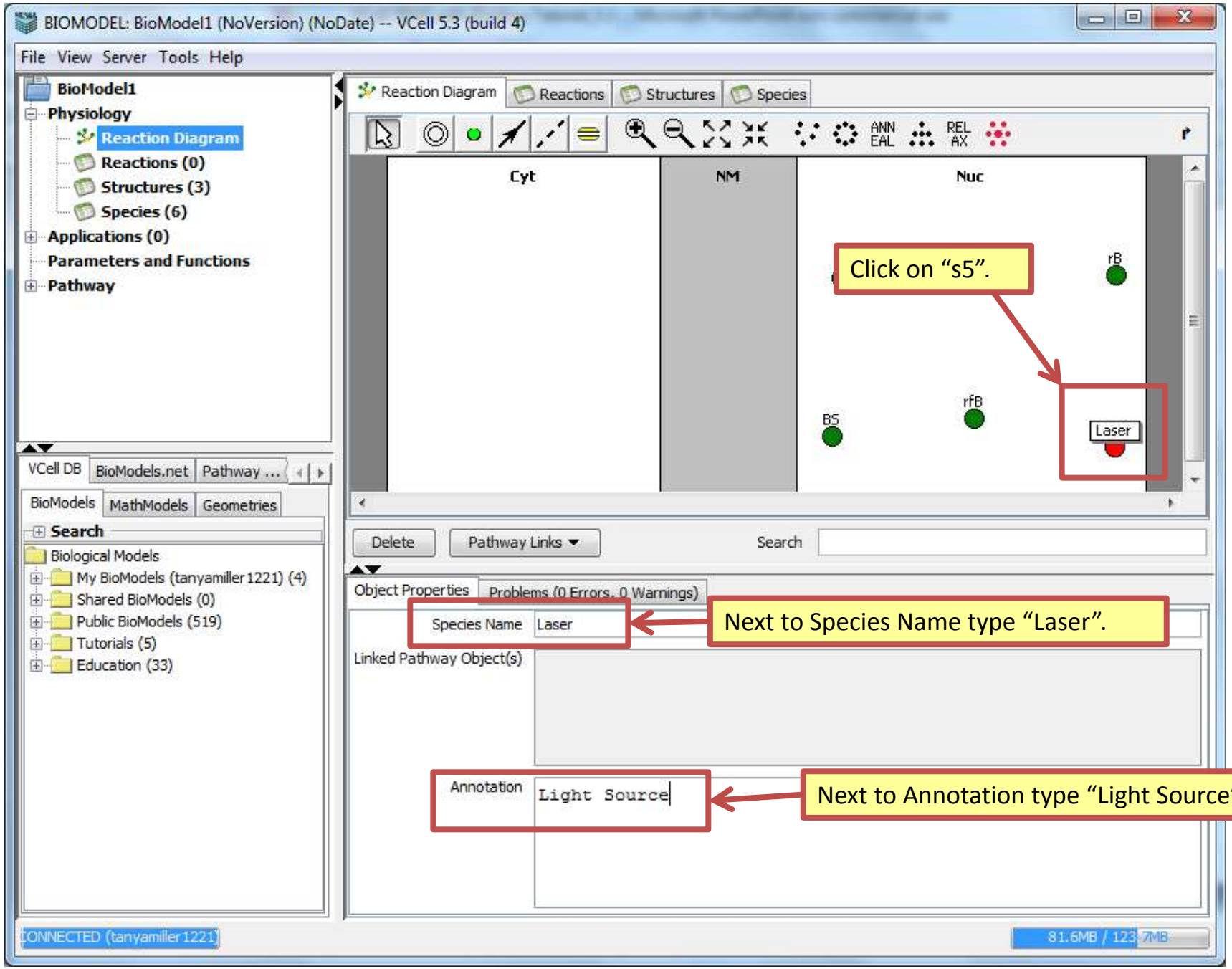

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Click on "s0".
r
s1
s2
s3
s4
s5
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 (tanyamiller1221)
60.3MB
123.7MB

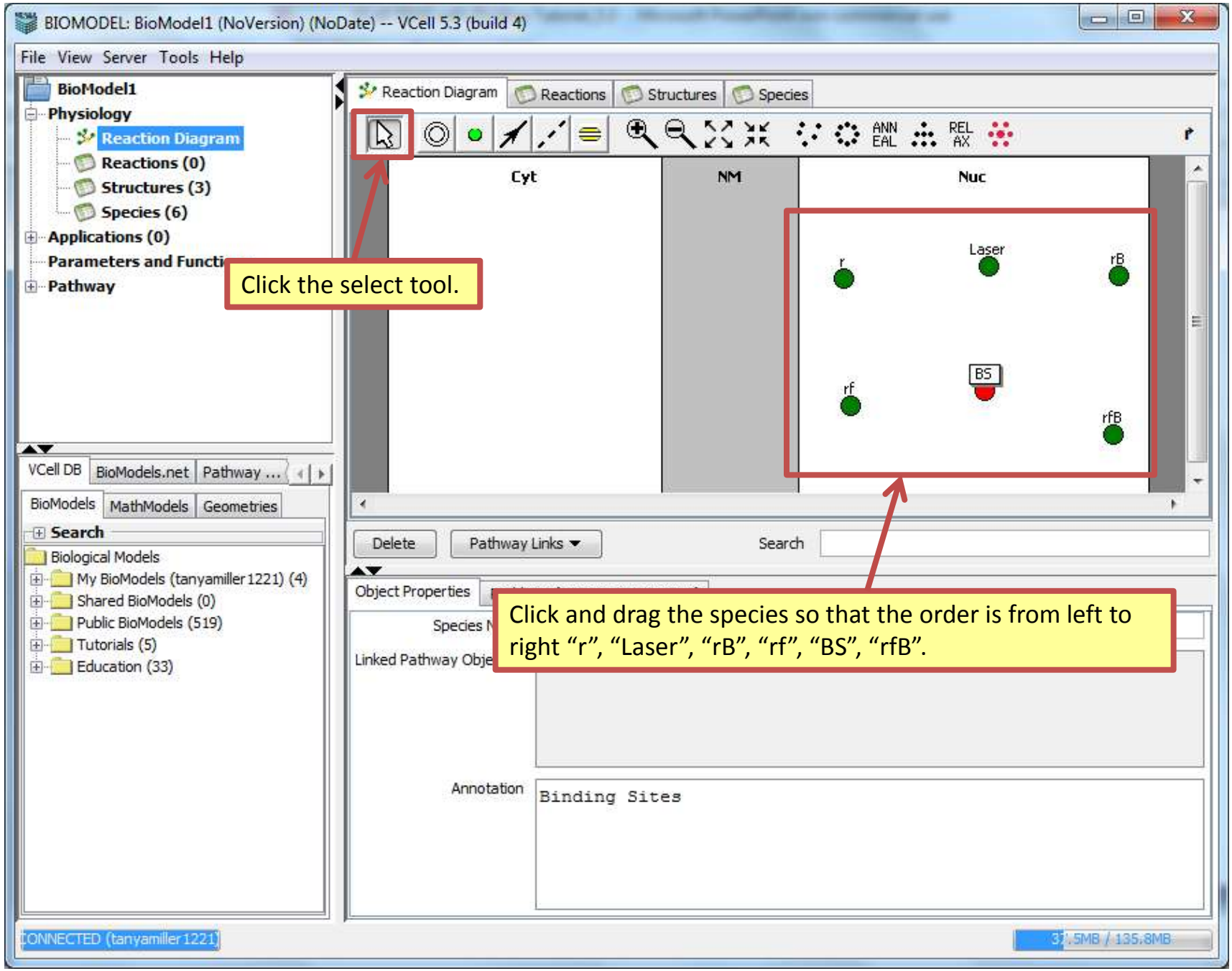

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Click on “s1”.
rf
r
s2
s3
s4
s5
Delete
Pathway Links
Search
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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 (tanyamiller1221)
63.4MB / 123.7MB

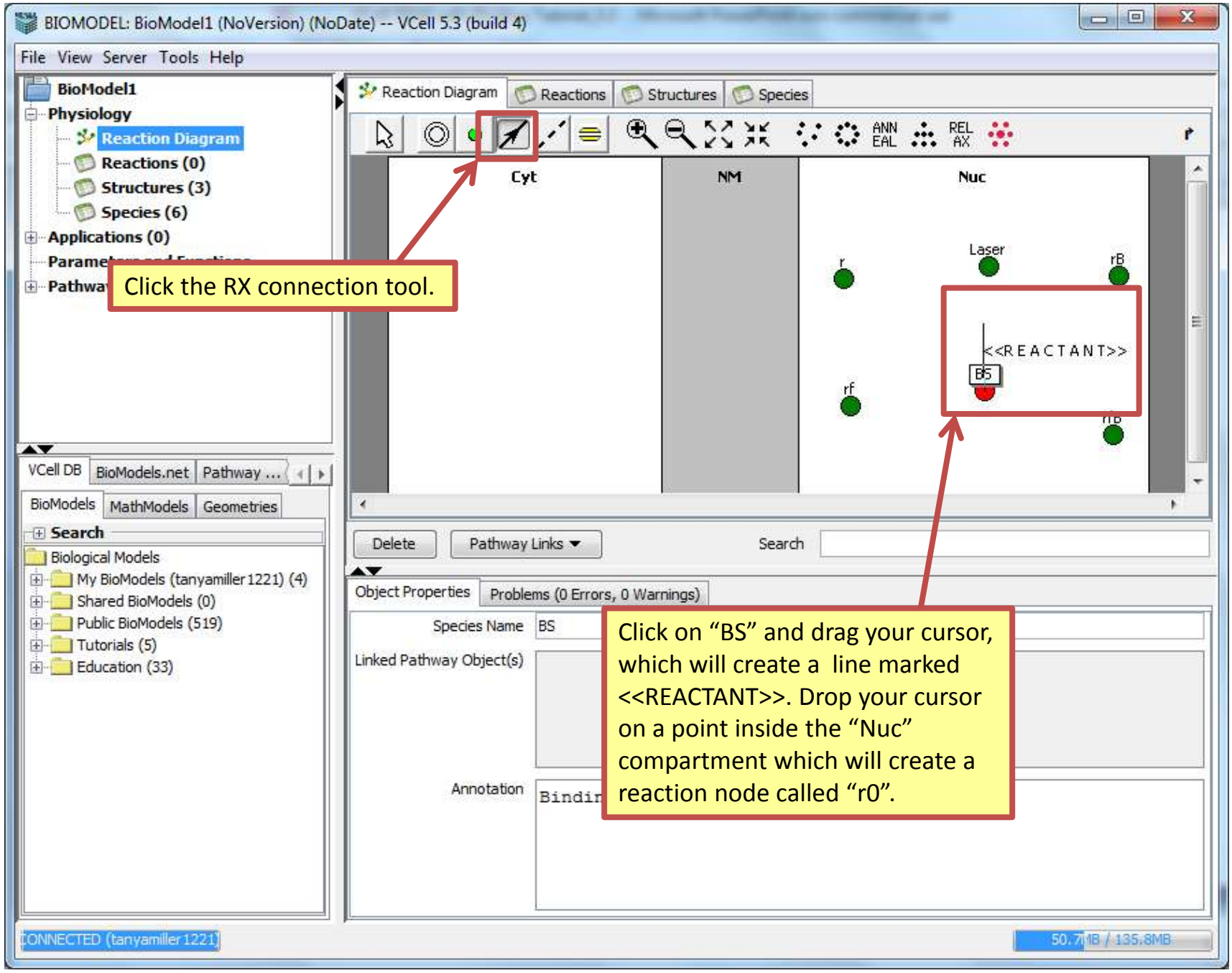

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Click on "s2".
rB
rf
r
s3
s4
s5
Delete
Pathway Links
Search
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Object Properties
Species Name
rB
Next to Species Name type "rB".
Linked Pathway Object(s)
Annotation
RAN_Bound
Next to Annotation type "RAN_Bound".
CONNECTED (tanyamiller1221)

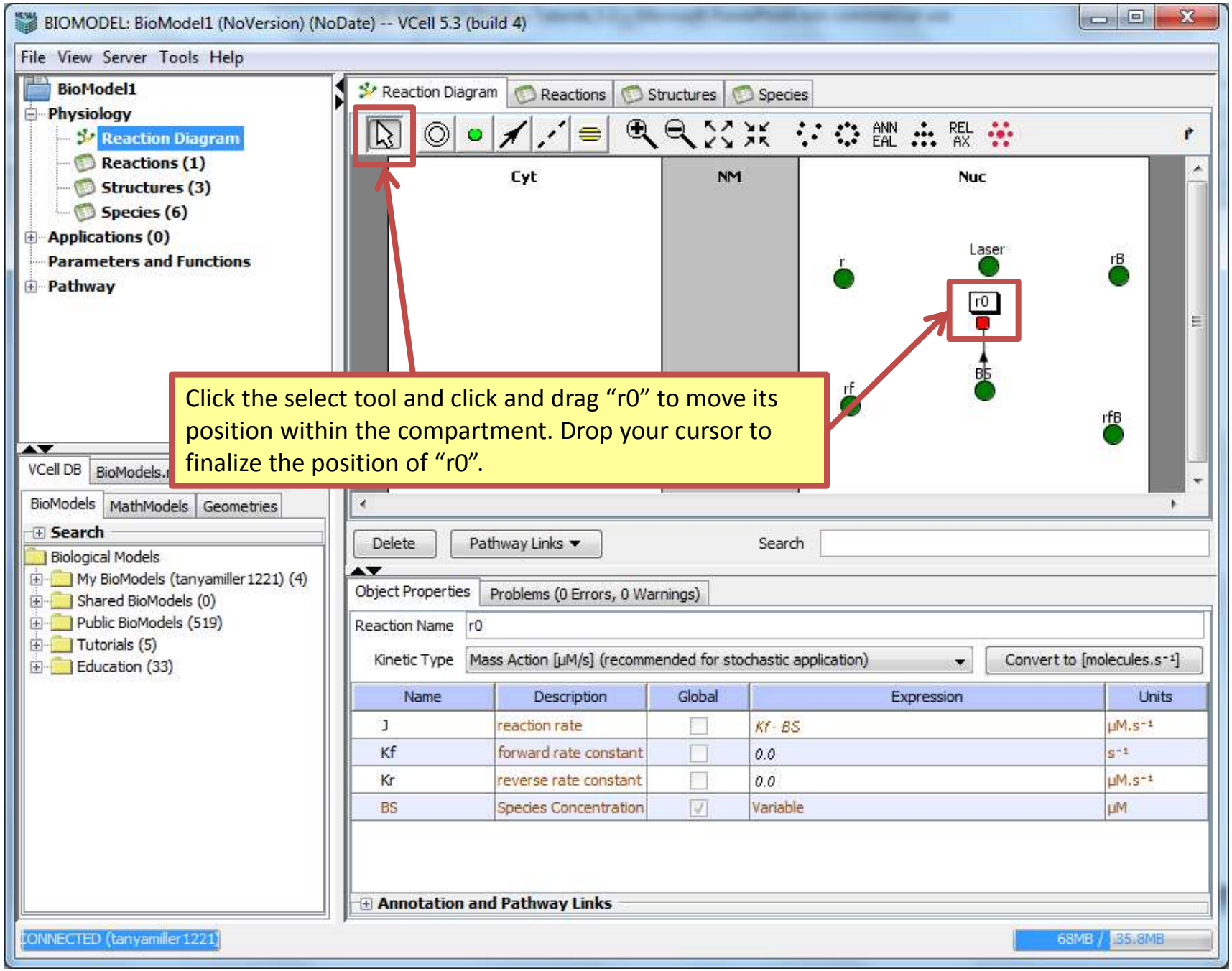

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
r
rf
rB
s4
s5
BS
Click on “s3”.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Delete
Pathway Links
Search
Object Properties
Species Name
BS
Next to Species Name type “BS”.
Linked Pathway Object(s)
Annotation
Binding Sites
Next to Annotation type “Binding Sites”.
CONNECTED (tanyamiller1221)
74.7MB / 123.7MB

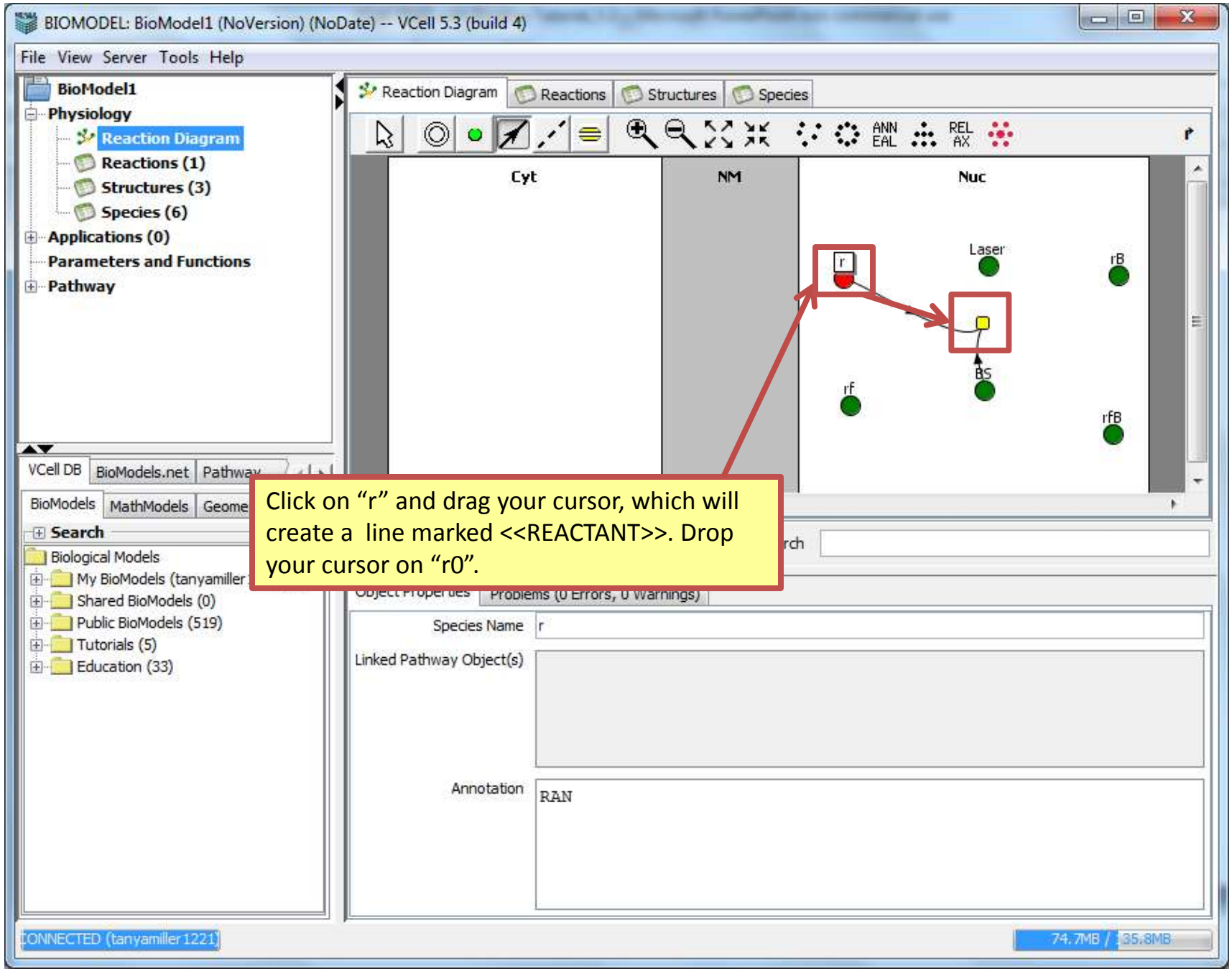

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Click on “s4”.
rf
rB
rfB
BS
s5
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Delete
Pathway Links
Search
Object Properties
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 (tanyamiller1221)

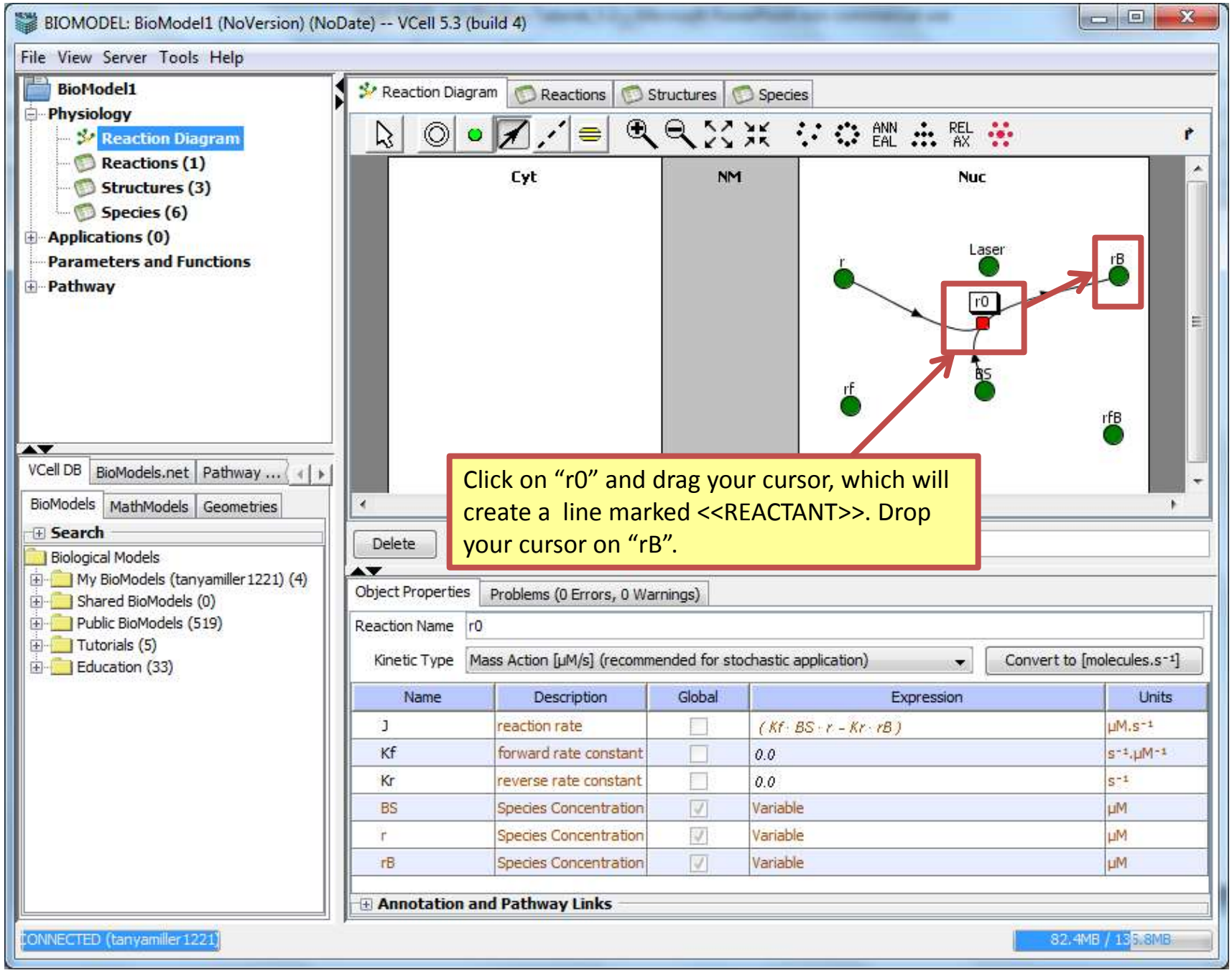

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
rB
rfB
BS
Laser
Click on “s5”.
Delete
Pathway Links
Search
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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 (tanyamiller1221)
81.6MB / 123.7MB

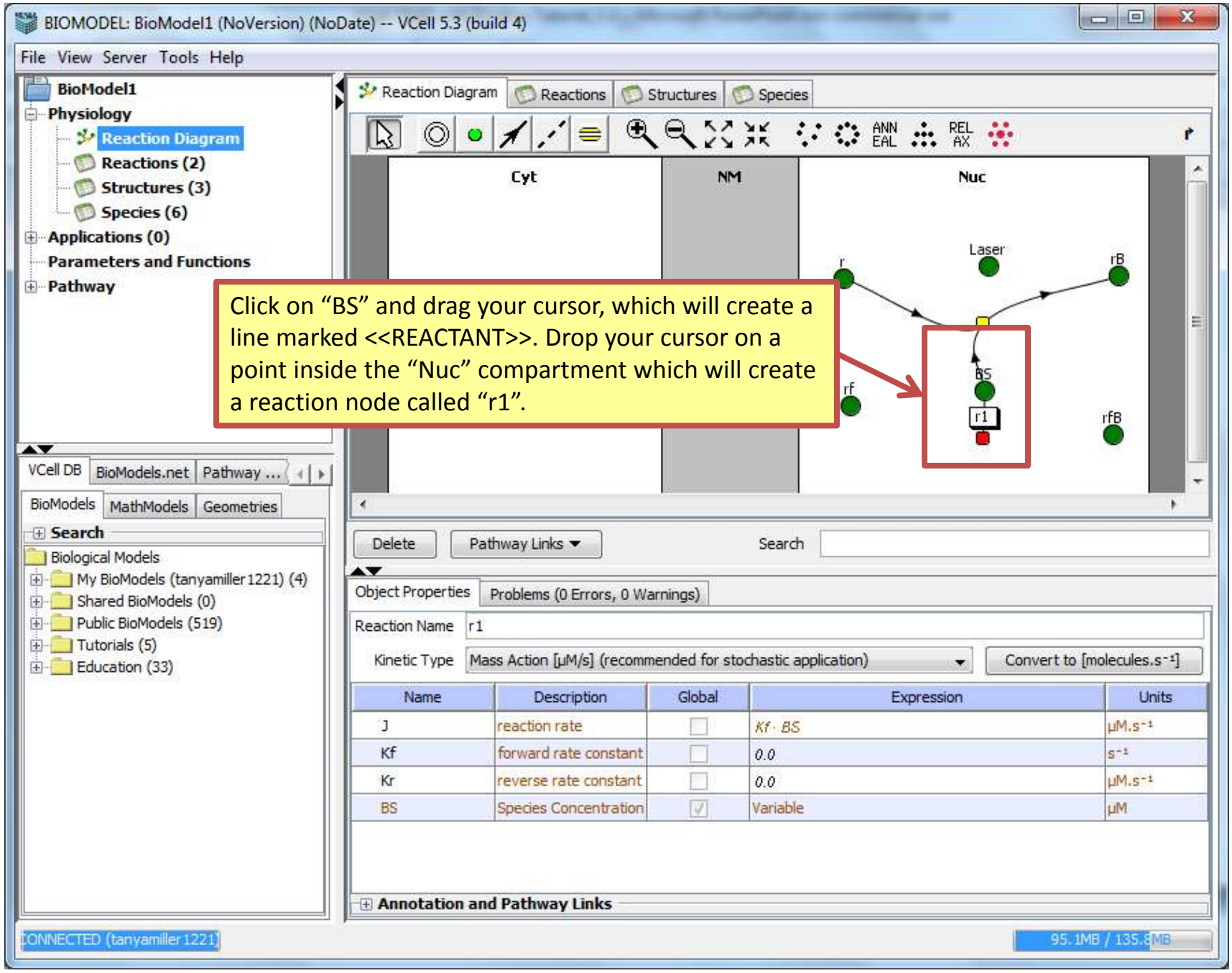

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Applications (0)
Parameters and Functi
Pathway
Click the select tool.
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
r
Laser
rB
rf
BS
rfB
Delete
Pathway Links
Search
Object Properties
Species
Linked Pathway Obje
Click and drag the species so that the order is from left to right “r”, “Laser”, “rB”, “rf”, “BS”, “rfB”.
Annotation
Binding Sites
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)

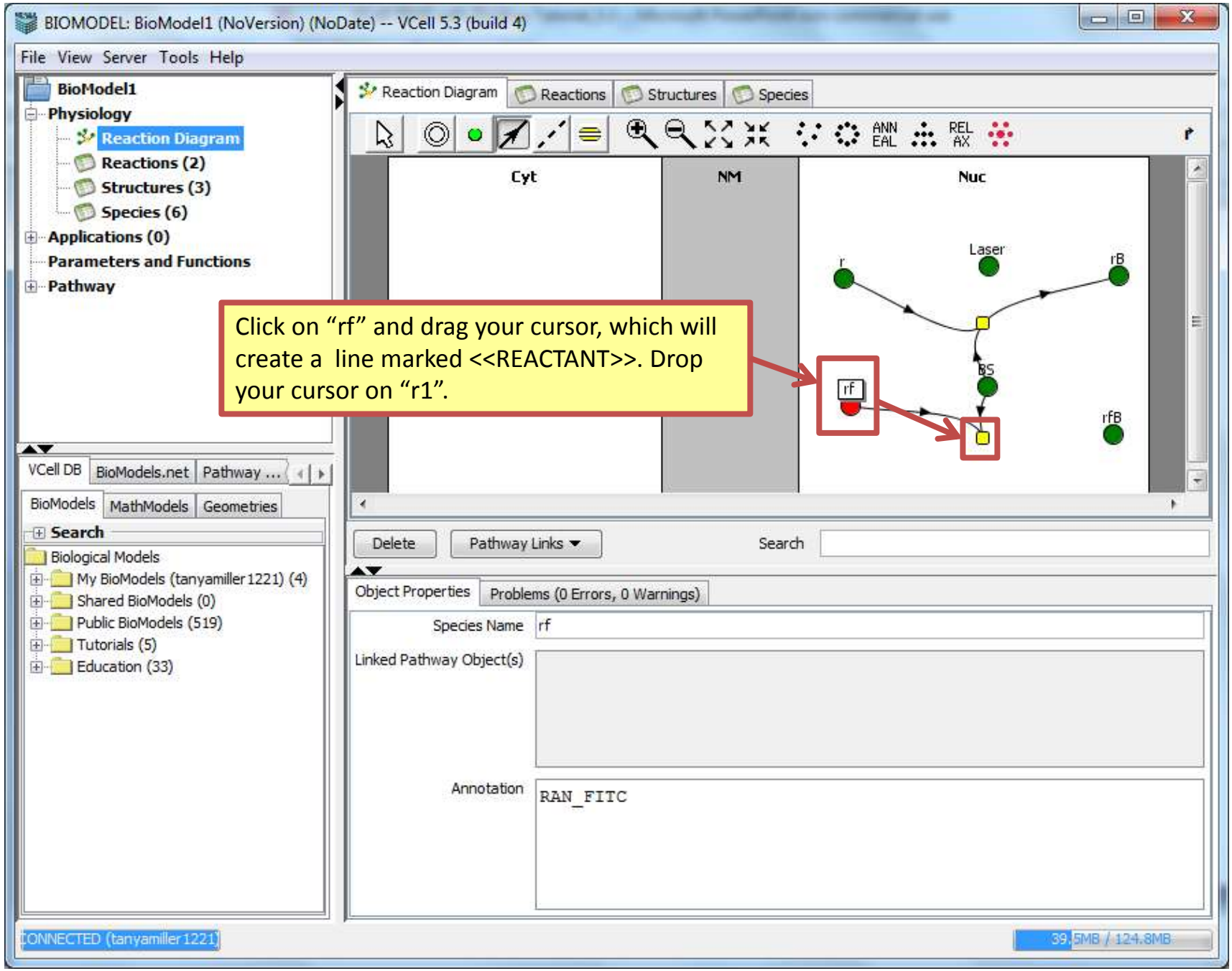

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (6)
Applications (0)
Click the RX connection tool.
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
rf
<<REACTANT>>
BS
Delete
Pathway Links
Search
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
BS
Linked Pathway Object(s)
Annotation
Click on “BS” and drag your cursor, which will create a line marked <<REACTANT>>. Drop your cursor on a point inside the “Nuc” compartment which will create a reaction node called “r0”.
CONNECTED (tanyamiller1221)

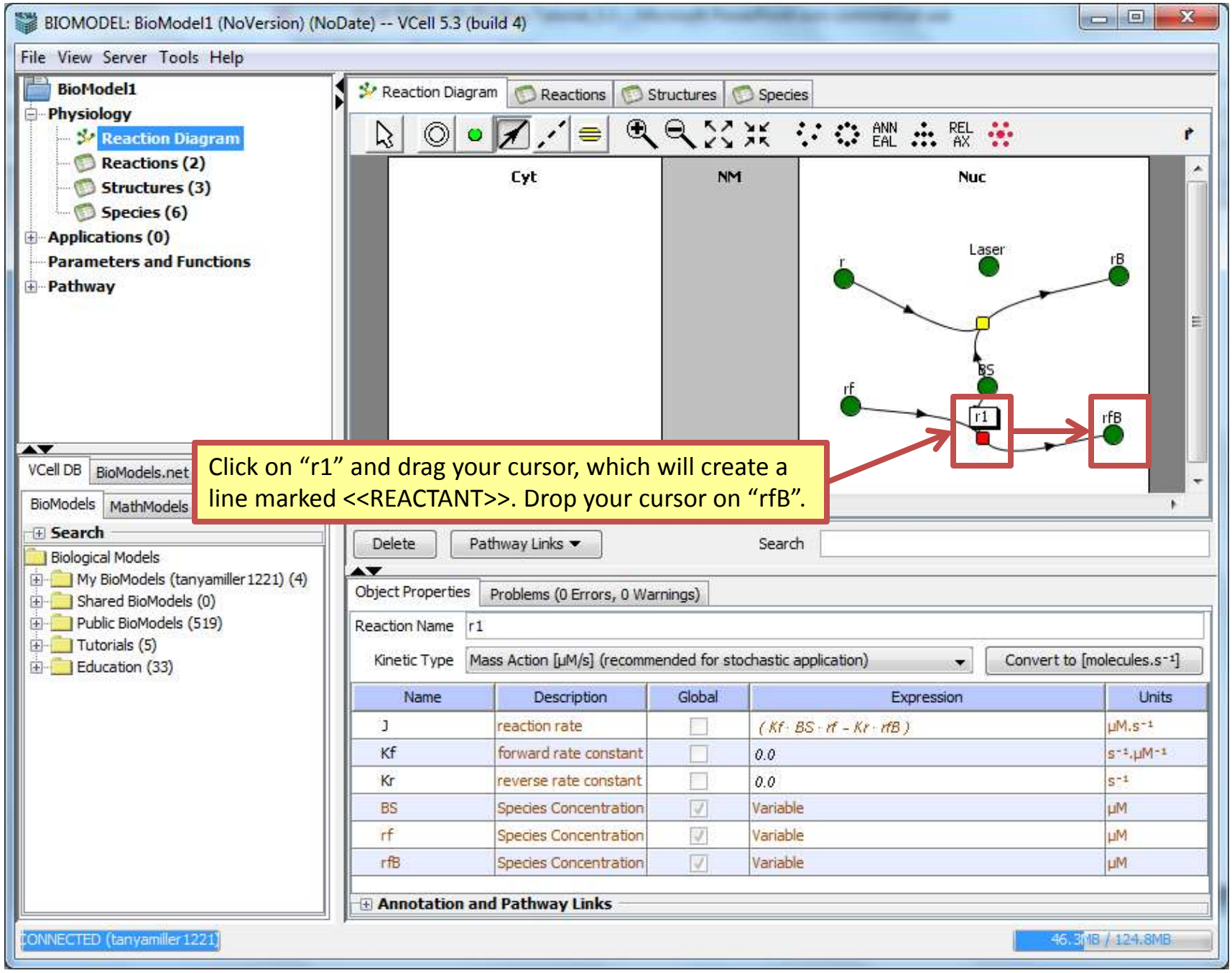

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (1)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
r0
BS
rf
rfB
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".
VCell DB
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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
CONNECTED (tanyamiller1221)
68MB / 35.8MB

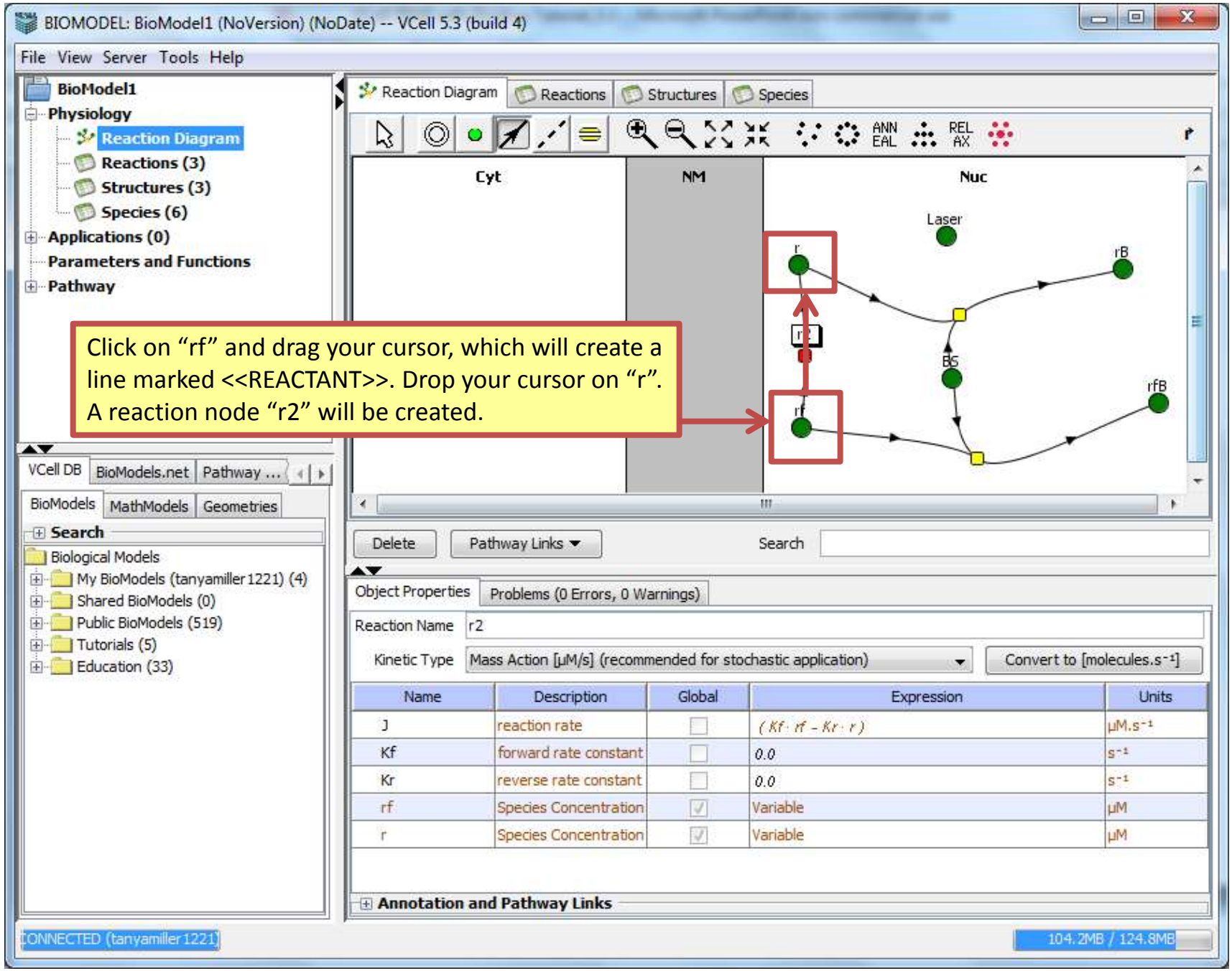

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (1)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
r
Laser
rB
BS
rf
rfB
Click on “r” and drag your cursor, which will create a line marked <<REACTANT>>. Drop your cursor on “r0”.
VCell DB
BioModels.net
BioModels
MathModels
Search
Biological Models
My BioModels (tanyamiller
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Problems (0 Errors, 0 Warnings)
Species Name
r
Linked Pathway Object(s)
Annotation
RAN
CONNECTED (tanyamiller1221)
74.7MB / 35.8MB

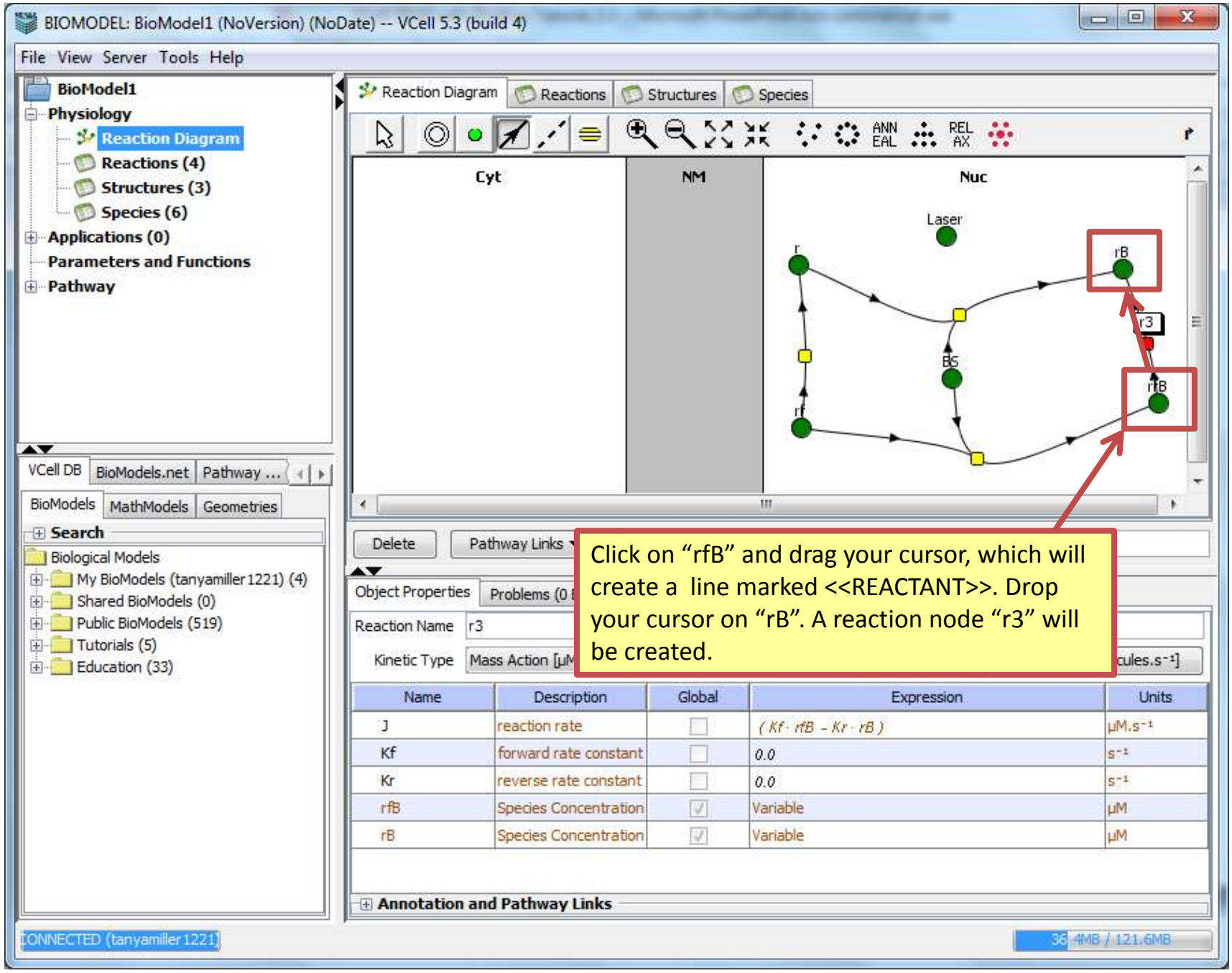

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (1)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
r0
BS
rf
rfB
Click on "r0" and drag your cursor, which will create a line marked <<REACTANT>>. Drop your cursor on "rB".
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Delete
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 (tanyamiller1221)
82.4MB / 135.8MB

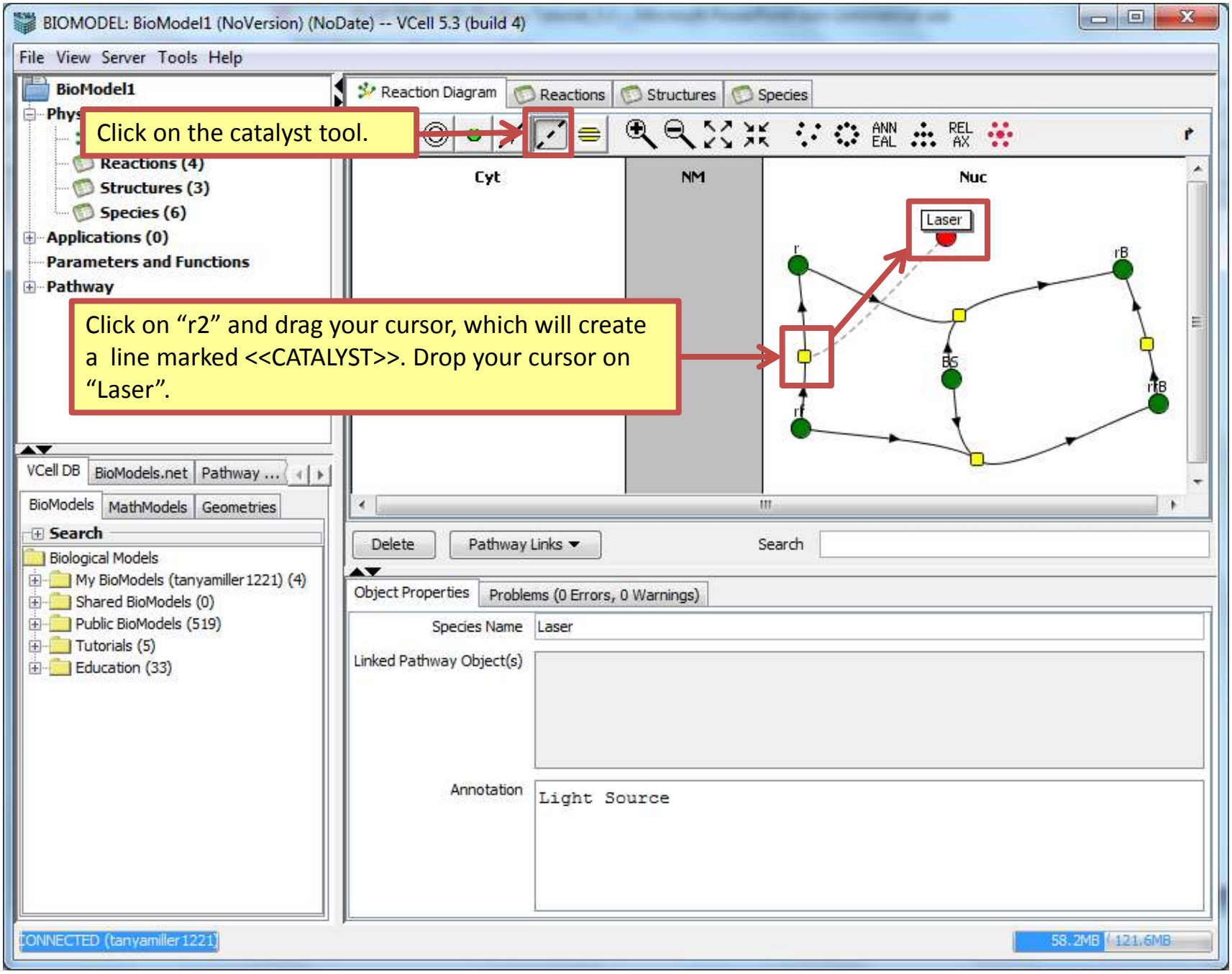

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (2)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
rf
BS
r1
rfB
Click on "BS" and drag your cursor, which will create a line marked <<REACTANT>>. Drop your cursor on a point inside the "Nuc" compartment which will create a reaction node called "r1".
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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 (tanyamiller1221)
95.1MB / 135.8MB

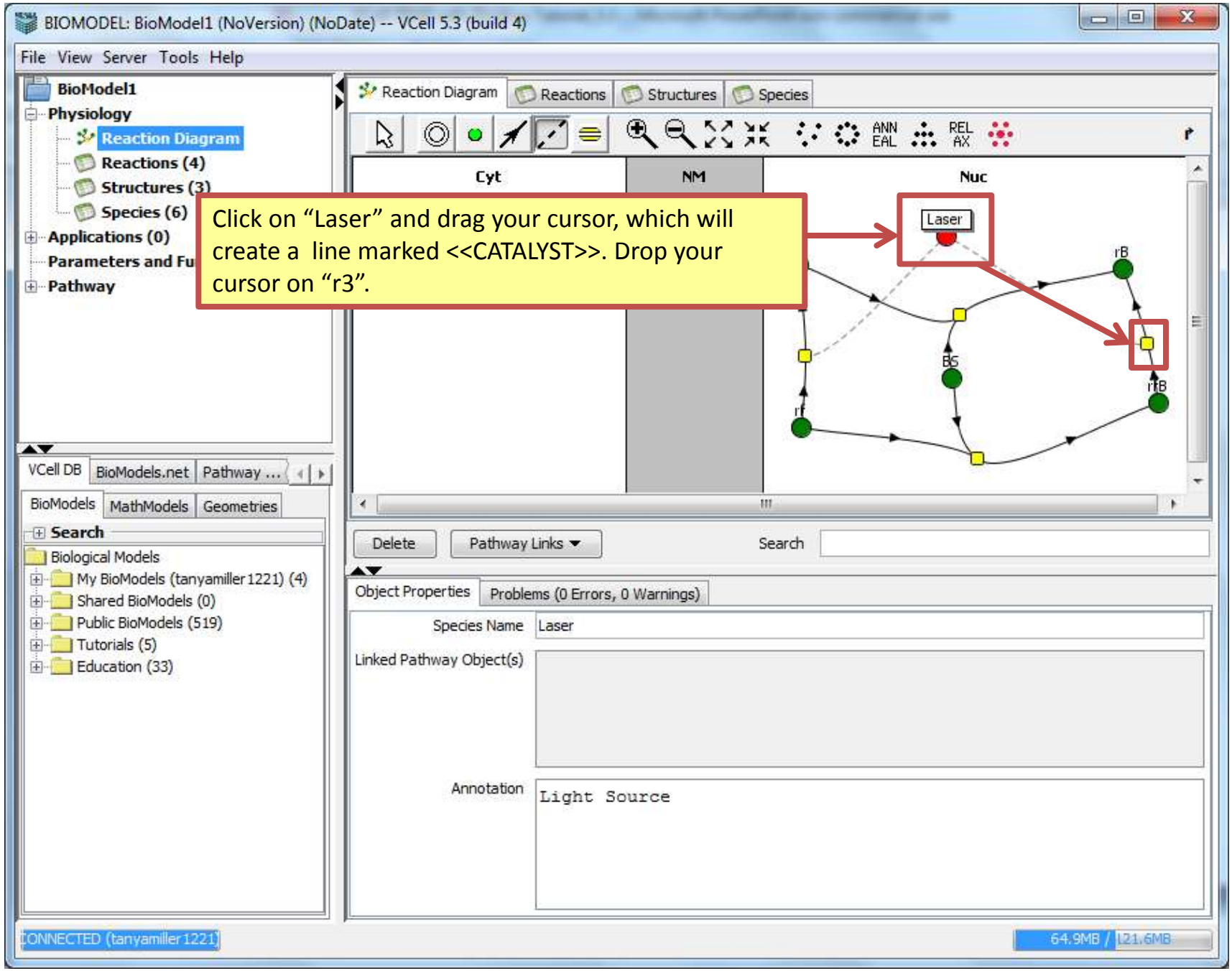

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (2)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
BS
rf
rfB
Click on “rf” and drag your cursor, which will create a line marked <<REACTANT>>. Drop your cursor on “r1”.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
rf
Linked Pathway Object(s)
Annotation
RAN_FITC
CONNECTED (tanyamiller1221)
39.5MB / 124.8MB

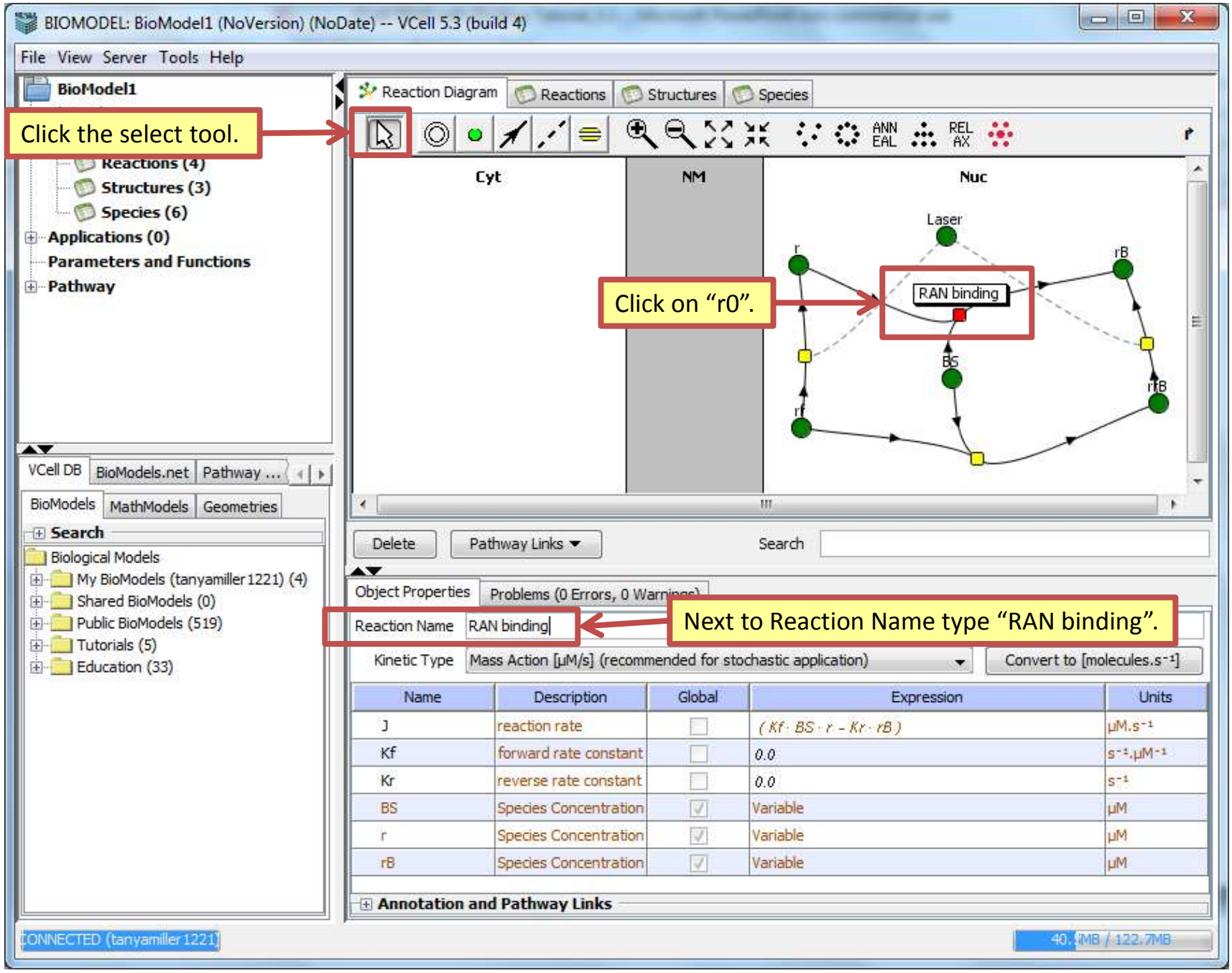

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (2)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
BS
rf
r1
rfB
Click on "r1" and drag your cursor, which will create a line marked <<REACTANT>>. Drop your cursor on "rfB".
VCell DB
BioModels.net
BioModels
MathModels
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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 (tanyamiller1221)
46.3MB / 124.8MB

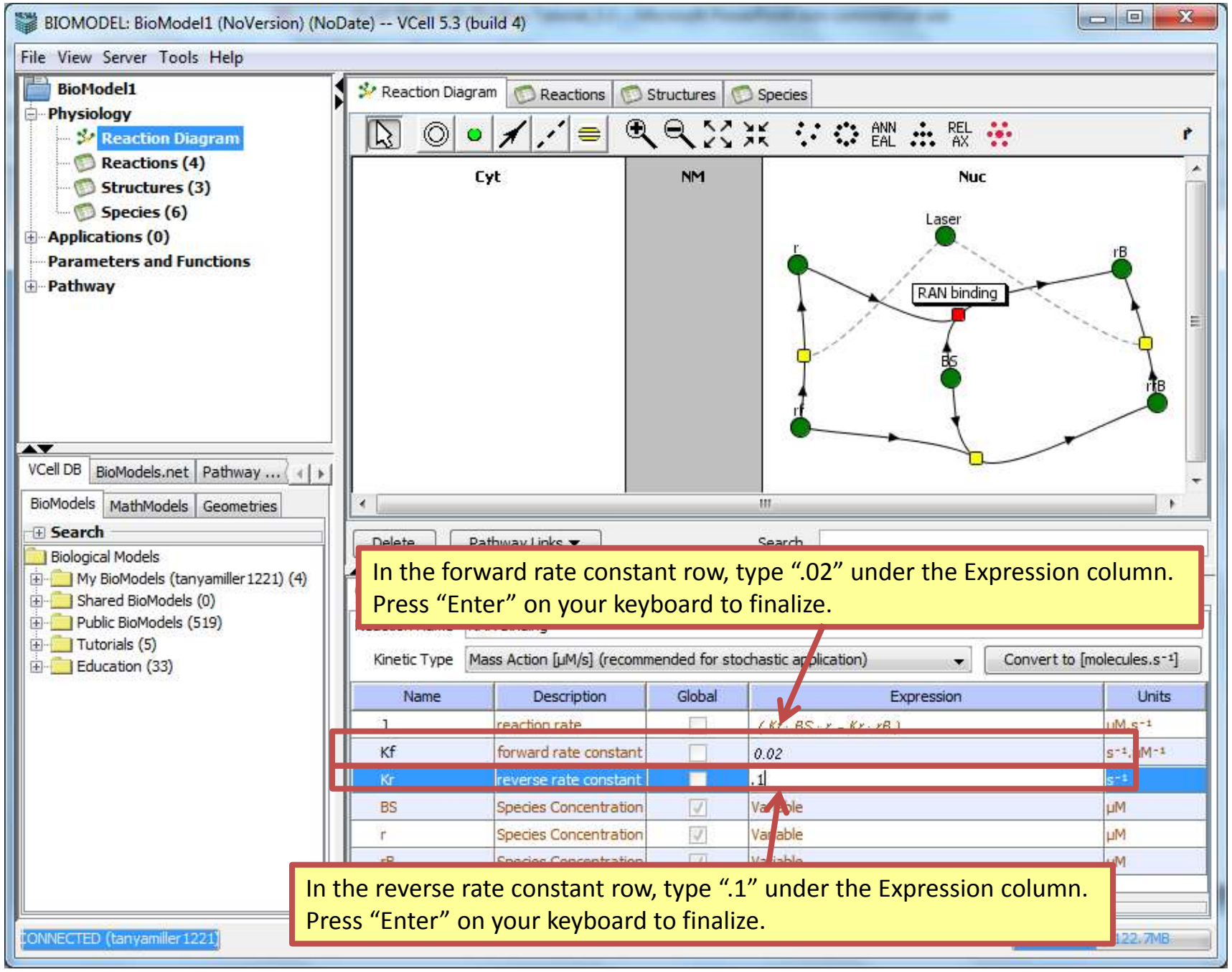

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (3)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
r2
BS
rf
rfB
Click on “rf” and drag your cursor, which will create a line marked <<REACTANT>>. Drop your cursor on “r”. A reaction node “r2” will be created.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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 (tanyamiller1221)
104.2MB / 124.8MB


BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
r3
BS
rfB
rf
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Delete
Pathway Links
Click on “rfB” and drag your cursor, which will create a line marked <<REACTANT>>. Drop your cursor on “rB”. A reaction node “r3” will be created.
Object Properties
Problems (0
Reaction Name
r3
Kinetic Type
Mass Action
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 (tanyamiller1221)


BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Reactions (4)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Click on the catalyst tool.
Cyt
NM
Nuc
Laser
r
rB
BS
rrB
rr
Click on “r2” and drag your cursor, which will create a line marked <<CATALYST>>. Drop your cursor on “Laser”.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
Laser
Linked Pathway Object(s)
Annotation
Light Source
CONNECTED (tanyamiller1221)
58.2MB
121.6MB

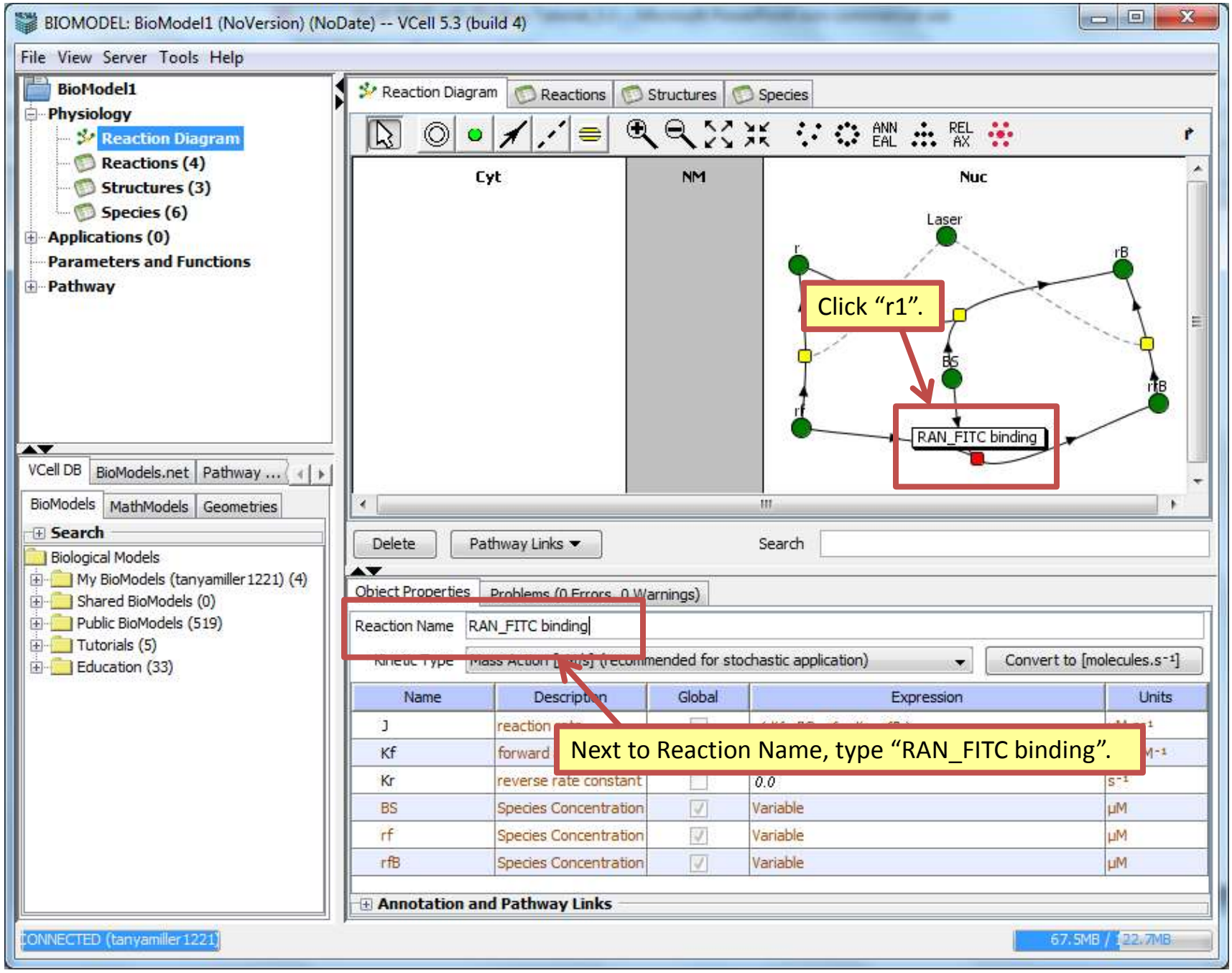

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (0)
Parameters and Fu
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
rB
BS
rfB
rf
Click on “Laser” and drag your cursor, which will create a line marked <<CATALYST>>. Drop your cursor on “r3”.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
Laser
Linked Pathway Object(s)
Annotation
Light Source
CONNECTED (tanyamiller1221)
64.9MB / 121.6MB

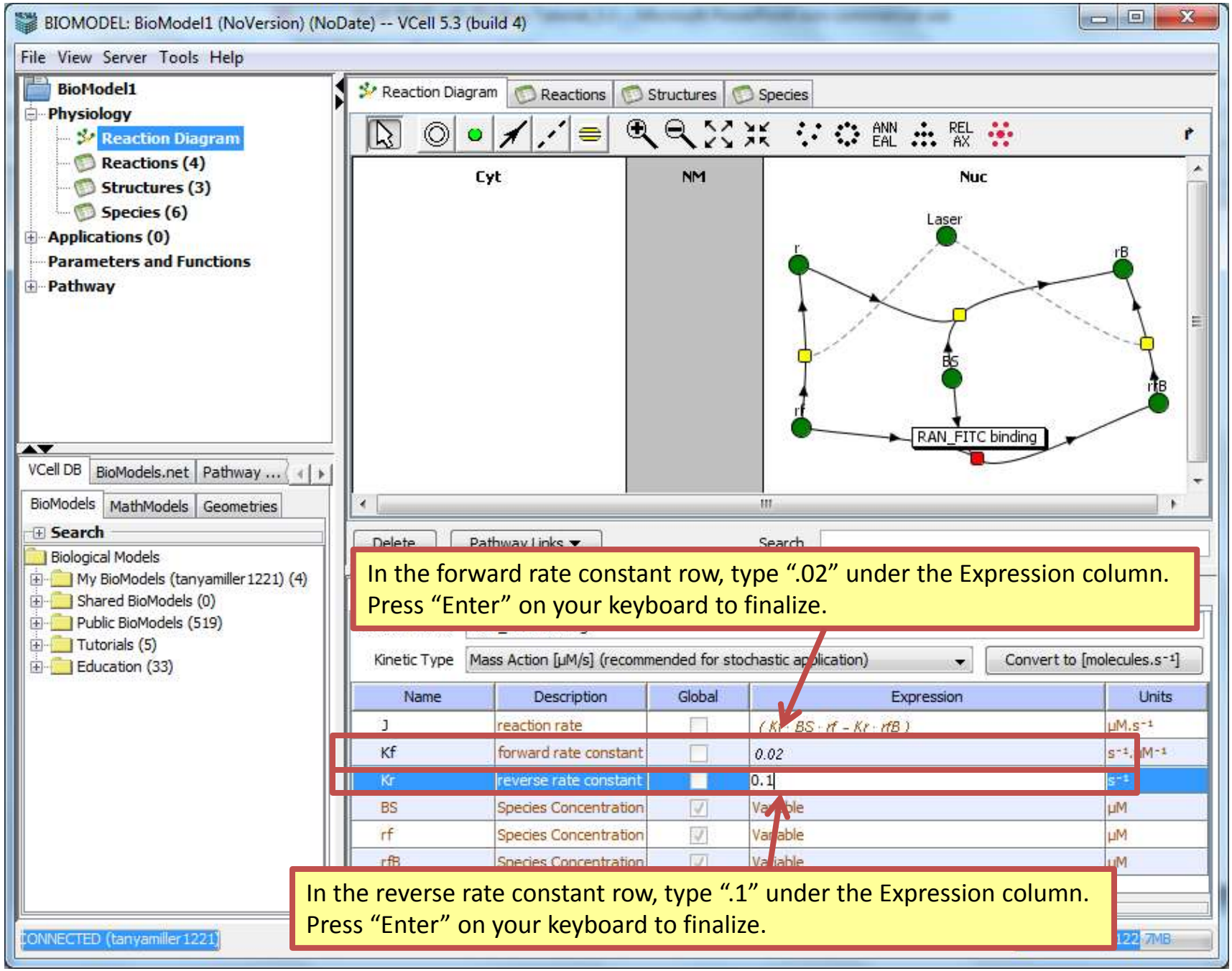

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Reactions (4)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Click the select tool.
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
RAN binding
Click on "r0".
BS
rrB
rr
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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 (tanyamiller1221)



In the forward rate constant row, type ".02" under the Expression column. Press "Enter" on your keyboard to finalize.

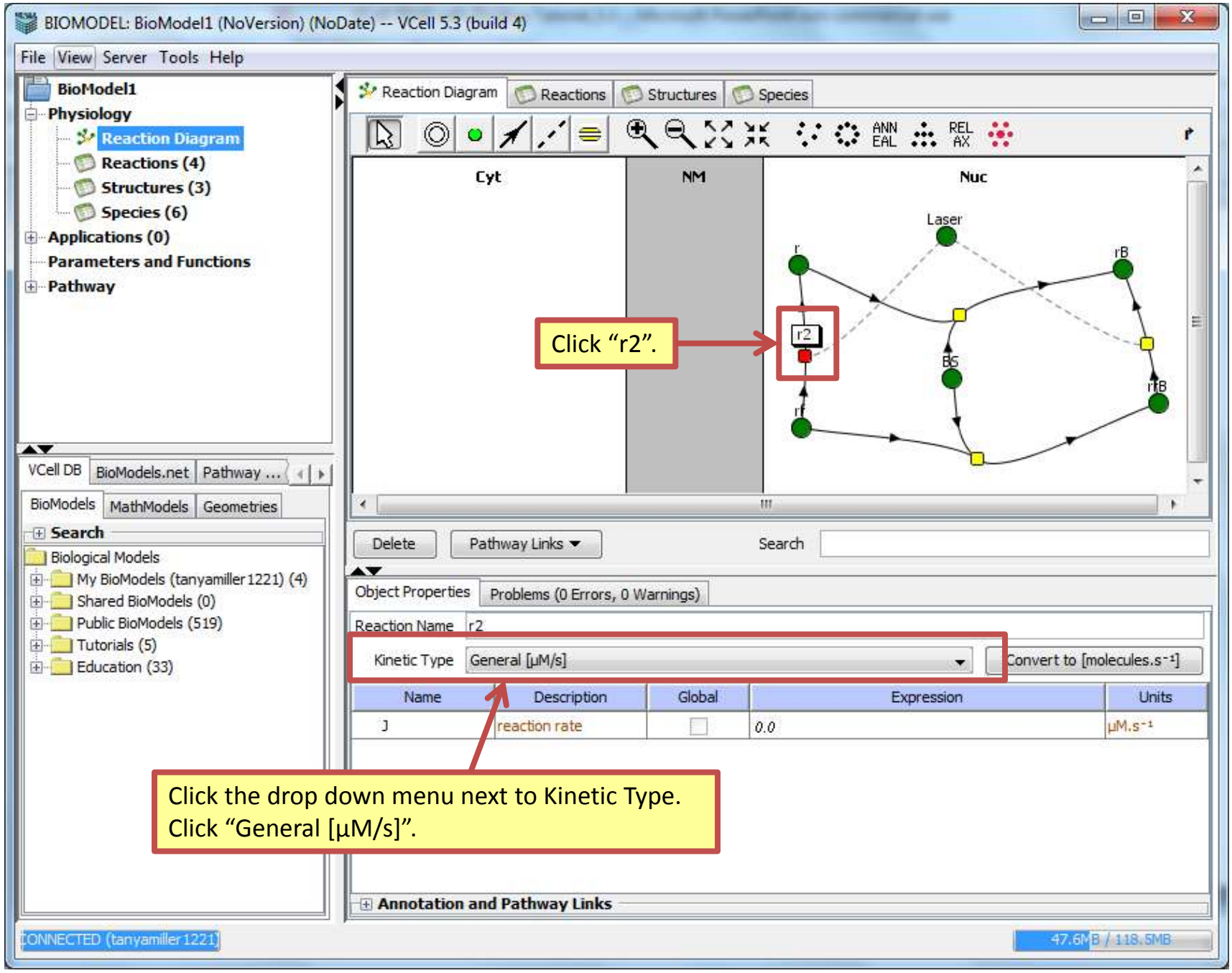
In the reverse rate constant row, type ".1" under the Expression column. Press "Enter" on your keyboard to finalize.

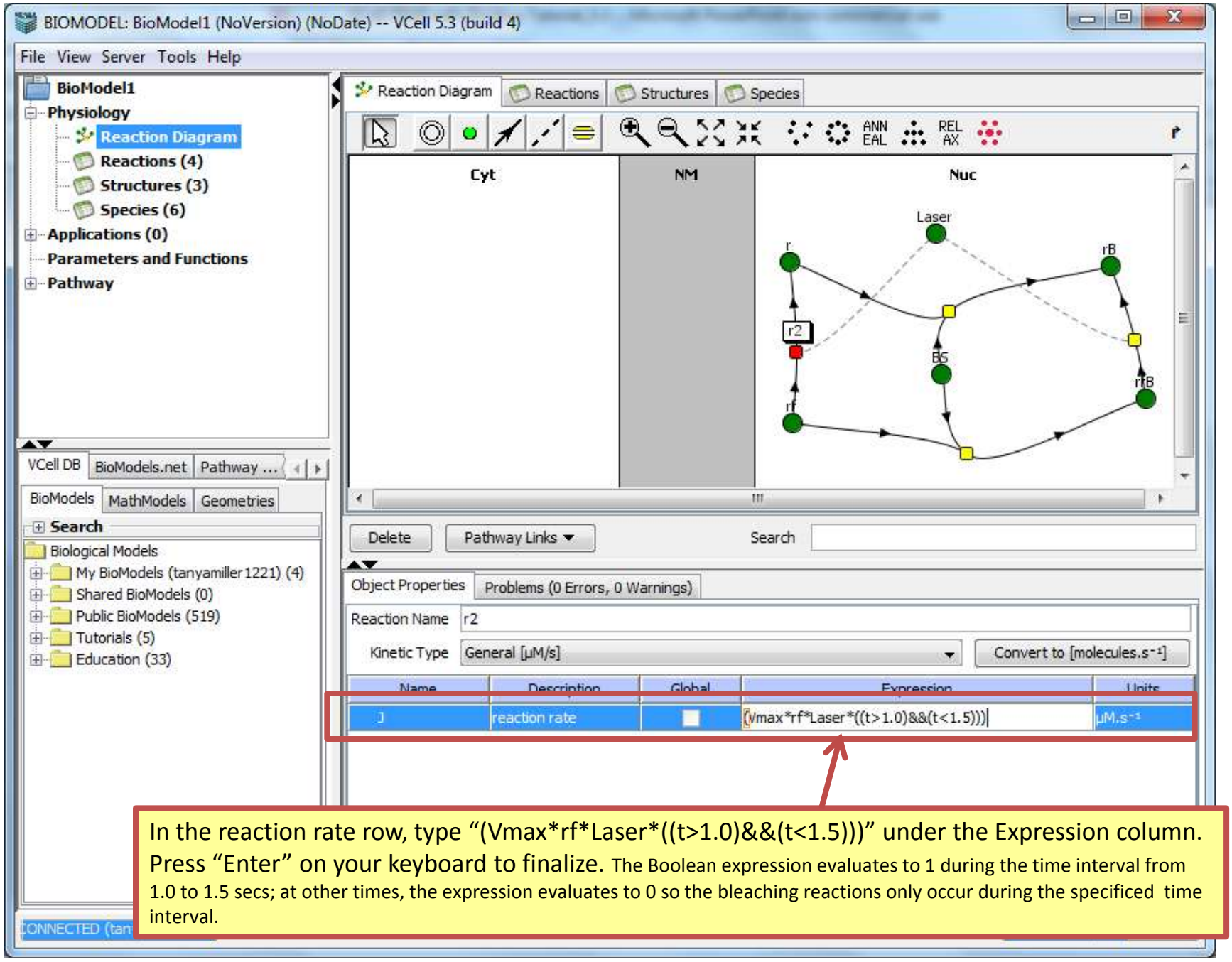

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
BS
rfB
rf
RAN_FITC binding
Click "r1".
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Reaction Name
RAN_FITC binding
Convert to [molecules.s⁻¹]
Next to Reaction Name, type "RAN_FITC binding".
Name
Description
Global
Expression
Units
J
Kf
forward
Kr
reverse rate constant
0.0
BS
Species Concentration
Variable
µM
rf
Species Concentration
Variable
µM
rfB
Species Concentration
Variable
µM
Annotation and Pathway Links
CONNECTED (tanyamiller1221)
67.5MB



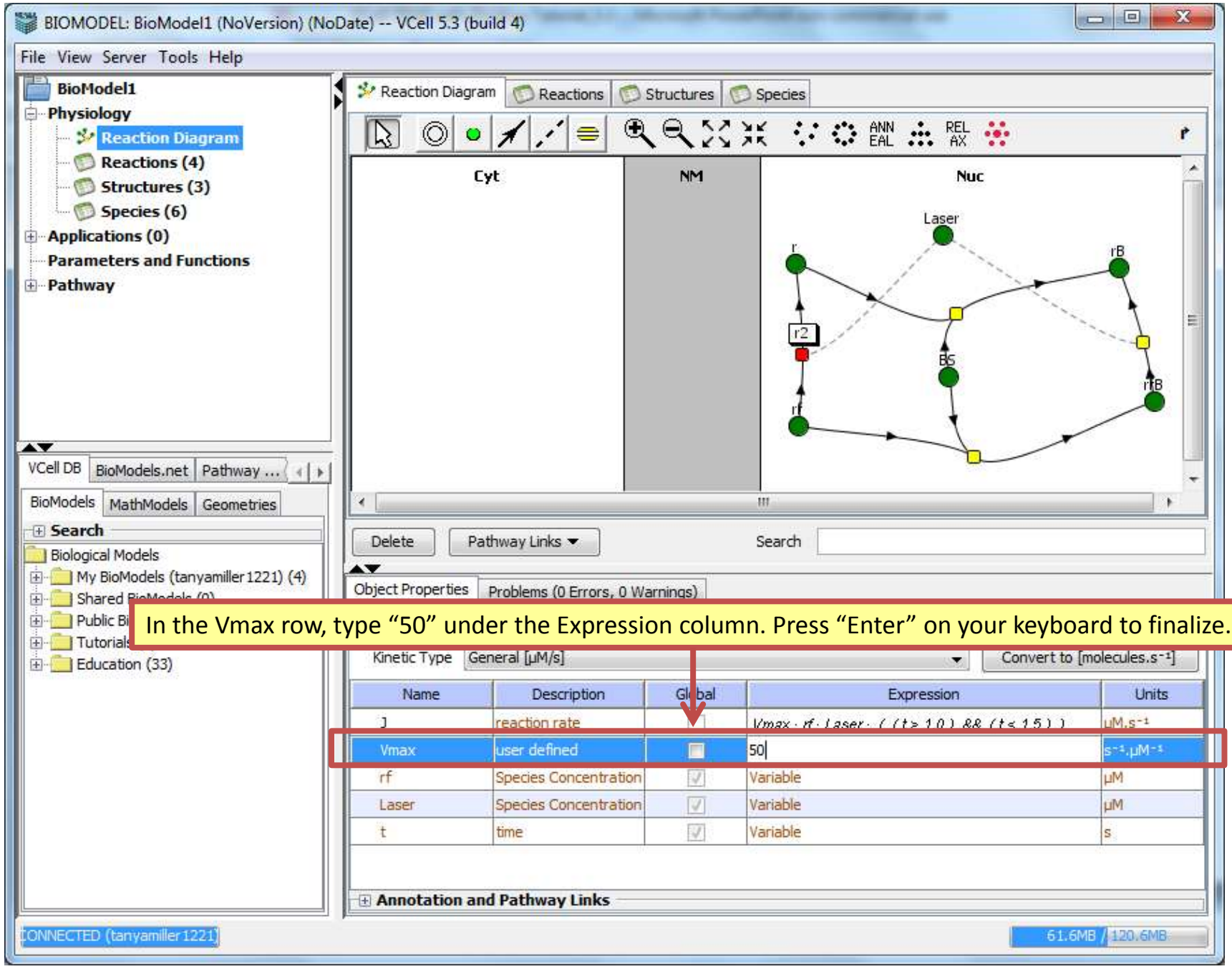
In the forward rate constant row, type ".02" under the Expression column. Press "Enter" on your keyboard to finalize.

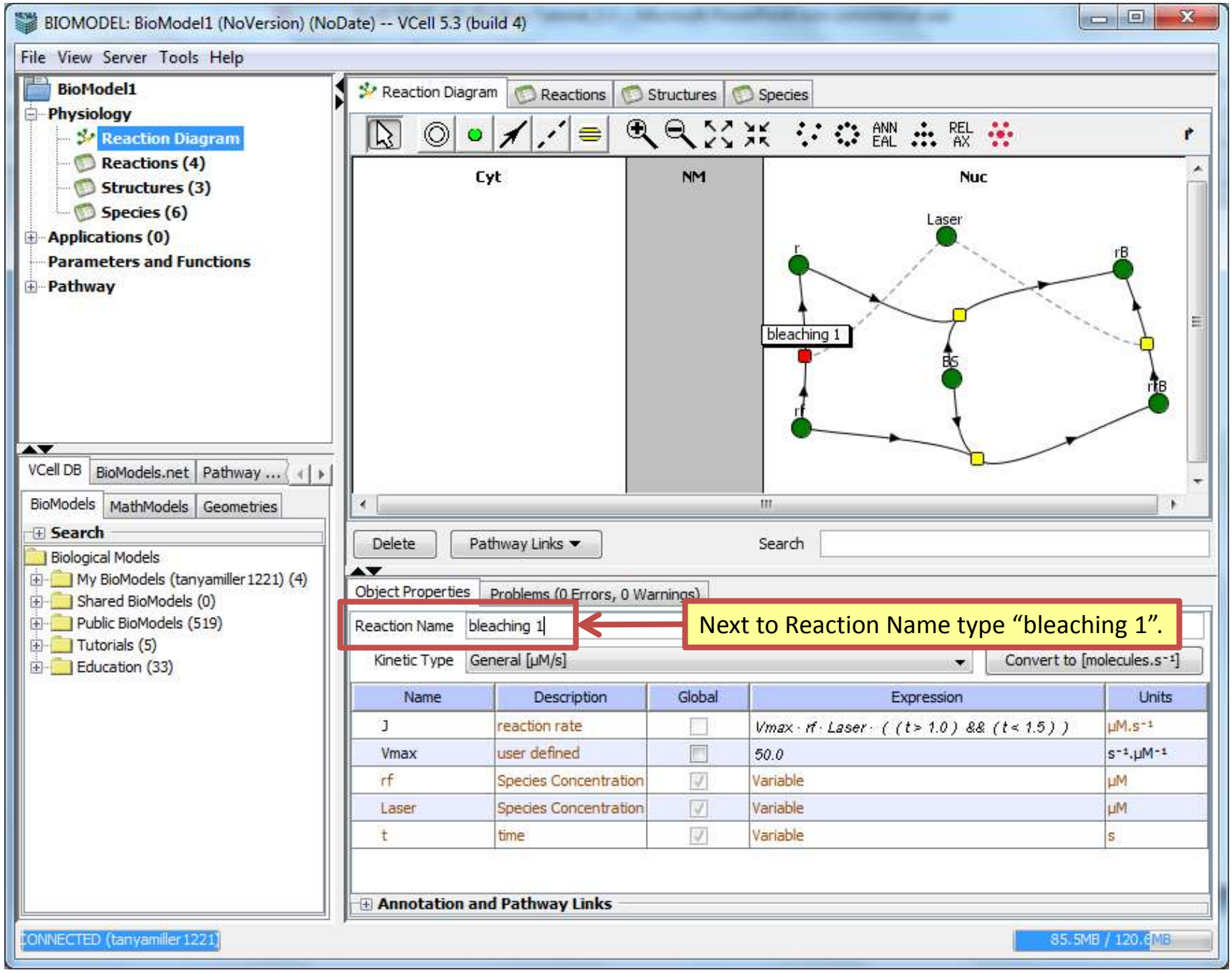
In the reverse rate constant row, type ".1" under the Expression column. Press "Enter" on your keyboard to finalize.

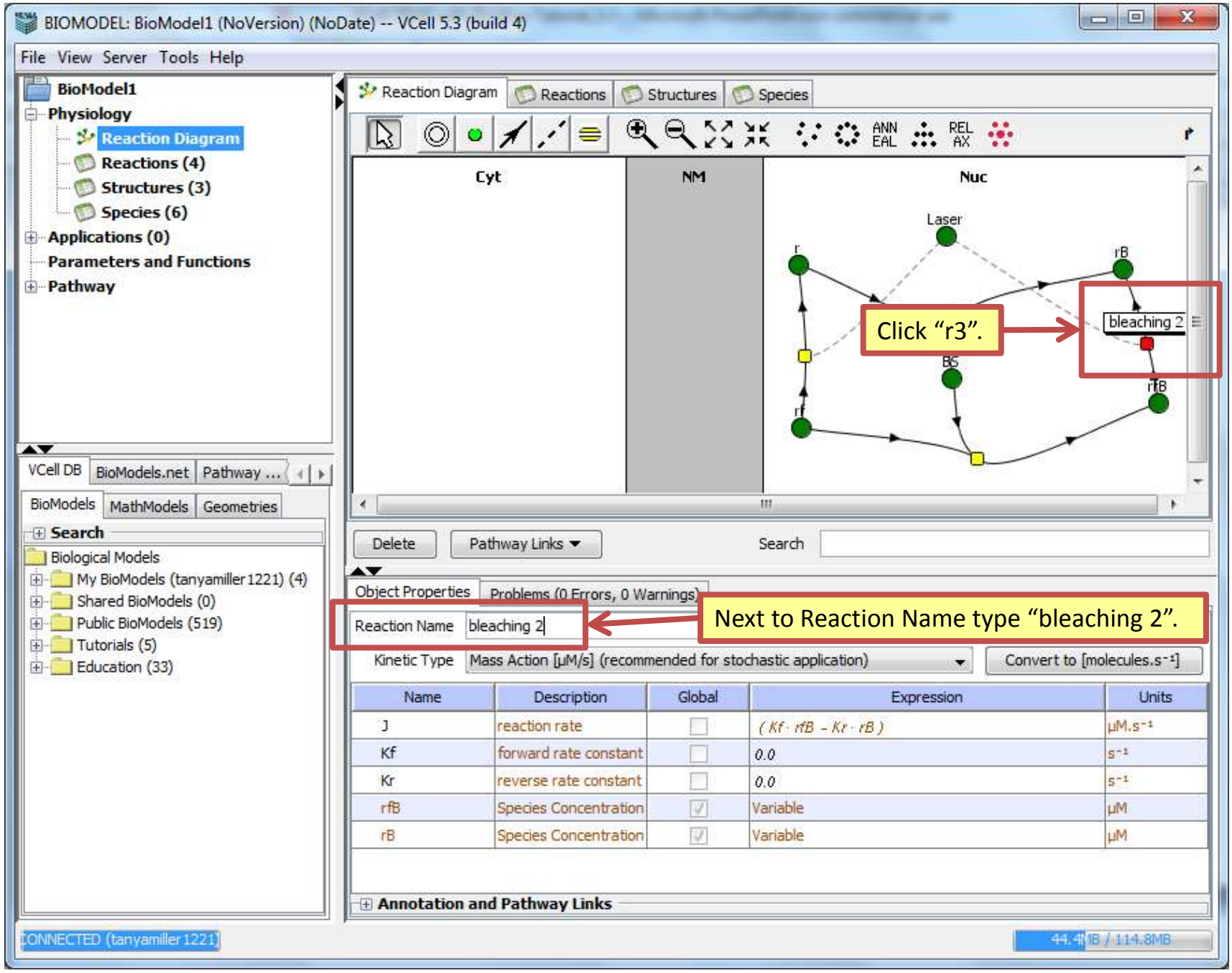

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
r2
BS
rfB
rf
Click "r2".
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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
0.0
µM.s⁻¹
Click the drop down menu next to Kinetic Type.
Click "General [µM/s]".
Annotation and Pathway Links
CONNECTED (tanyamiller1221)
47.6MB / 118.5MB

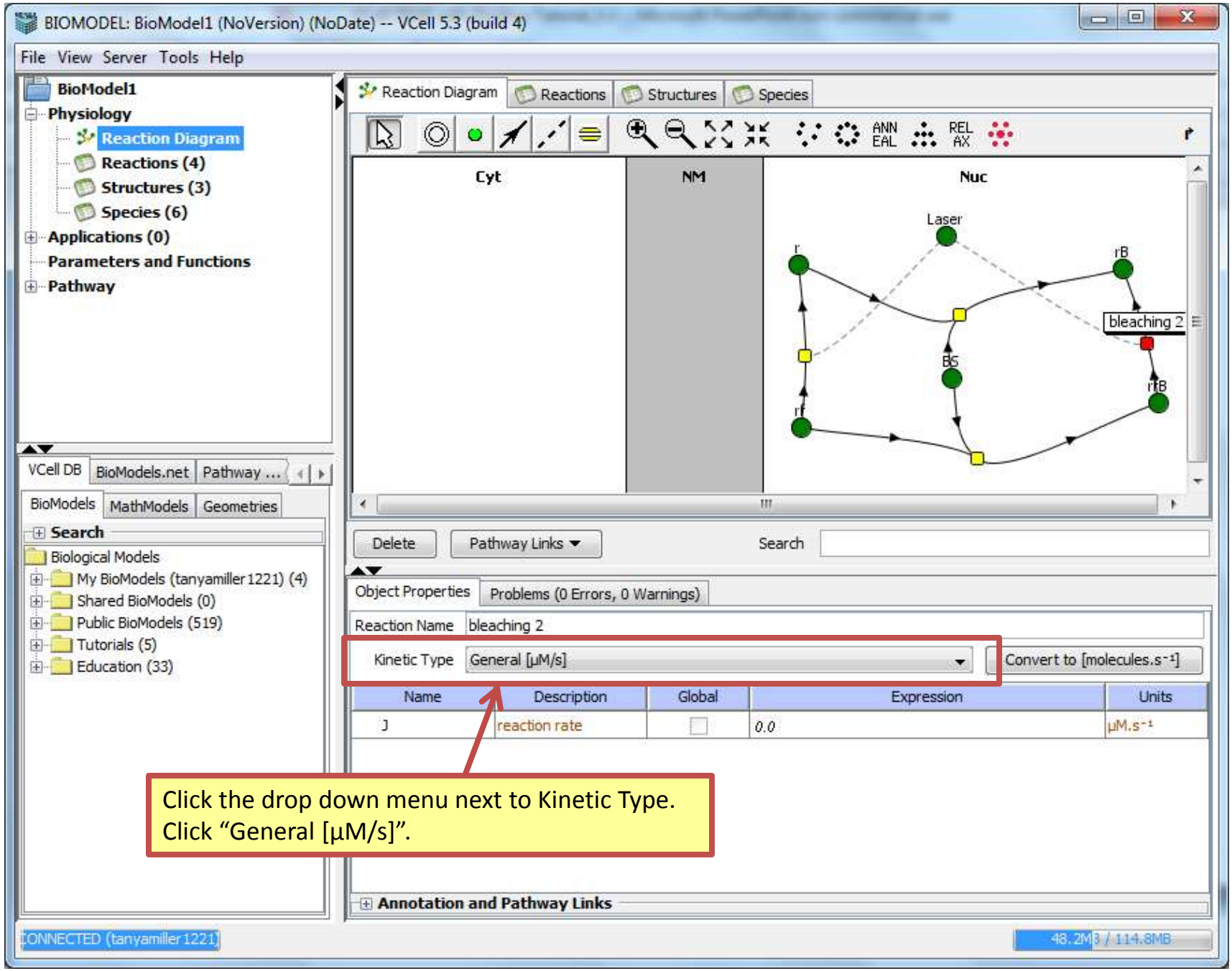


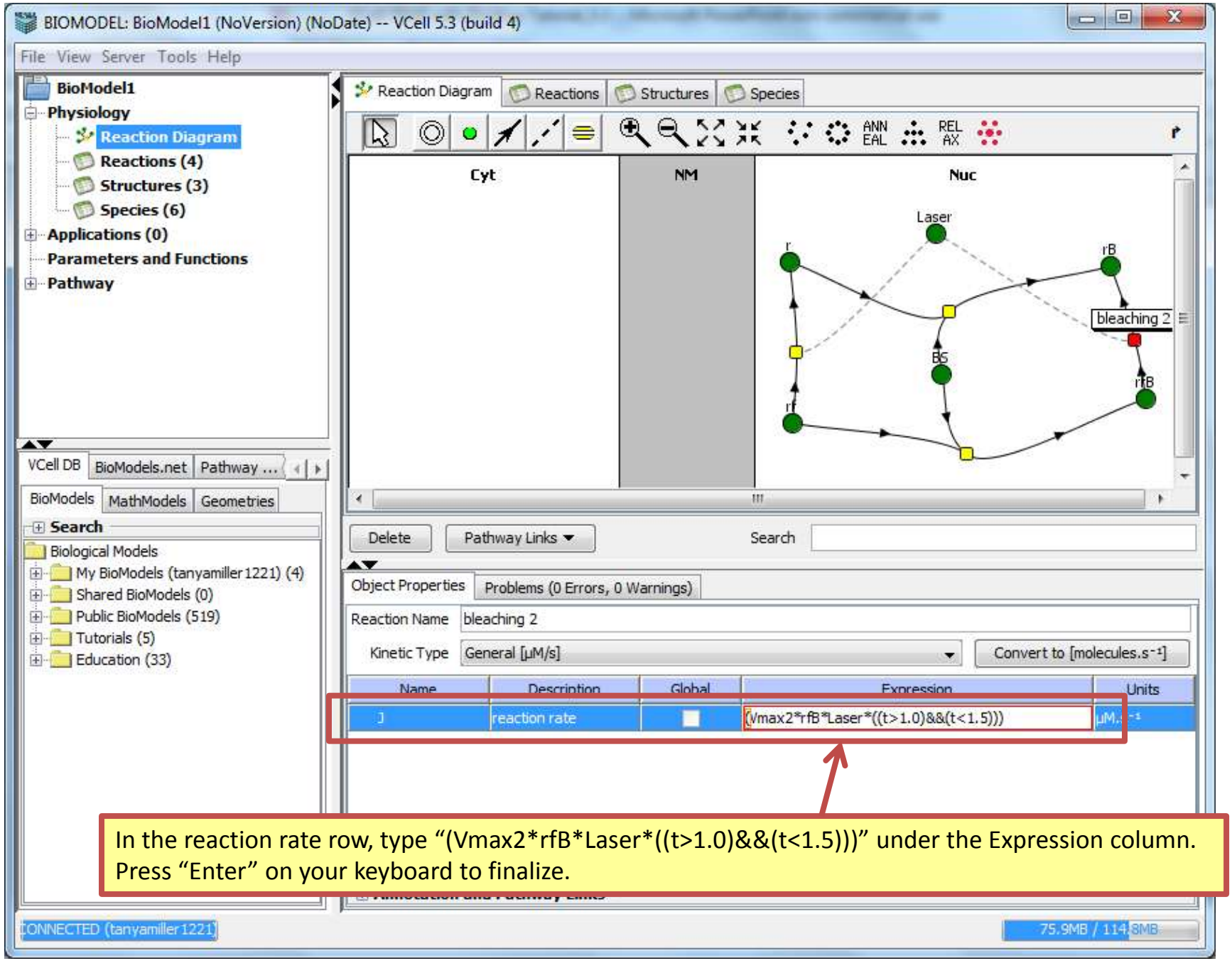
In the reaction rate row, type "(Vmax*rf*Laser*((t>1.0)&&(t<1.5)))" under the Expression column. Press "Enter" on your keyboard to finalize. The Boolean expression evaluates to 1 during the time interval from 1.0 to 1.5 secs; at other times, the expression evaluates to 0 so the bleaching reactions only occur during the specificed time interval.


BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
r2
BS
rfB
rf
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
In the Vmax row, type “50” under the Expression column. Press “Enter” on your keyboard to finalize.
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
s⁻¹.µM⁻¹
rf
Species Concentration
Variable
µM
Laser
Species Concentration
Variable
µM
t
time
Variable
s
Annotation and Pathway Links
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Public Bi
Tutorials
Education (33)
CONNECTED (tanyamiller1221)
61.6MB / 120.6MB

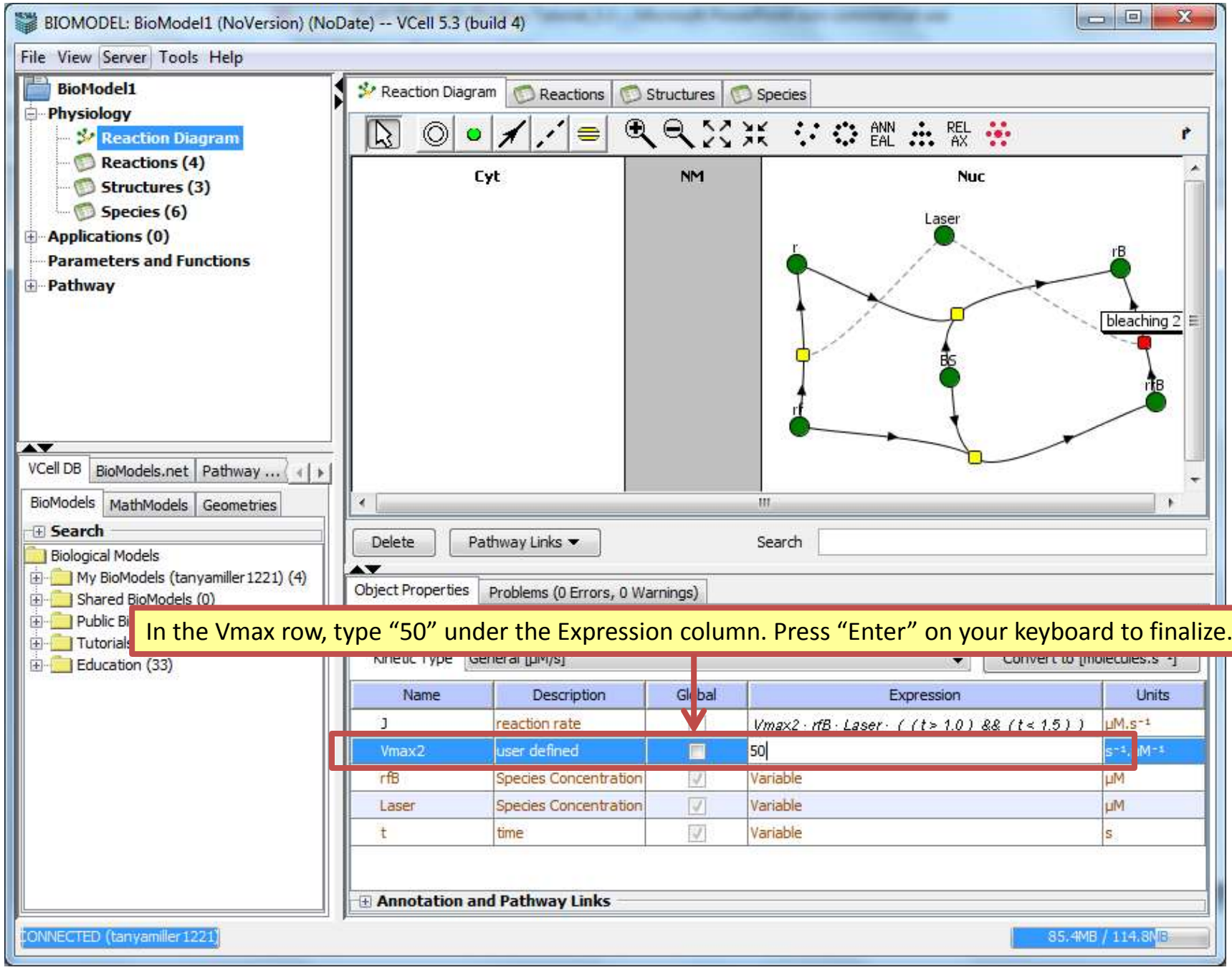

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
bleaching 1
BS
rfB
rf
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 (tanyamiller1221)
85.5MB / 120.6MB

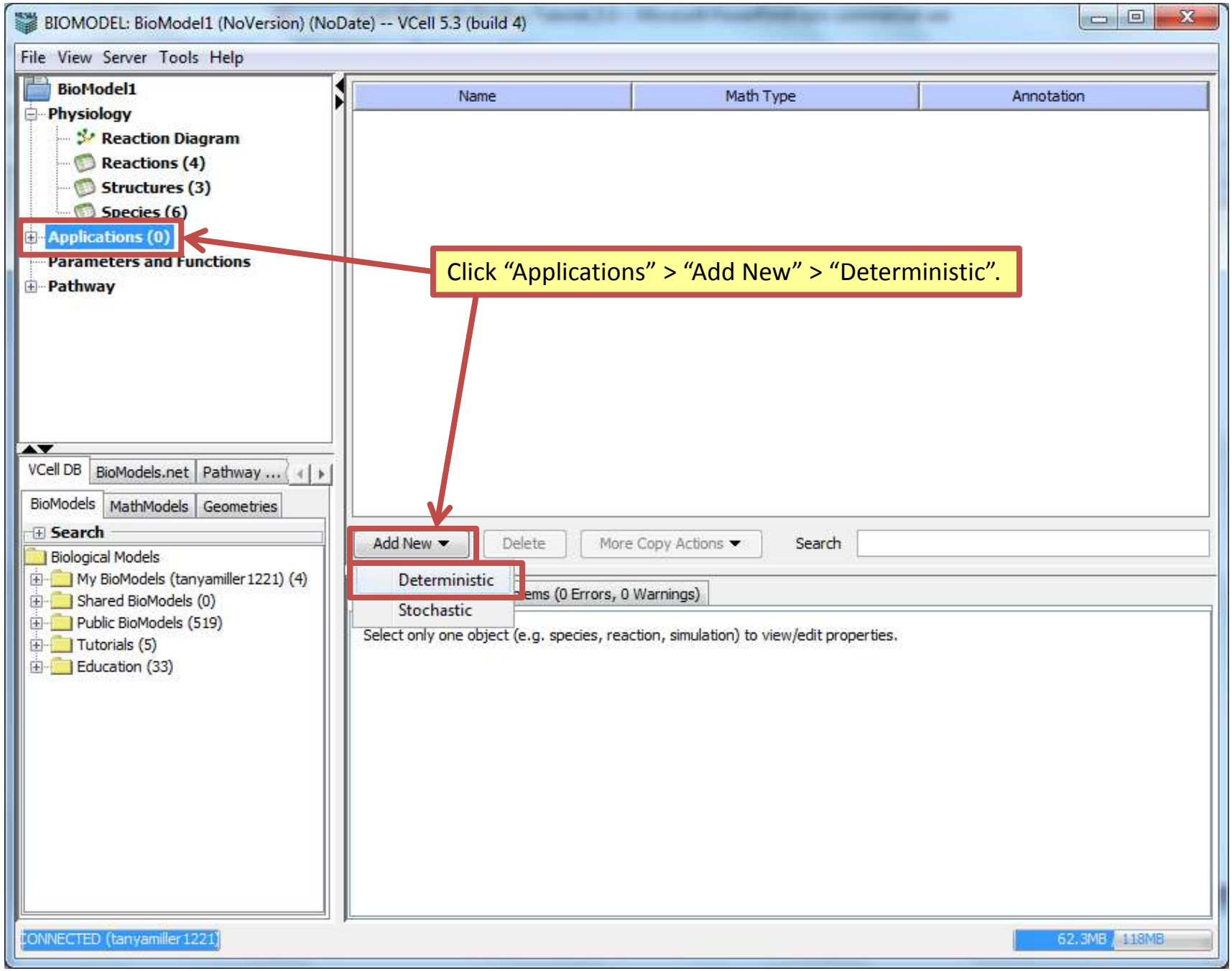

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
bleaching 2
BS
rfB
rf
Click "r3".
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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 (tanyamiller1221)
44.4MB / 114.8MB

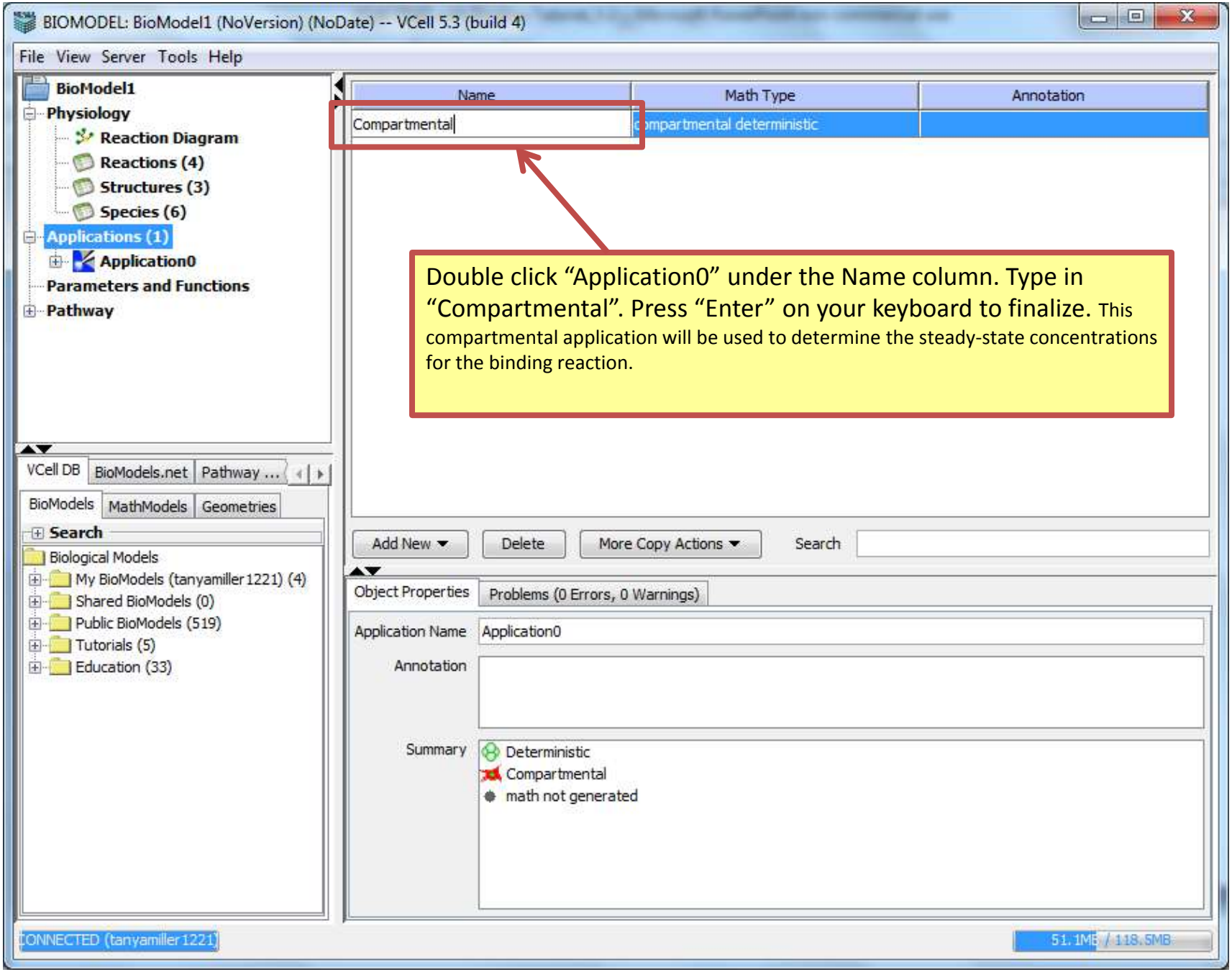

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
bleaching 2
BS
rfB
rf
Delete
Pathway Links
Search
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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
Annotation and Pathway Links
CONNECTED (tanyamiller1221)
48.2MB / 114.8MB
Click the drop down menu next to Kinetic Type.
Click “General [µM/s]”.

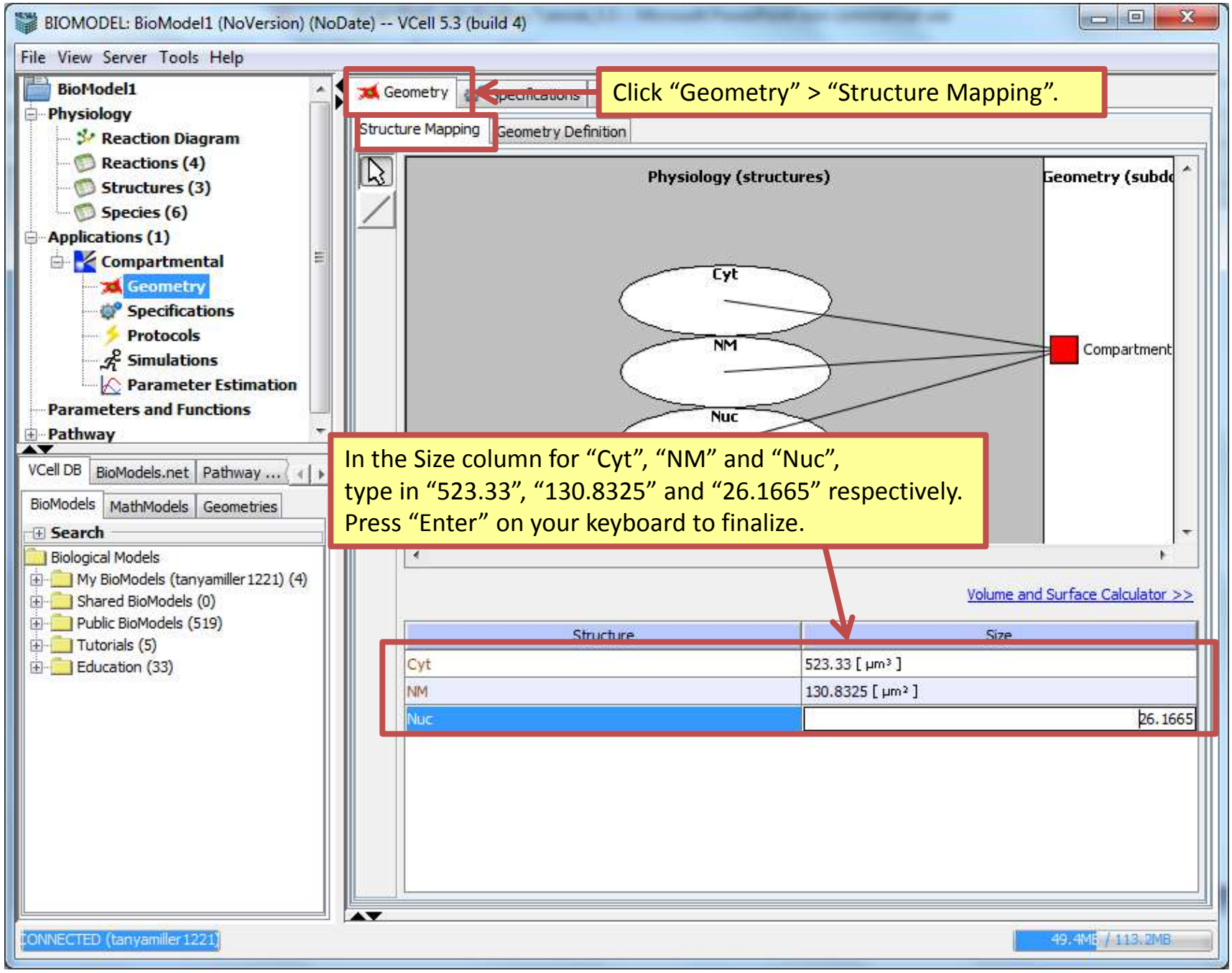


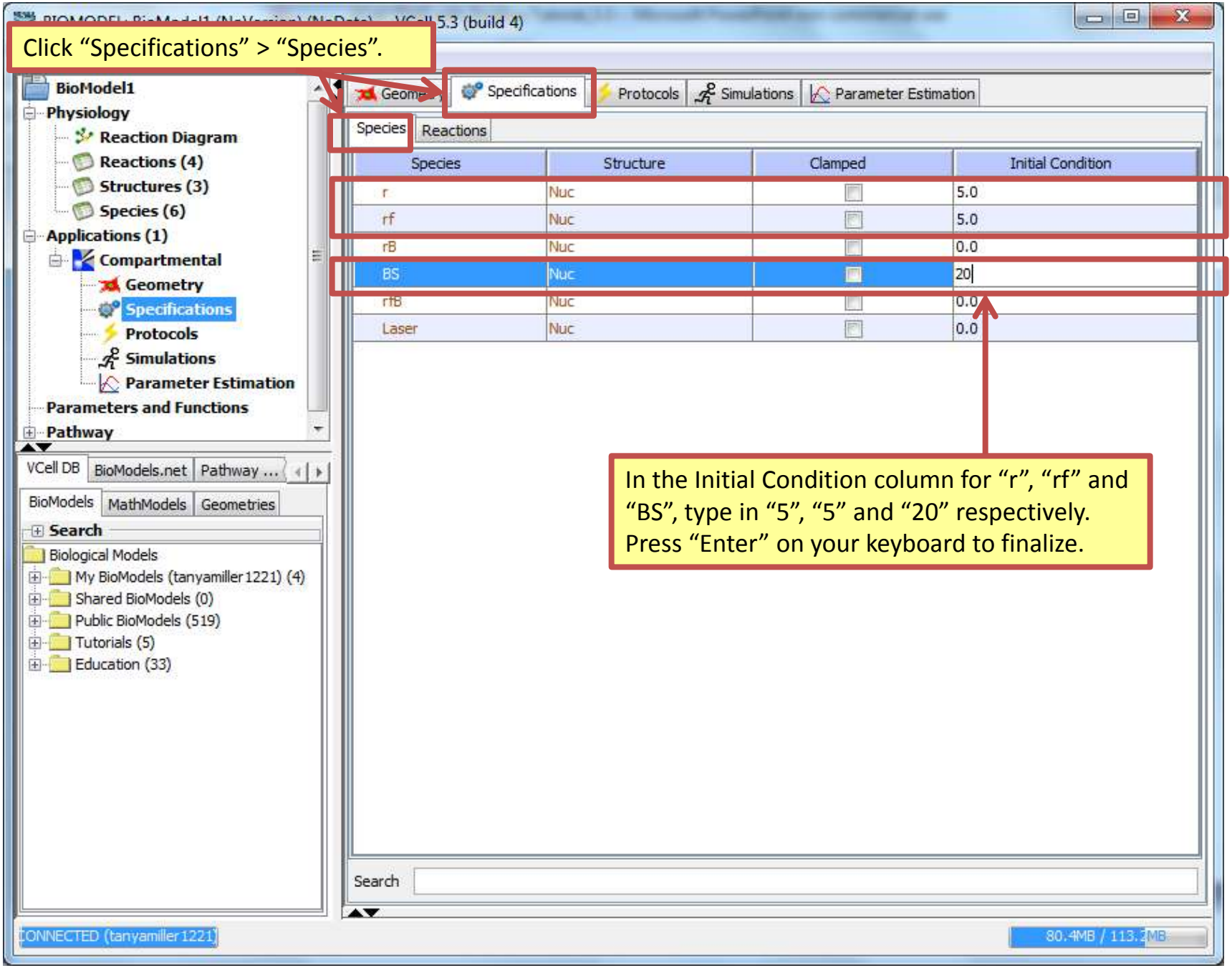
In the reaction rate row, type “(Vmax2*rfB*Laser*((t>1.0)&&(t<1.5)))” under the Expression column. Press “Enter” on your keyboard to finalize.

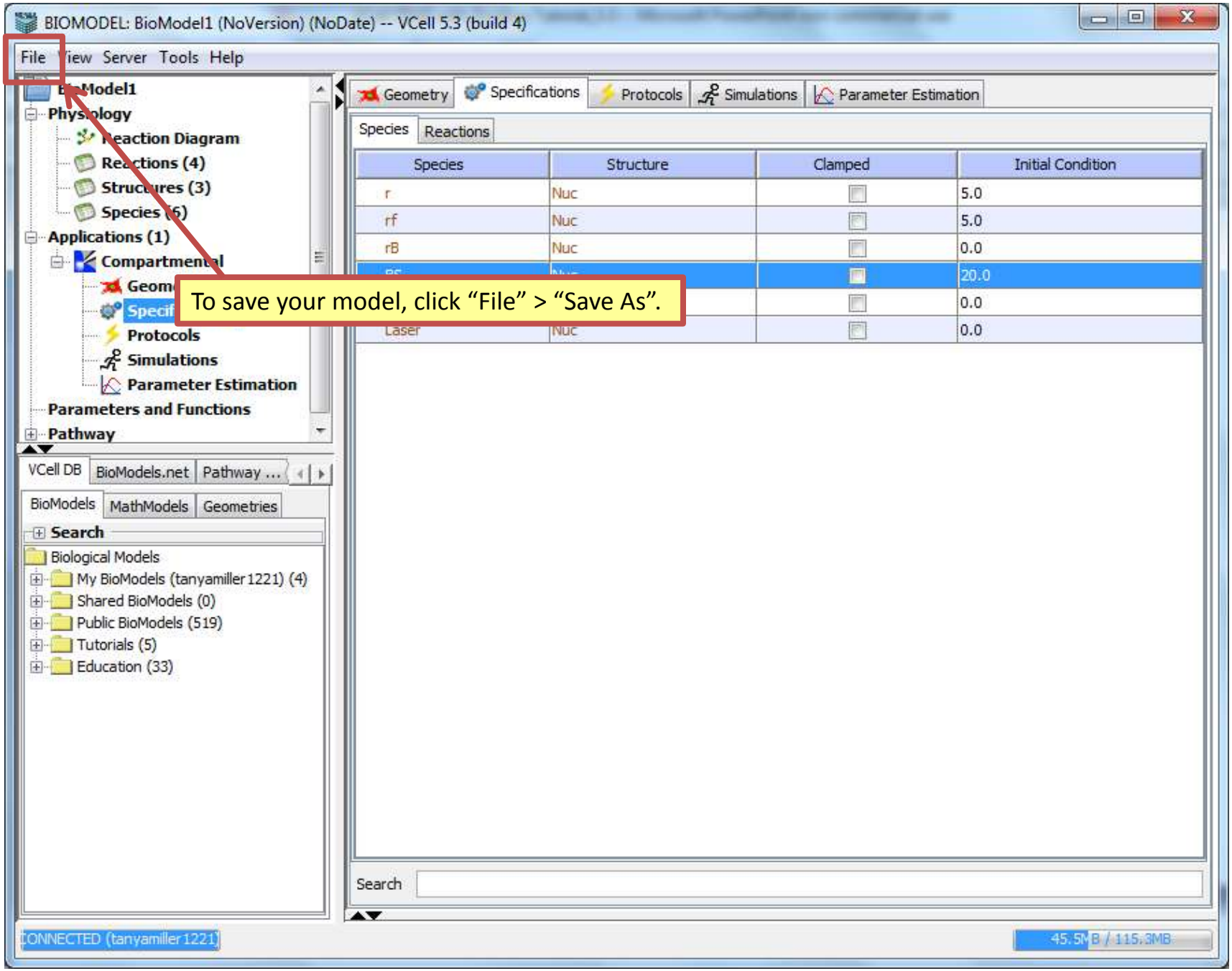

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Cyt
NM
Nuc
Laser
r
rB
bleaching 2
BS
rfB
rf
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
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
rfB
Species Concentration
Variable
μM
Laser
Species Concentration
Variable
μM
t
time
Variable
s
Annotation and Pathway Links
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public Bi
Tutorials
Education (33)
CONNECTED (tanyamiller1221)
85.4MB / 114.8MB

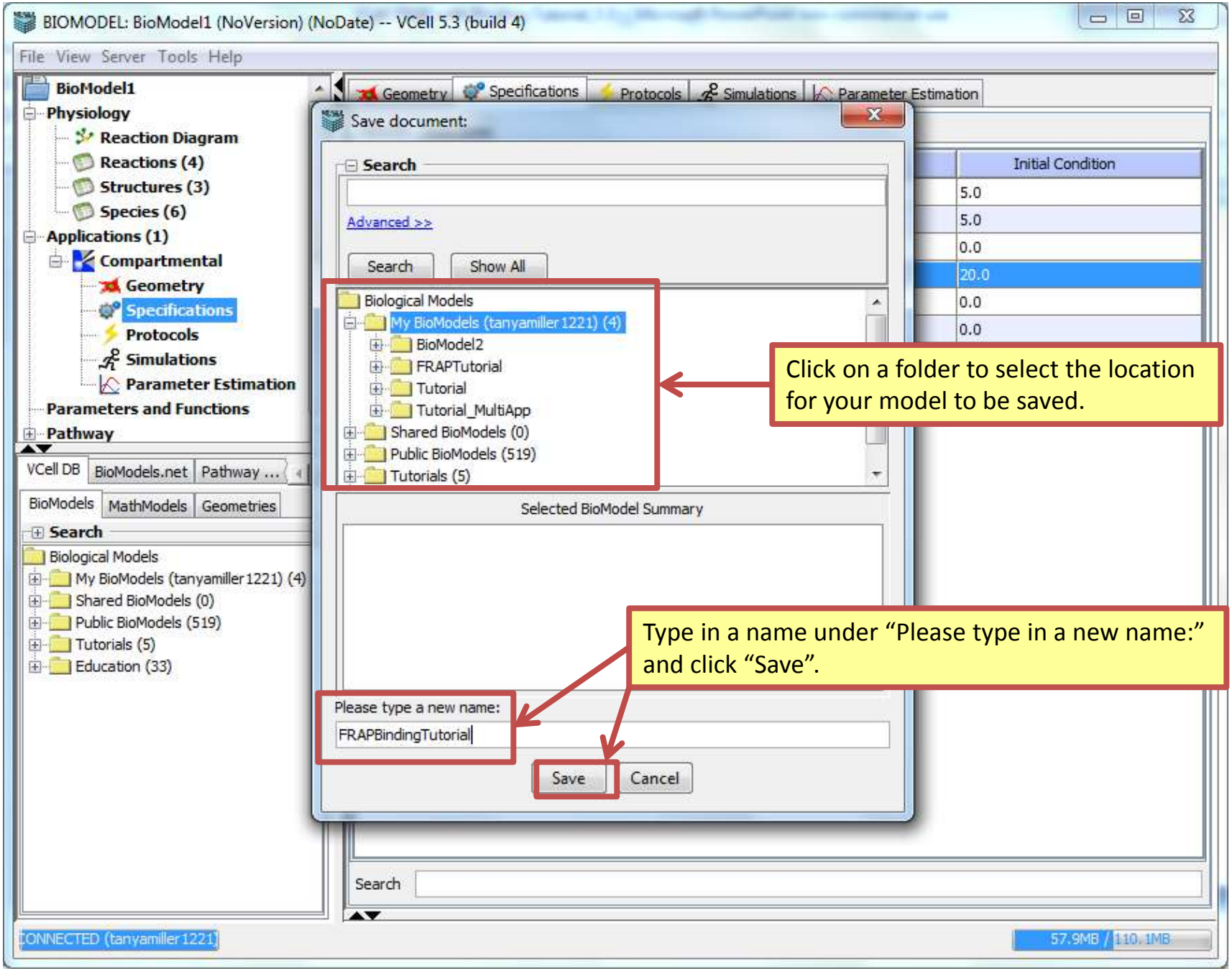

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (0)
Parameters and Functions
Pathway
Name
Math Type
Annotation
Click “Applications” > “Add New” > “Deterministic”.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Add New
Delete
More Copy Actions
Search
Deterministic
Stochastic
ems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (tanyamiller1221)
62.3MB
118MB

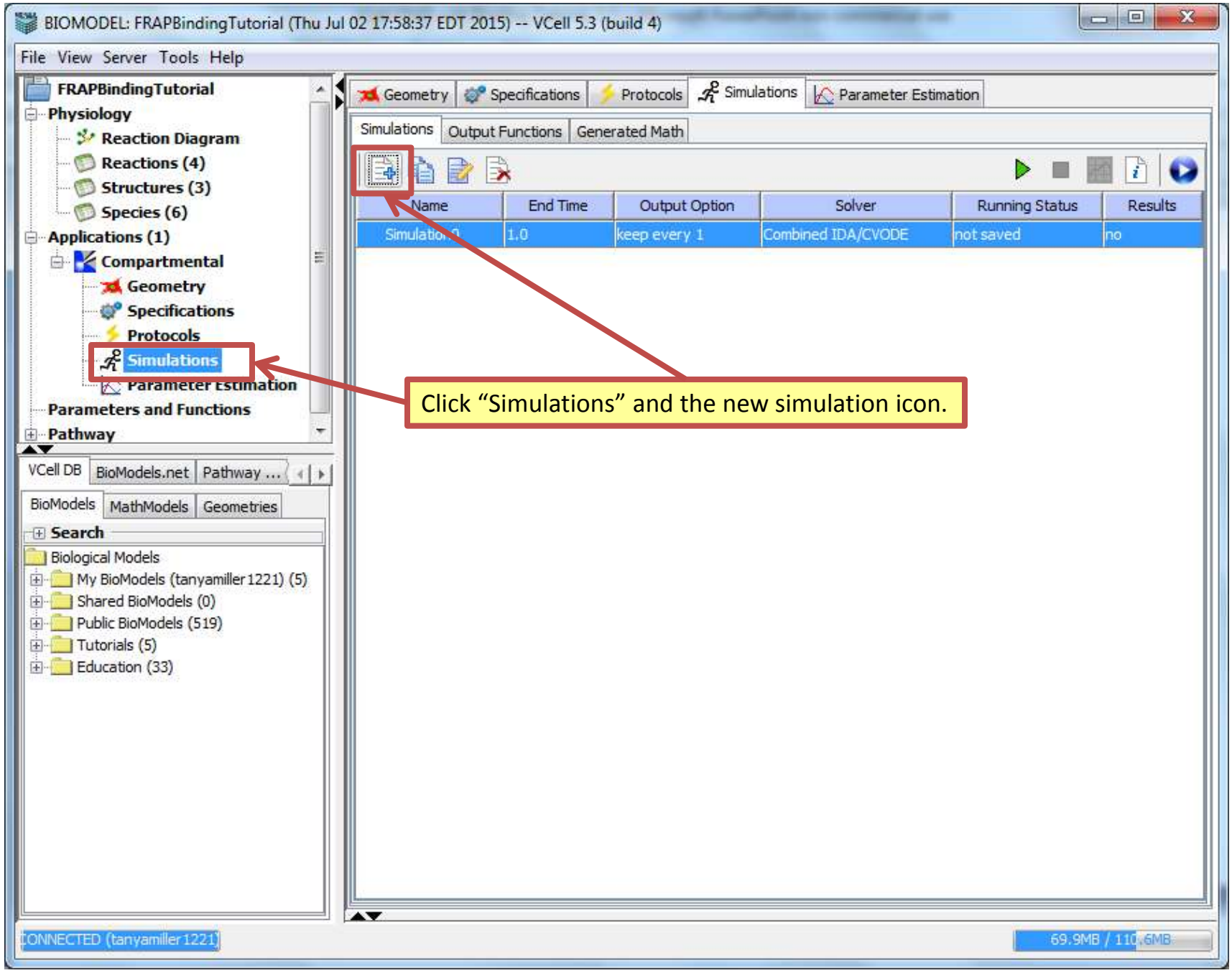

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (1)
Application0
Parameters and Functions
Pathway
Name
Math Type
Annotation
Compartmental
ompartmental deterministic
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.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Add New
Delete
More Copy Actions
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Application Name
Application0
Annotation
Summary
Deterministic
Compartmental
math not generated
CONNECTED (tanyamiller1221)
51.1MB / 118.5MB

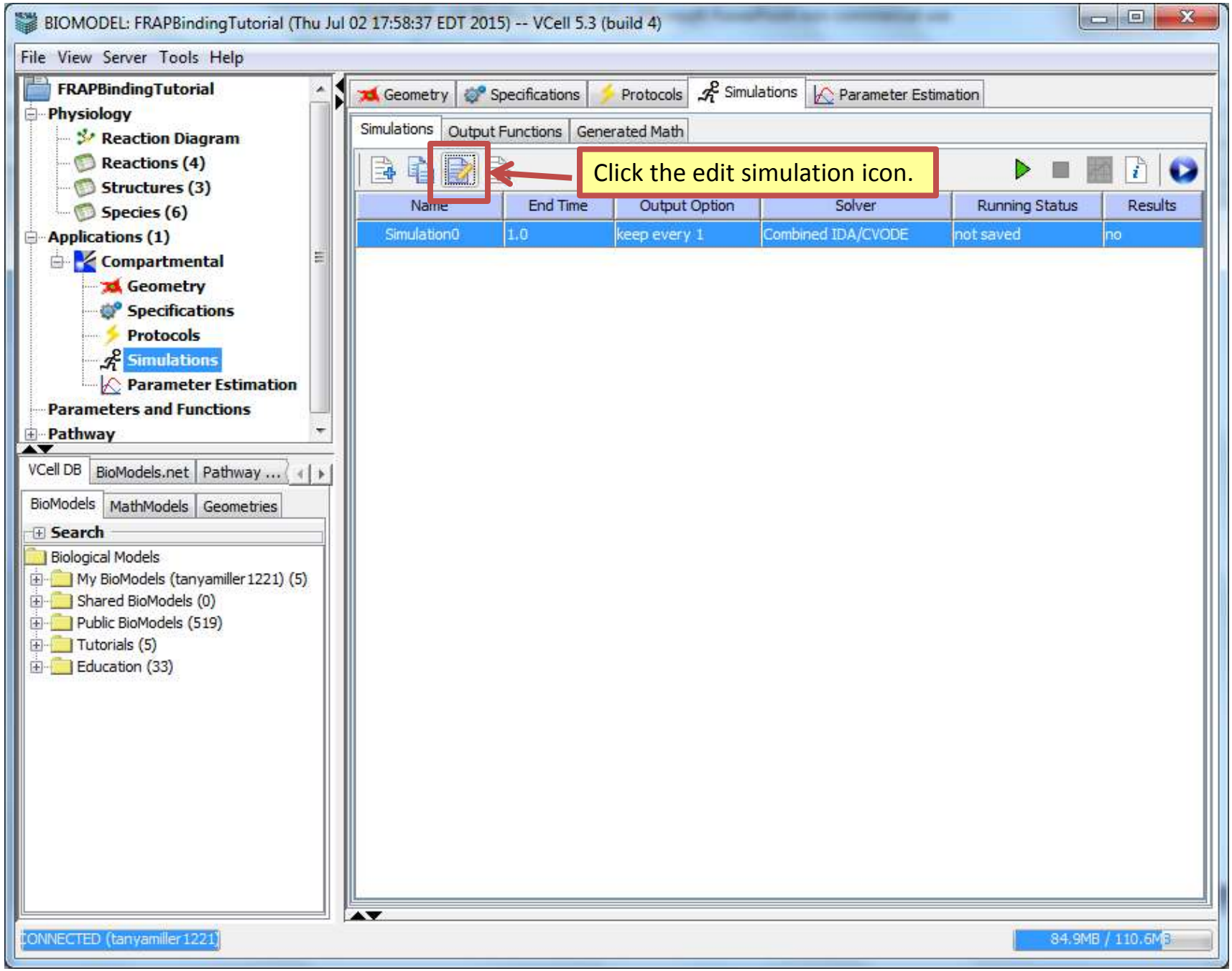

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (1)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Structure Mapping
Geometry Definition
Click “Geometry” > “Structure Mapping”.
Physiology (structures)
Geometry (subdo
Cyt
NM
Nuc
Compartment
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.
Volume and Surface Calculator >>
Structure
Size
Cyt
523.33 [µm³]
NM
130.8325 [µm²]
Nuc
26.1665
CONNECTED (tanyamiller1221)
49.4MB / 113.2MB

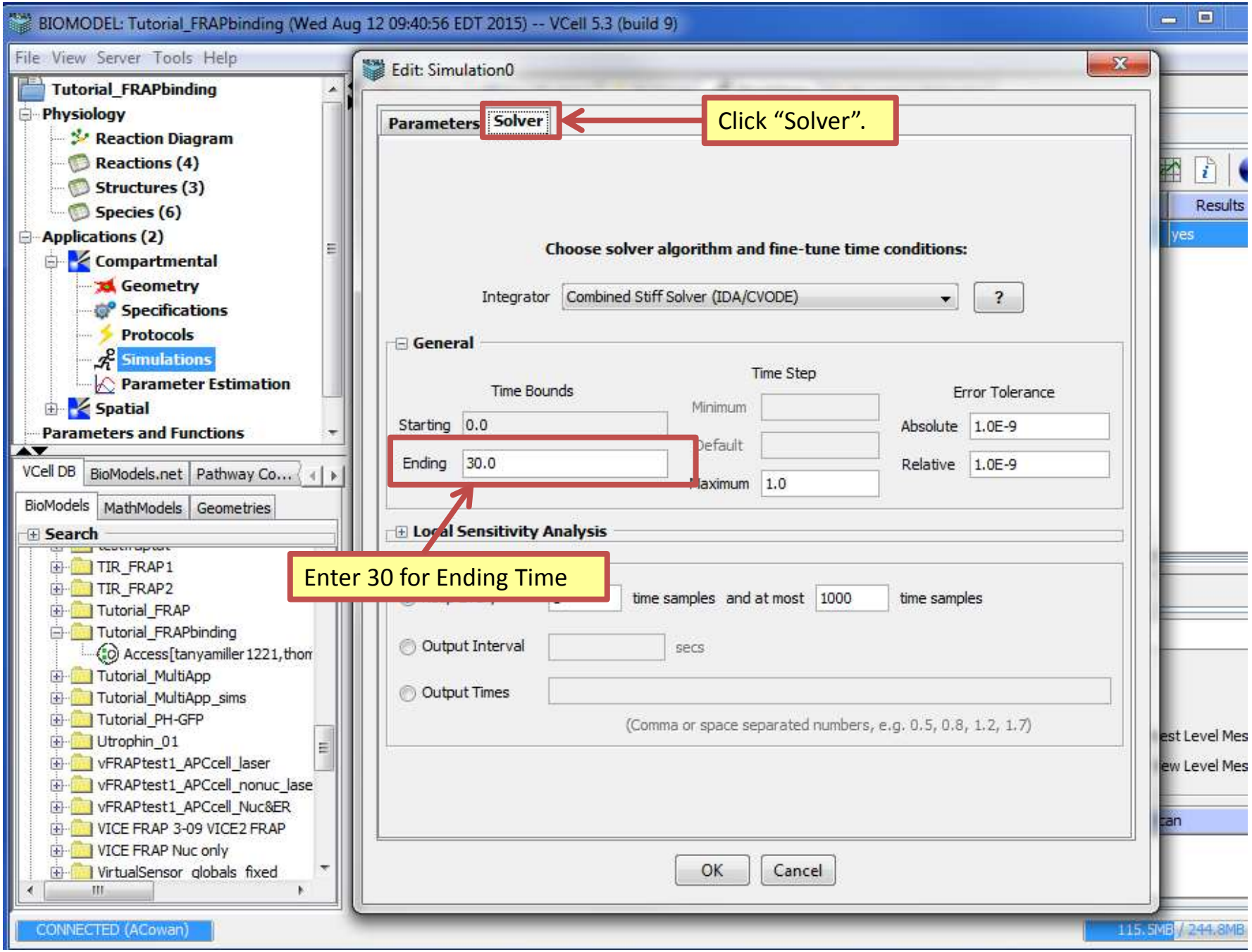

Click “Specifications” > “Species”.
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (1)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Parameters and Functions
Pathway
Specifications
Protocols
Simulations
Parameter Estimation
Species
Reactions
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.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Search
CONNECTED (tanyamiller1221)
80.4MB / 113.2MB

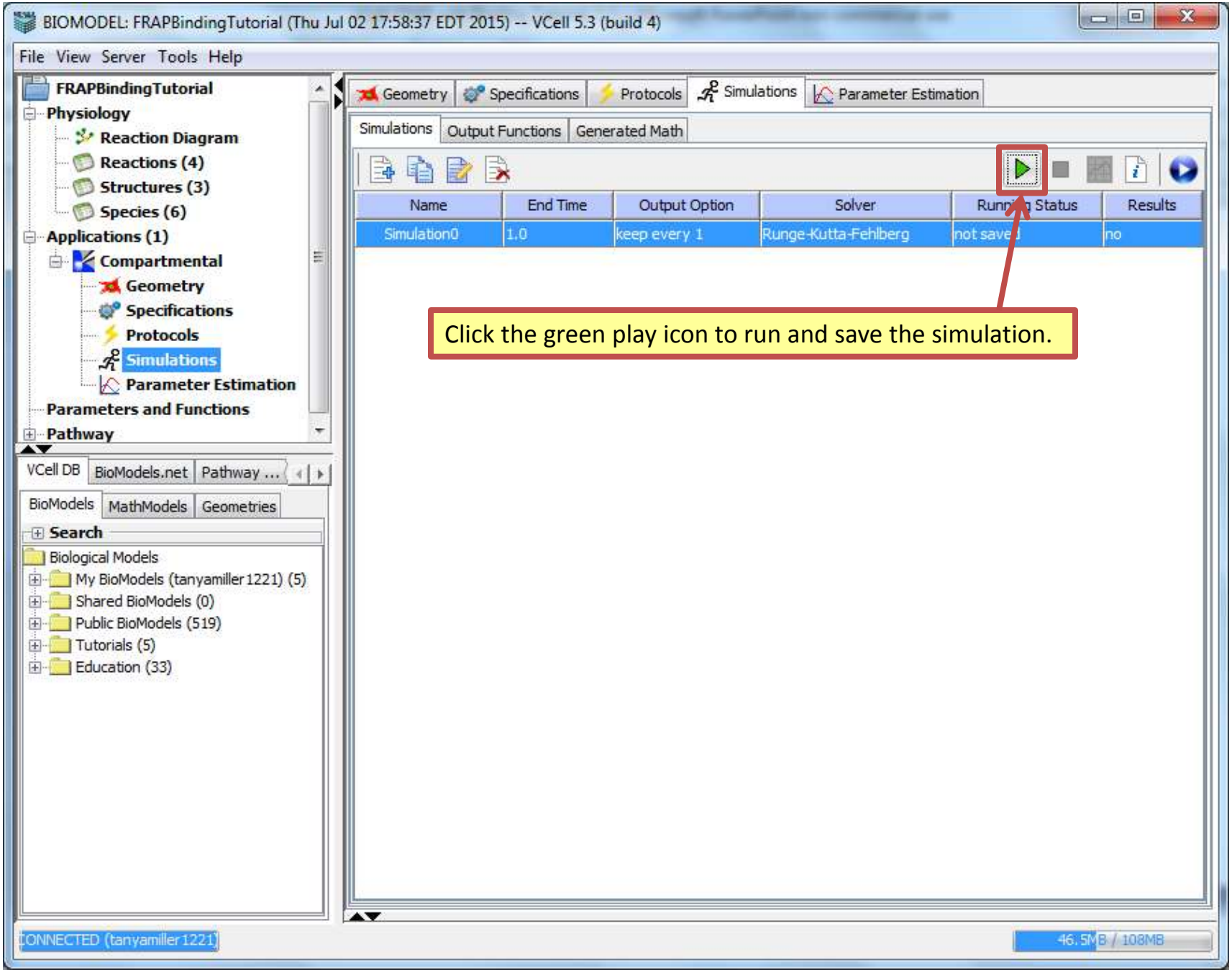

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (1)
Compartmental
Protocols
Simulations
Parameter Estimation
Parameters and Functions
Pathway
To save your model, click “File” > “Save As”.
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Species
Reactions
Species
Structure
Clamped
Initial Condition
r
Nuc
5.0
rf
Nuc
5.0
rB
Nuc
0.0
20.0
0.0
Laser
Nuc
0.0
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Search
CONNECTED (tanyamiller1221)
45.5MB / 115.3MB

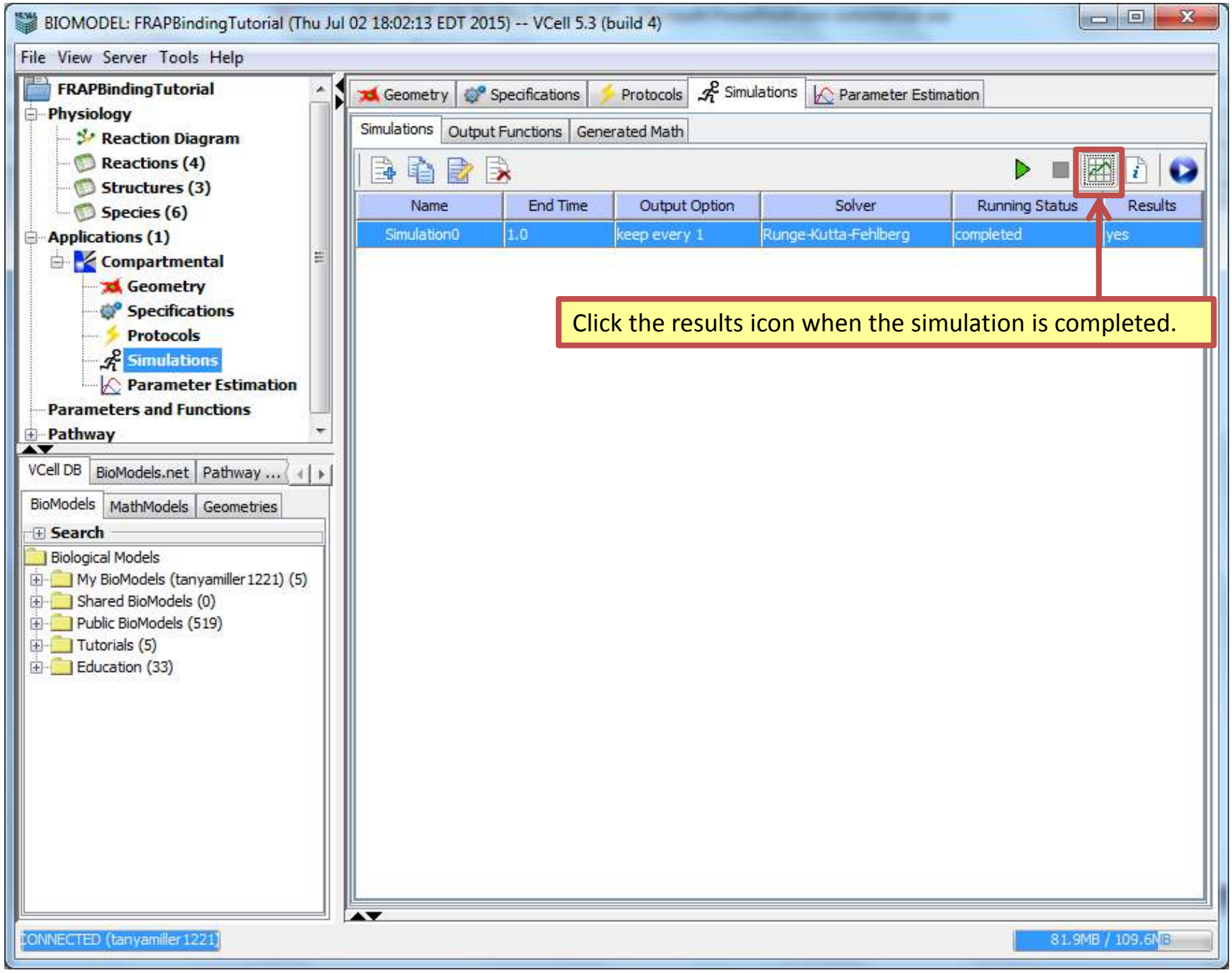

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (1)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Parameters and Functions
Pathway
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Initial Condition
5.0
5.0
0.0
20.0
0.0
0.0
Save document:
Search
Advanced >>
Search
Show All
Biological Models
My BioModels (tanyamiller1221) (4)
BioModel2
FRAPTutorial
Tutorial
Tutorial_MultiApp
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Selected BioModel Summary
Please type a new name:
FRAPBindingTutorial
Save
Cancel
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”.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Search
CONNECTED (tanyamiller1221)
57.9MB / 110.1MB

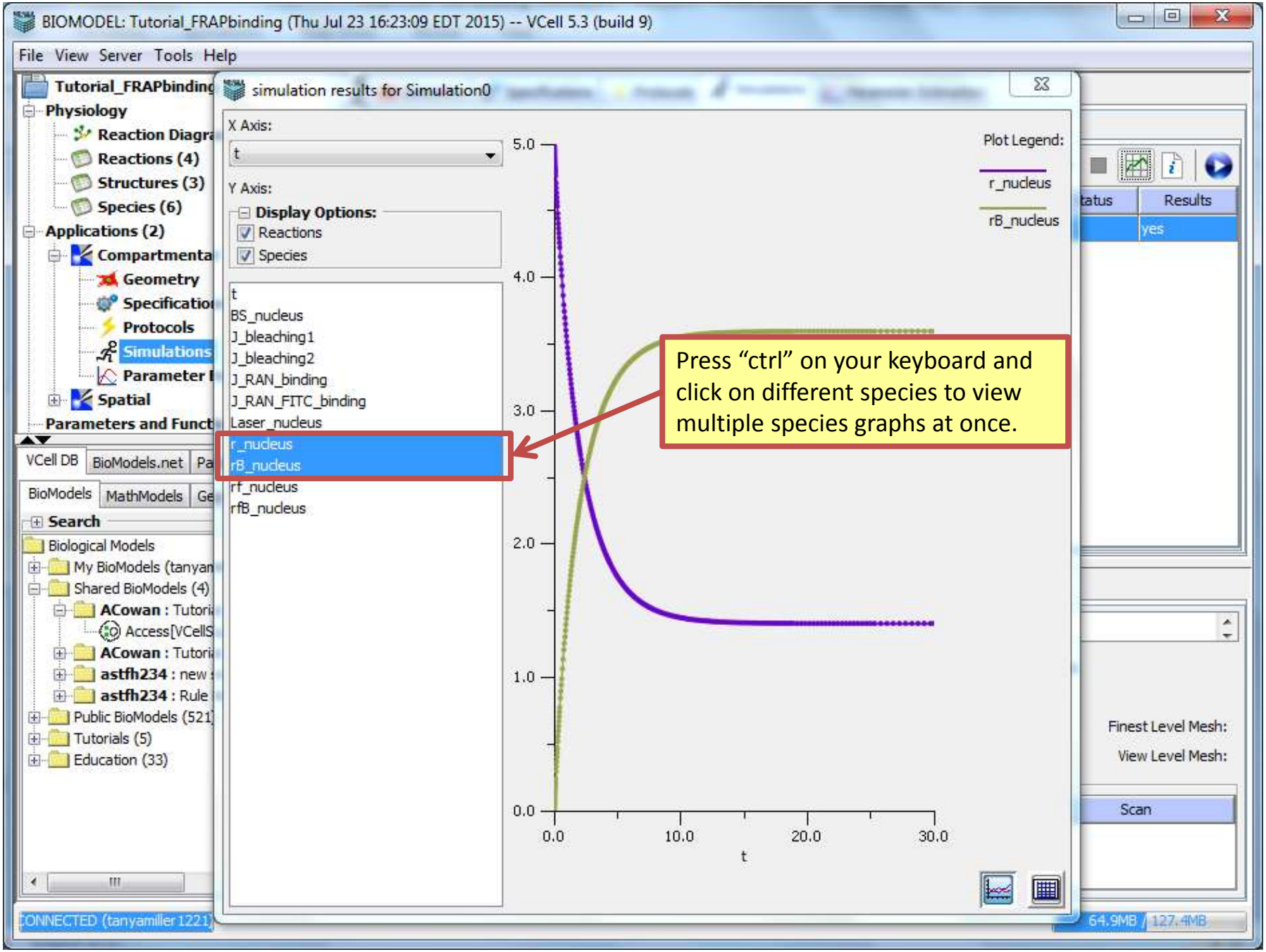

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 17:58:37 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (1)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
1.0
keep every 1
Combined IDA/CVODE
not saved
no
Click “Simulations” and the new simulation icon.
CONNECTED (tanyamiller1221)
69.9MB / 110.6MB

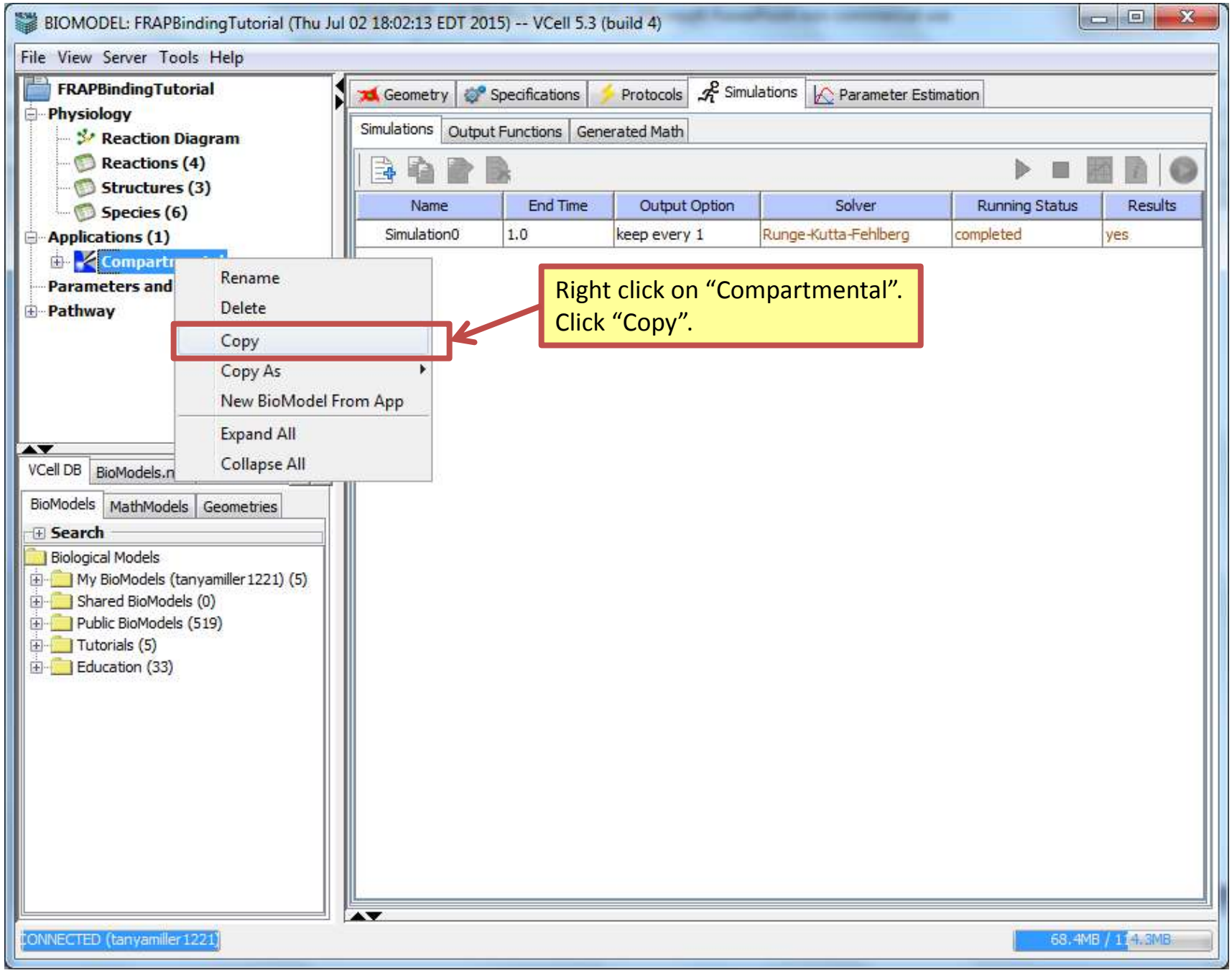

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 17:58:37 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (1)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Simulations
Output Functions
Generated Math
Click the edit simulation icon.
Name
End Time
Output Option
Solver
Running Status
Results
Simulation0
1.0
keep every 1
Combined IDA/CVODE
not saved
no
CONNECTED (tanyamiller1221)
84.9MB / 110.6MB

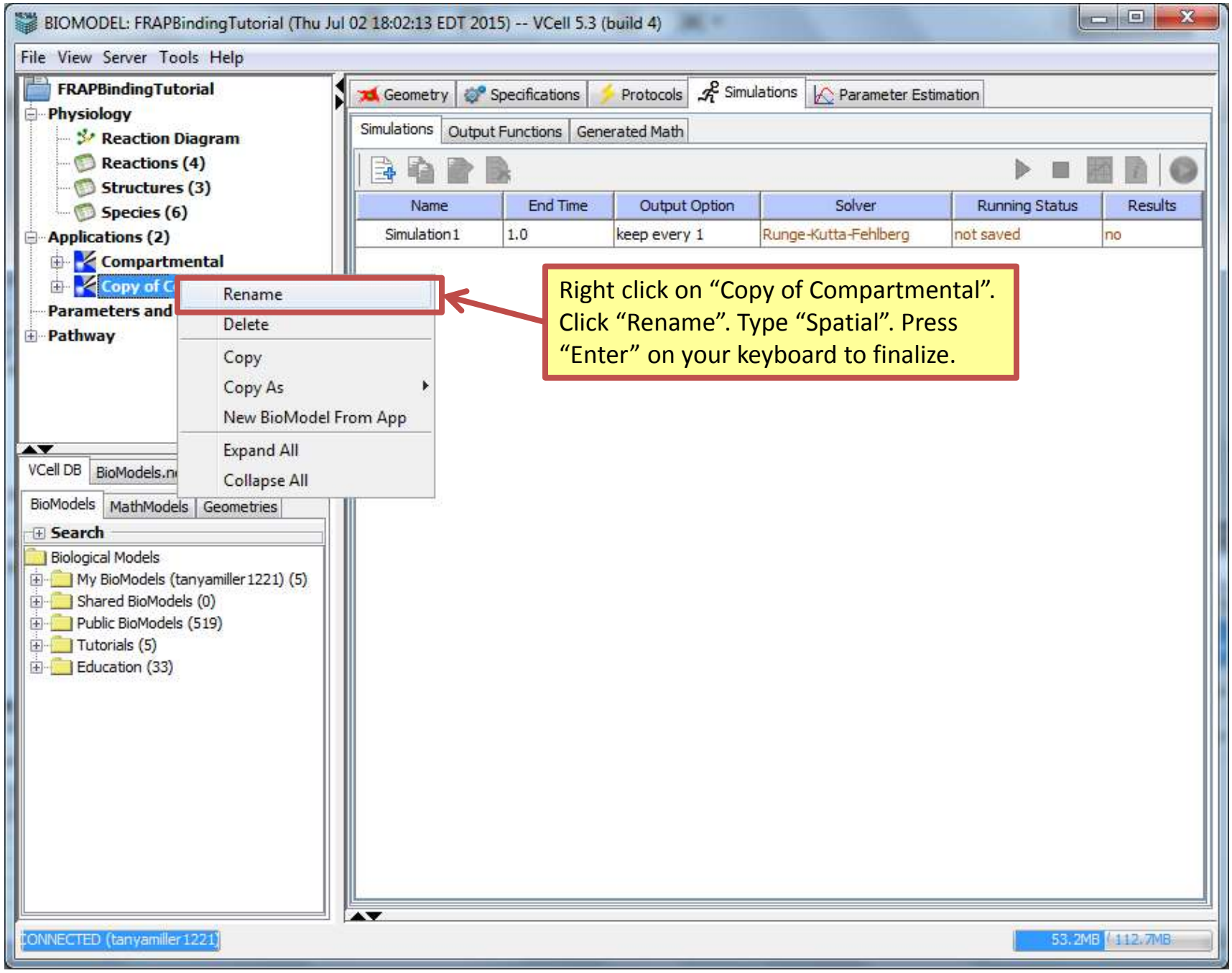

BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 5.3 (build 9)
File View Server Tools Help
Tutorial_FRAPbinding
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Spatial
Parameters and Functions
VCell DB
BioModels.net
Pathway Co...
BioModels
MathModels
Geometries
Search
TIR_FRAP1
TIR_FRAP2
Tutorial_FRAP
Tutorial_FRAPbinding
Access[tanyamiller1221,thom
Tutorial_MultiApp
Tutorial_MultiApp_sims
Tutorial_PH-GFP
Utrophin_01
vFRAPtest1_APCcell_laser
vFRAPtest1_APCcell_nonuc_lase
vFRAPtest1_APCcell_Nuc&ER
VICE FRAP 3-09 VICE2 FRAP
VICE FRAP Nuc only
VirtualSensor globals fixed
CONNECTED (ACowan)
Edit: Simulation0
Parameters
Solver
Click “Solver”.
Choose solver algorithm and fine-tune time conditions:
Integrator
Combined Stiff Solver (IDA/CVODE)
?
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
Enter 30 for Ending Time
time samples and at most
1000
time samples
Output Interval
secs
Output Times
(Comma or space separated numbers, e.g. 0.5, 0.8, 1.2, 1.7)
OK
Cancel
Results
115.5MB / 244.8MB

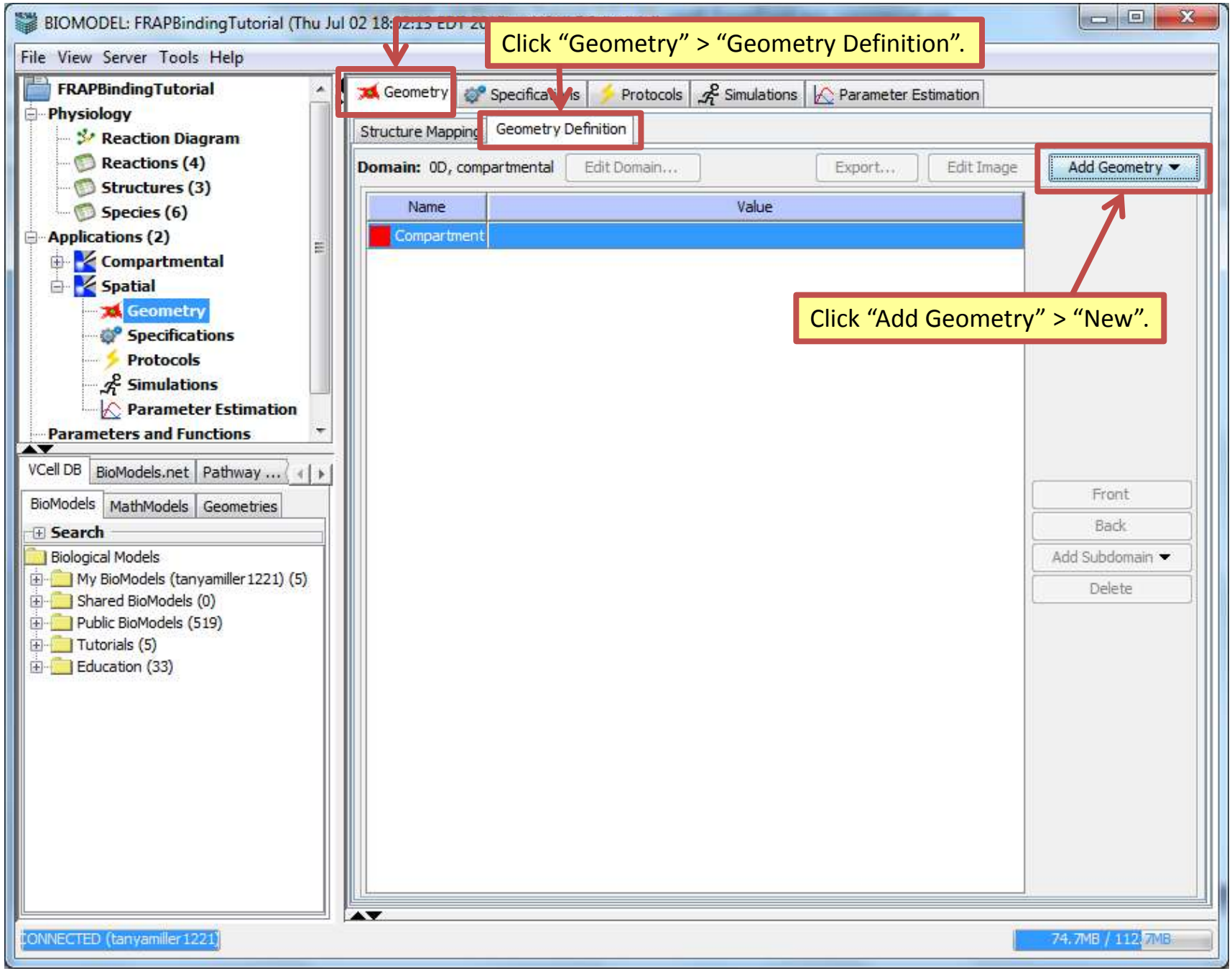

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 17:58:37 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (1)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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
Runge-Kutta-Fehlberg
not saved
no
Click the green play icon to run and save the simulation.
CONNECTED (tanyamiller1221)
46.5MB / 108MB

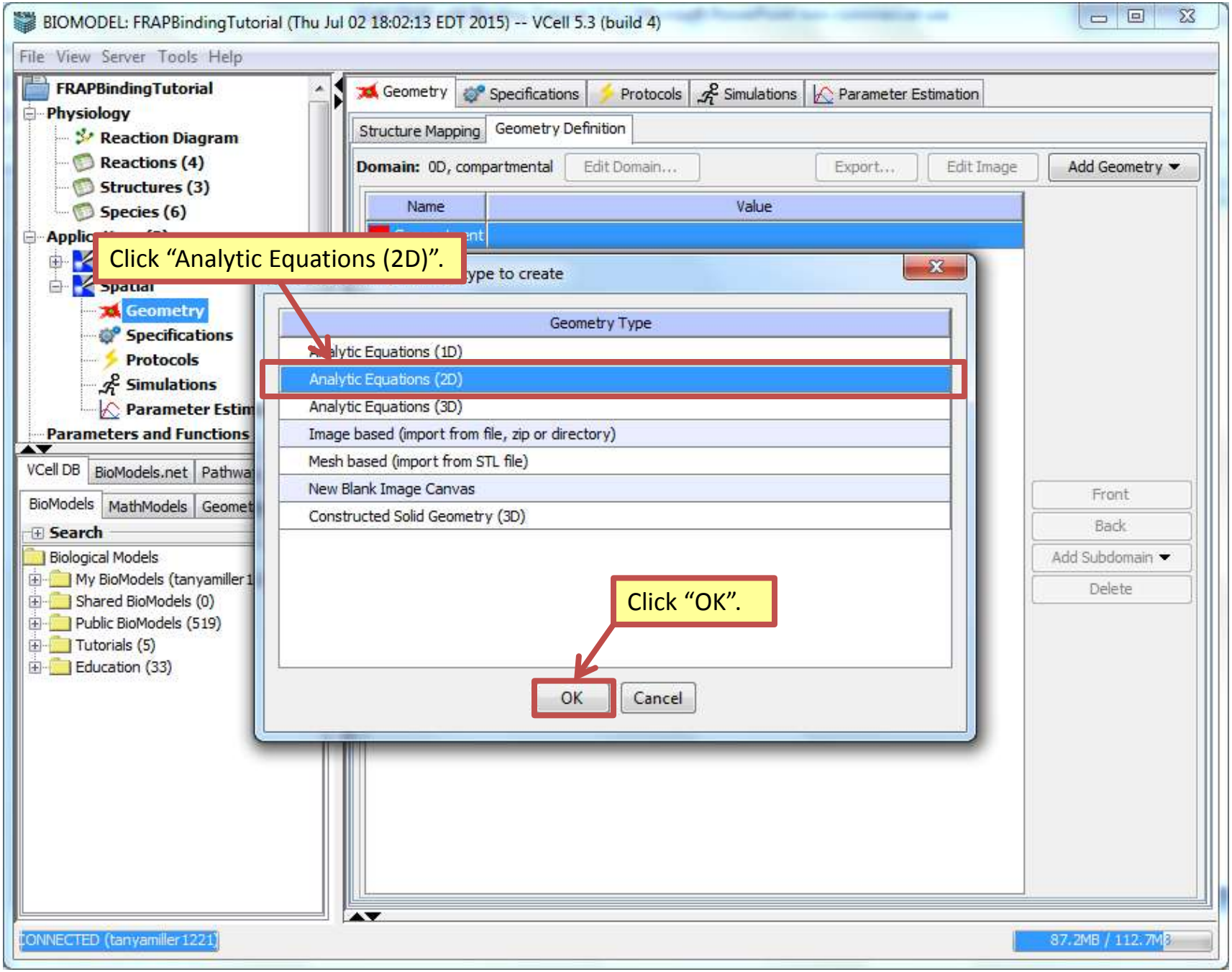

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (1)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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
Runge-Kutta-Fehlberg
completed
yes
Click the results icon when the simulation is completed.
CONNECTED (tanyamiller1221)
81.9MB / 109.6MB

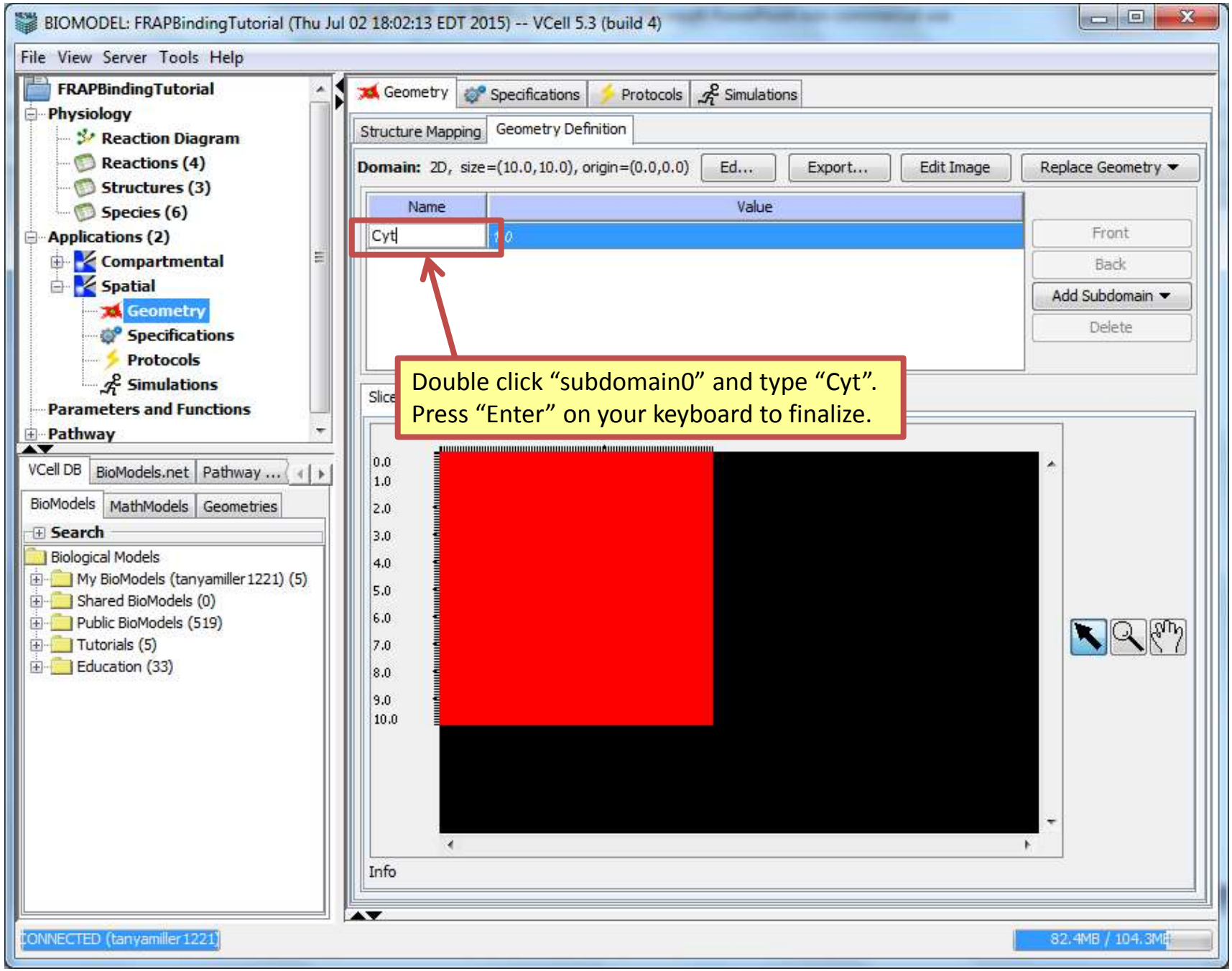

BIOMODEL: Tutorial_FRAPbinding (Thu Jul 23 16:23:09 EDT 2015) -- VCell 5.3 (build 9)
File View Server Tools Help
Tutorial_FRAPbinding
Physiology
Reaction Diagra
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmenta
Geometry
Specificatio
Protocols
Simulations
Parameter
Spatial
Parameters and Funct
VCell DB
BioModels.net
BioModels
MathModels
Search
Biological Models
My BioModels (tanyan
Shared BioModels (4)
ACowan : Tutori
Access[VCellS
ACowan : Tutori
astfh234 : new
astfh234 : Rule
Public BioModels (521)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
simulation results for 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
Plot Legend:
r_nucleus
rB_nucleus
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.
tatus
Results
yes
Finest Level Mesh:
View Level Mesh:
Scan
64.9MB
127.4MB

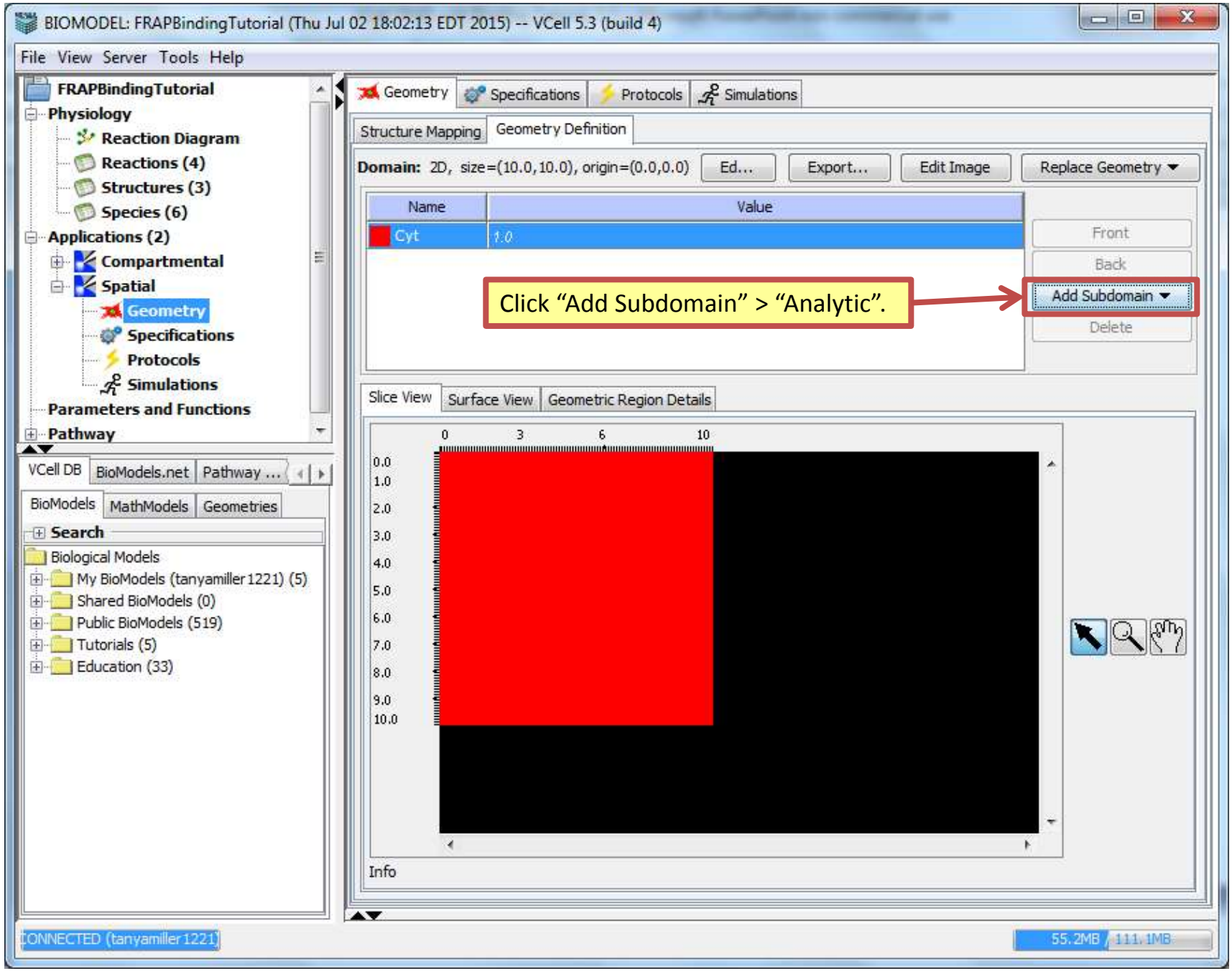

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (1)
Parameters and
Pathway
Rename
Delete
Copy
Copy As
New BioModel From App
Expand All
Collapse All
Right click on "Compartmental".
Click "Copy".
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
Runge-Kutta-Fehlberg
completed
yes
VCell DB
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
68.4MB / 114.3MB

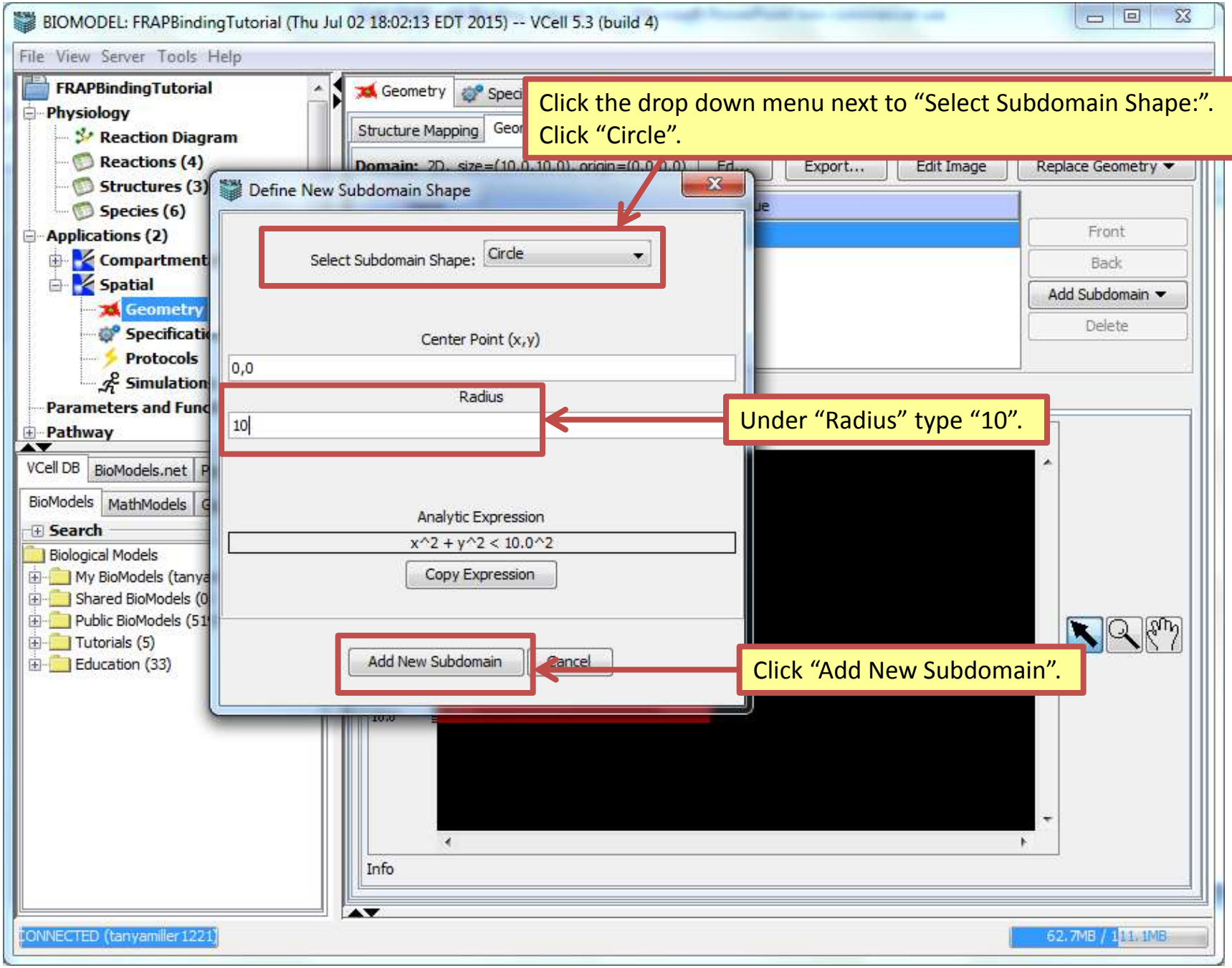

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Copy of C
Parameters and
Pathway
Rename
Delete
Copy
Copy As
New BioModel From App
Expand All
Collapse All
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
Runge-Kutta-Fehlberg
not saved
no
Right click on “Copy of Compartmental”. Click “Rename”. Type “Spatial”. Press “Enter” on your keyboard to finalize.
VCell DB
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
53.2MB
112.7MB

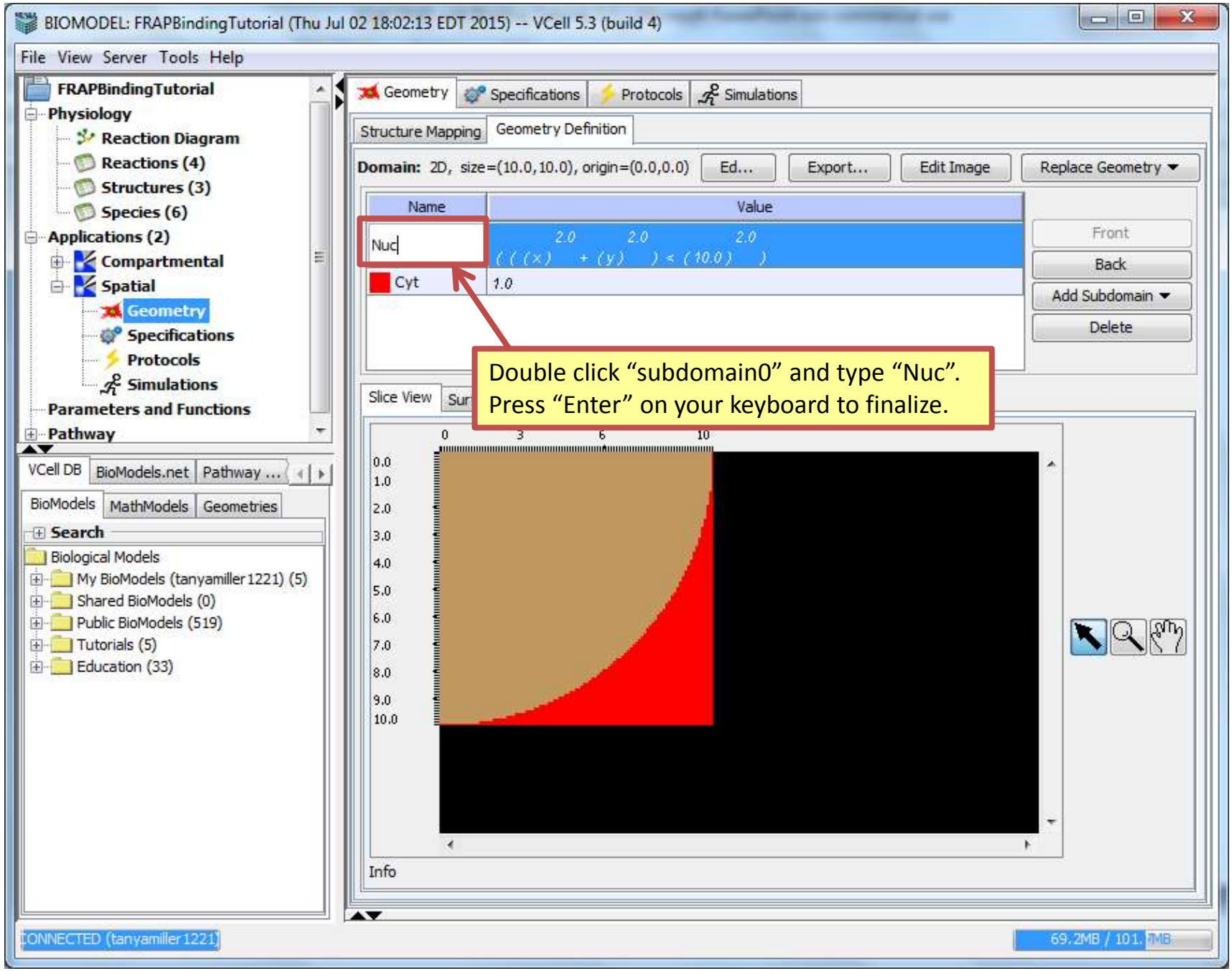

Click “Geometry” > “Geometry Definition”.
Click “Add Geometry” > “New”.
BIOMODEL: FRAPBindingTutorial
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Parameters and Functions
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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
CONNECTED (tanyamiller1221)
74.7MB / 112.7MB

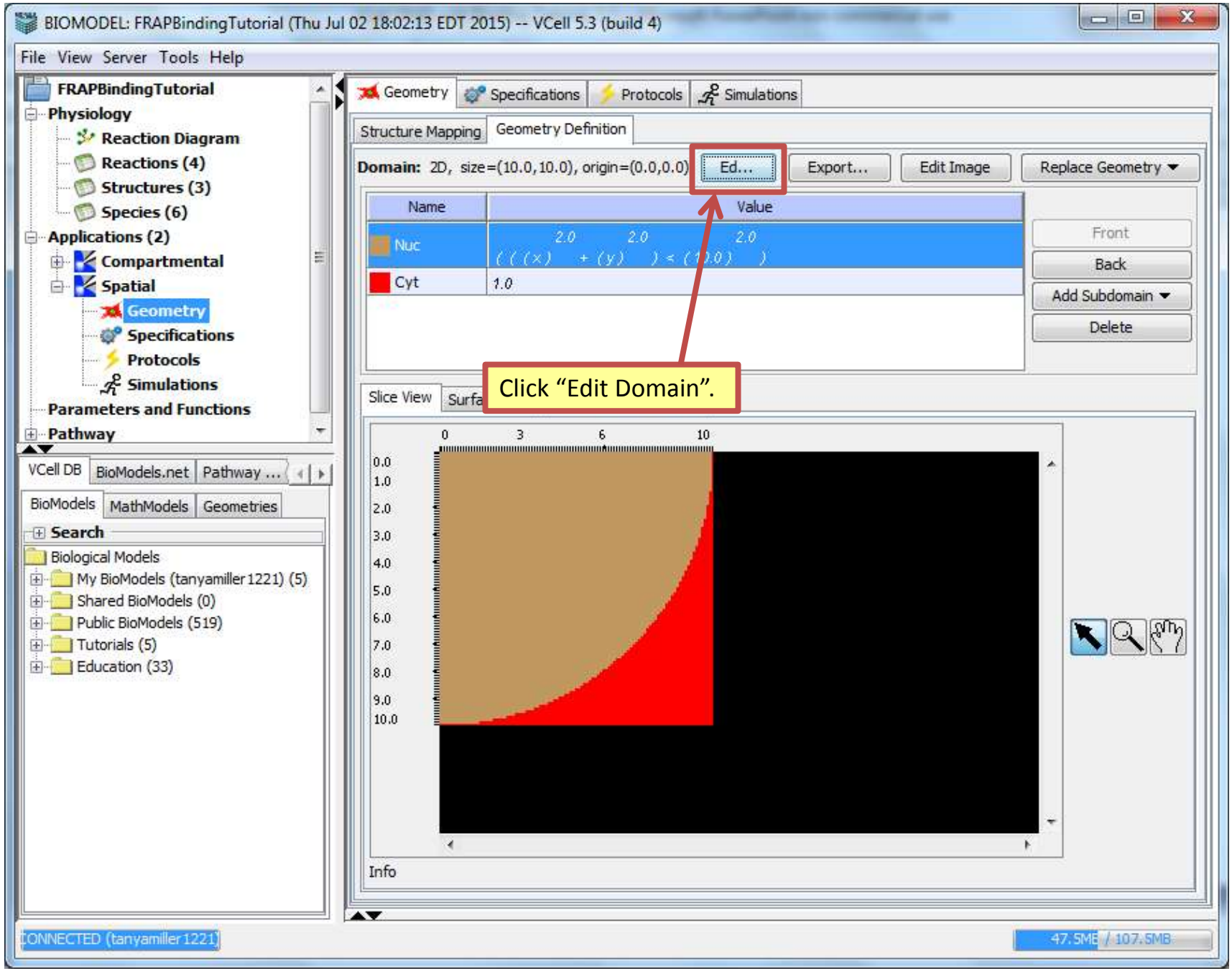

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Spatial
Geometry
Specifications
Protocols
Simulations
Parameter Estim
Parameters and Functions
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Structure Mapping
Geometry Definition
Domain: 0D, compartmental
Edit Domain...
Export...
Edit Image
Add Geometry
Name
Value
Click “Analytic Equations (2D)”.
ype to create
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
Front
Back
Add Subdomain
Delete
VCell DB
BioModels.net
BioModels
MathModels
Search
Biological Models
My BioModels (tanyamiller1
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
87.2MB / 112.7MB

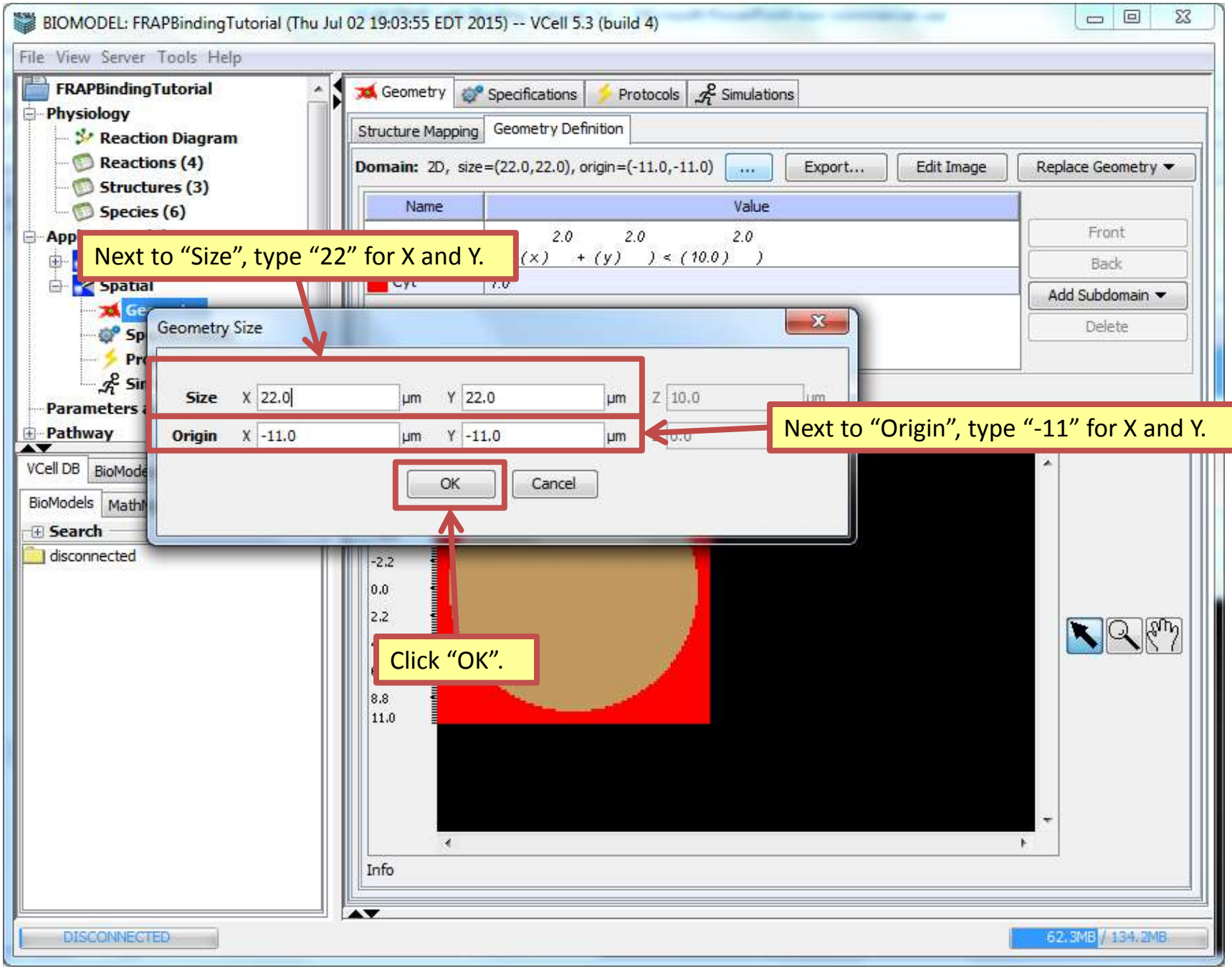

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
Domain: 2D, size=(10.0,10.0), origin=(0.0,0.0)
Ed...
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.
Slice
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Info
CONNECTED (tanyamiller1221)
82.4MB / 104.3MB

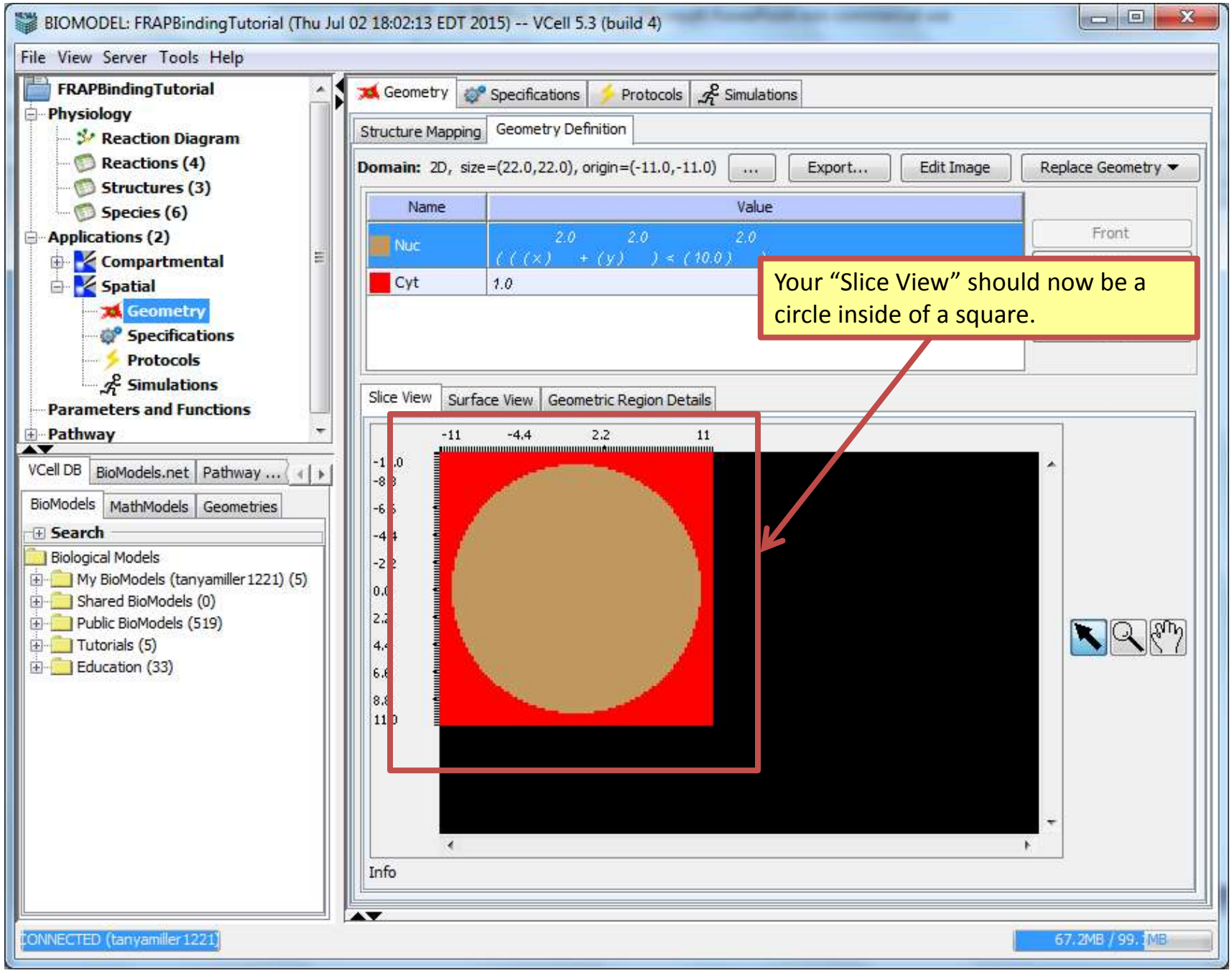

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
Domain: 2D, size=(10.0,10.0), origin=(0.0,0.0)
Ed...
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
5.0
6.0
7.0
8.0
9.0
10.0
Info
CONNECTED (tanyamiller1221)
55.2MB / 111.1MB

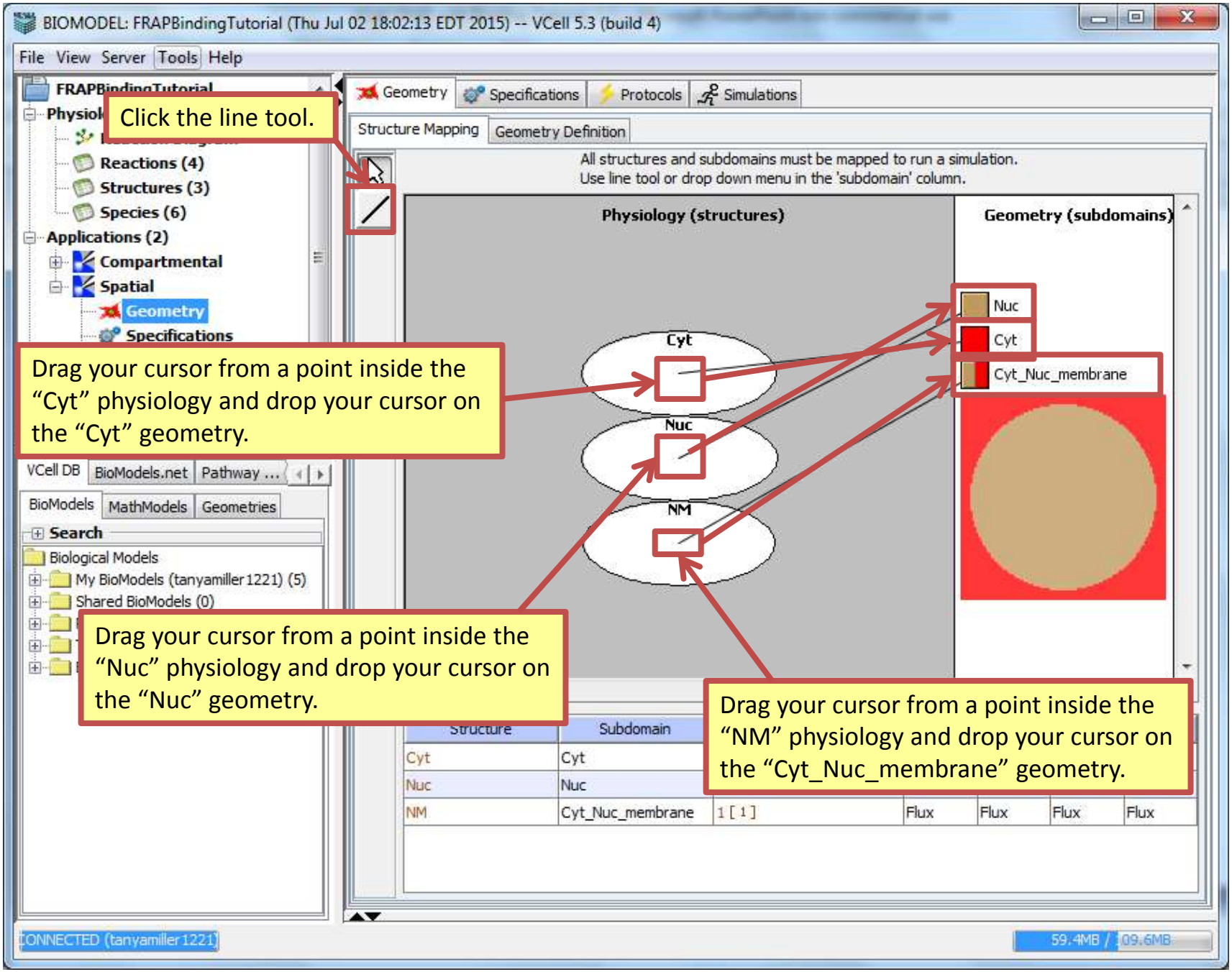

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartment
Spatial
Geometry
Specificati
Protocols
Simulation
Parameters and Func
Pathway
VCell DB
BioModels.net
BioModels
MathModels
Search
Biological Models
My BioModels (tanya
Shared BioModels (0
Public BioModels (51
Tutorials (5)
Education (33)
Geometry
Speci
Structure Mapping
Geo
Export...
Edit Image
Replace Geometry
Front
Back
Add Subdomain
Delete
Info
CONNECTED (tanyamiller1221)
62.7MB / 111.1MB
Define New Subdomain Shape
Select Subdomain Shape:
Circle
Center Point (x,y)
0,0
Radius
10
Analytic Expression
x^2 + y^2 < 10.0^2
Copy Expression
Add New Subdomain
Cancel
Click the drop down menu next to “Select Subdomain Shape:”. Click “Circle”.
Under “Radius” type “10”.
Click “Add New Subdomain”.

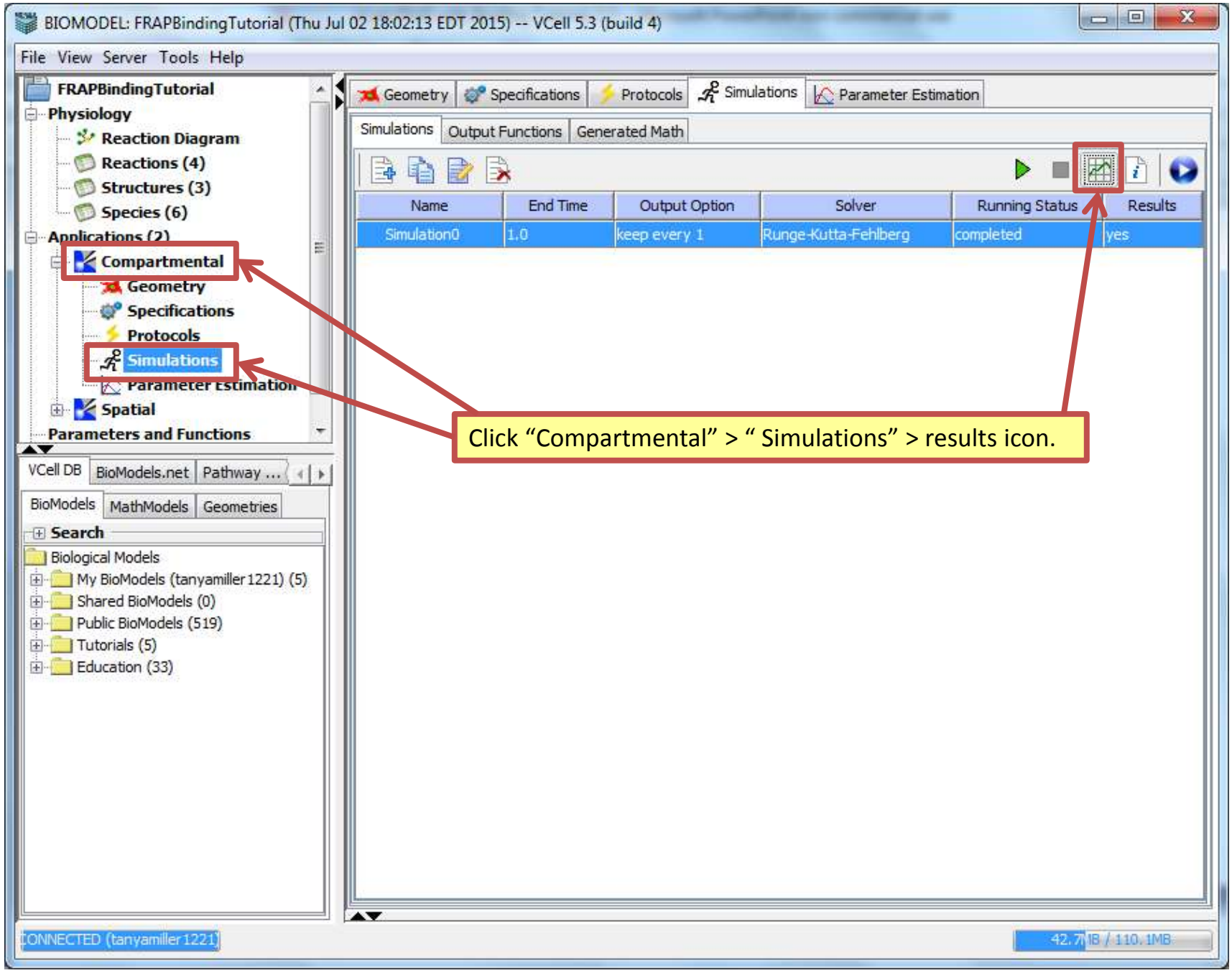

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
Domain: 2D, size=(10.0,10.0), origin=(0.0,0.0)
Ed...
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
Double click “subdomain0” and type “Nuc”.
Press “Enter” on your keyboard to finalize.
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
CONNECTED (tanyamiller1221)
69.2MB / 101.7MB

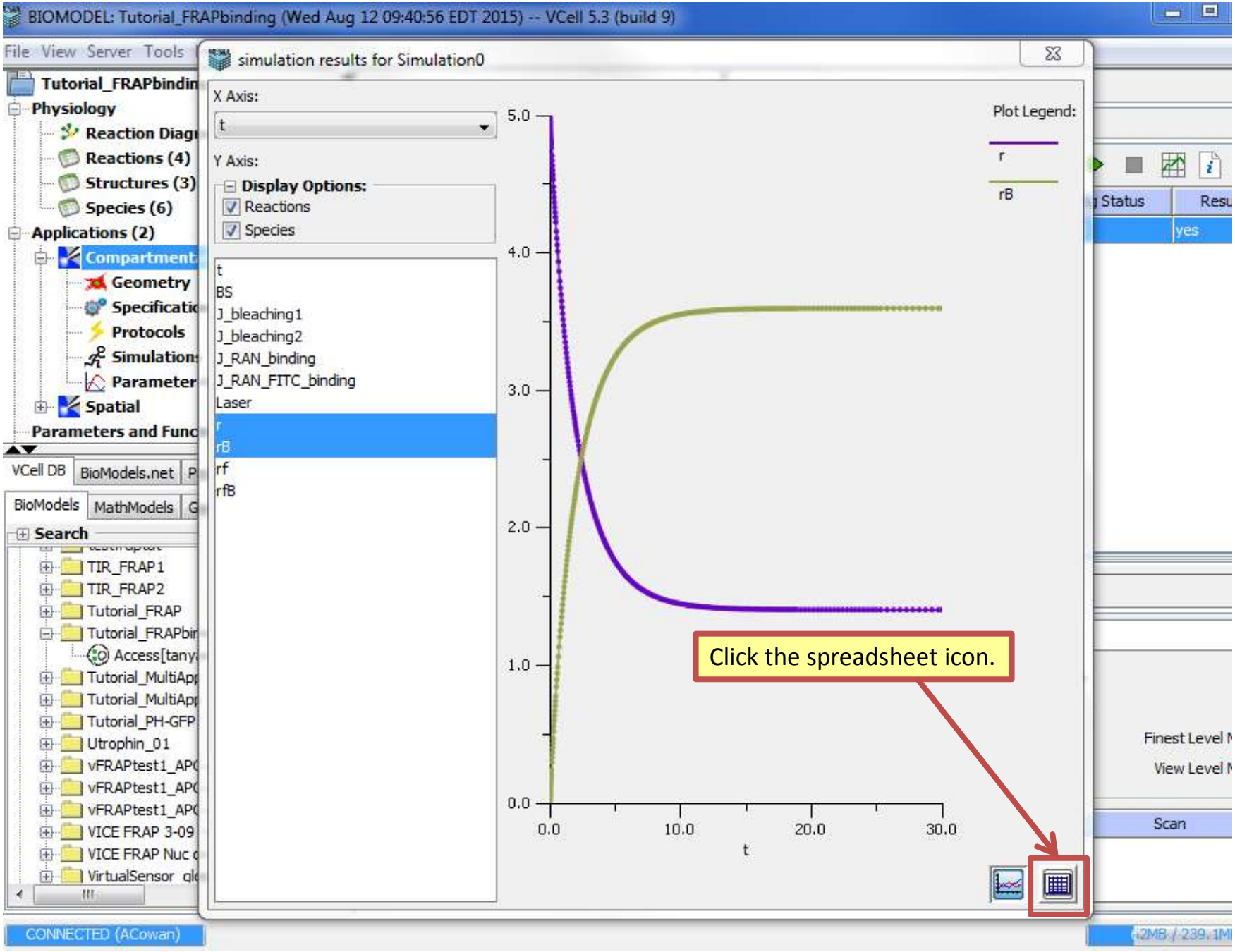

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
Domain: 2D, size=(10.0,10.0), origin=(0.0,0.0)
Ed...
Export...
Edit Image
Replace Geometry
Name
Value
Nuc
Cyt
1.0
Front
Back
Add Subdomain
Delete
Click “Edit Domain”.
Slice View
Surfa
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
CONNECTED (tanyamiller1221)
47.5MB / 107.5MB

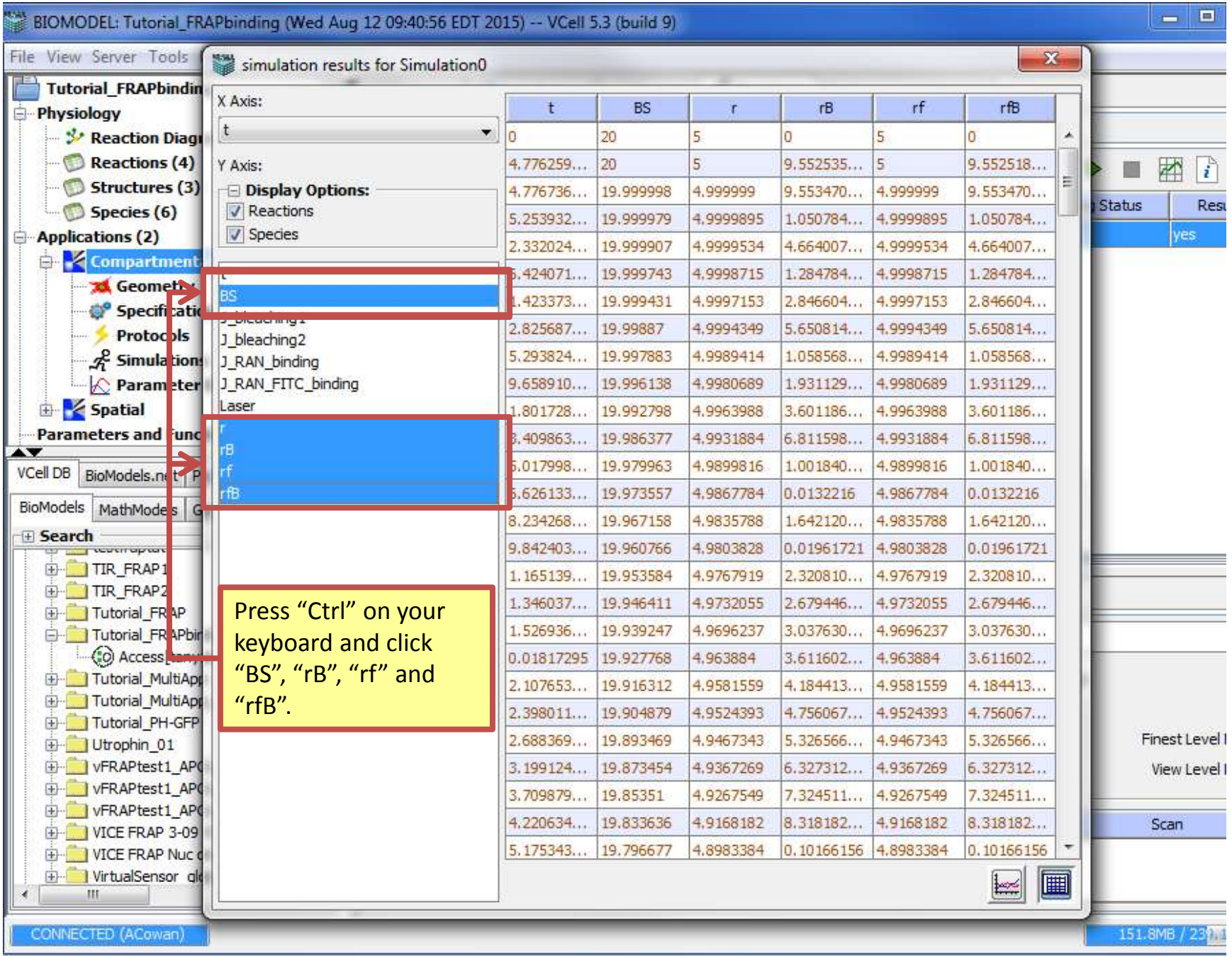

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 19:03:55 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Spatial
Parameters
Pathway
Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
Domain: 2D, size=(22.0,22.0), origin=(-11.0,-11.0)
Export...
Edit Image
Replace Geometry
Name
Value
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 µm
Origin X -11.0 µm Y -11.0 µm
OK
Cancel
Next to “Origin”, type “-11” for X and Y.
Click “OK”.
VCell DB
BioModels
Search
disconnected
Info
DISCONNECTED
62.3MB / 134.2MB

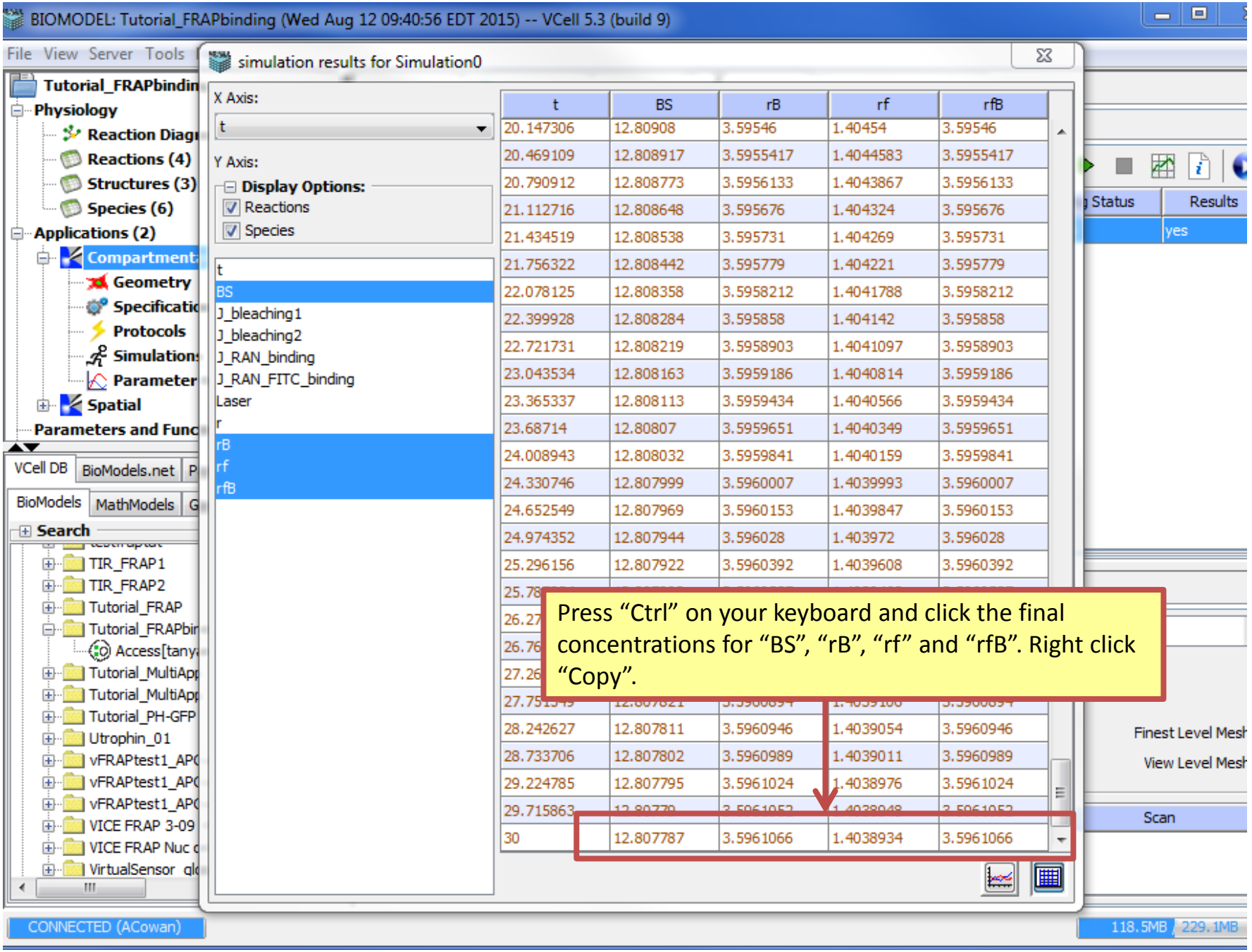

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
Domain: 2D, size=(22.0,22.0), origin=(-11.0,-11.0)
...
Export...
Edit Image
Replace Geometry
Name
Value
Nuc
2.0 2.0 2.0
(((x) + (y)) < (10.0)
Cyt
1.0
Front
Your "Slice View" should now be a circle inside of a square.
Slice View
Surface View
Geometric Region Details
-11
-4.4
2.2
11
Info
CONNECTED (tanyamiller1221)
67.2MB / 99.1MB

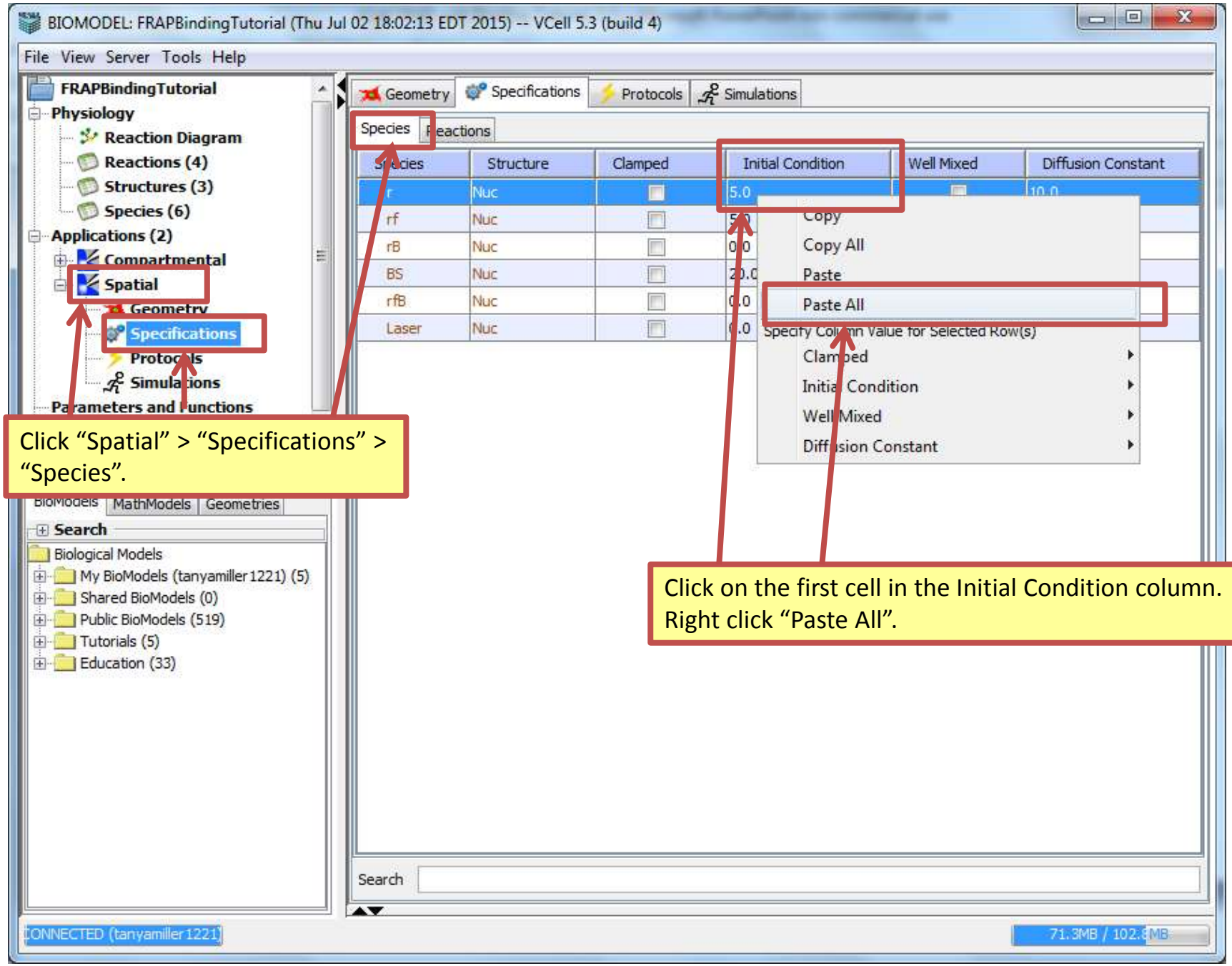

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
Click the line tool.
Drag your cursor from a point inside the "Cyt" physiology and drop your cursor on the "Cyt" geometry.
Drag your cursor from a point inside the "Nuc" physiology and drop your cursor on the "Nuc" geometry.
Drag your cursor from a point inside the "NM" physiology and drop your cursor on the "Cyt_Nuc_membrane" geometry.
Geometry
Specifications
Protocols
Simulations
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.
Physiology (structures)
Geometry (subdomains)
Cyt
Nuc
NM
Nuc
Cyt
Cyt_Nuc_membrane
Structure
Subdomain
Cyt
Cyt
Nuc
Nuc
NM
Cyt_Nuc_membrane
1 [1]
Flux
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
CONNECTED (tanyamiller1221)
59.4MB / 109.6MB

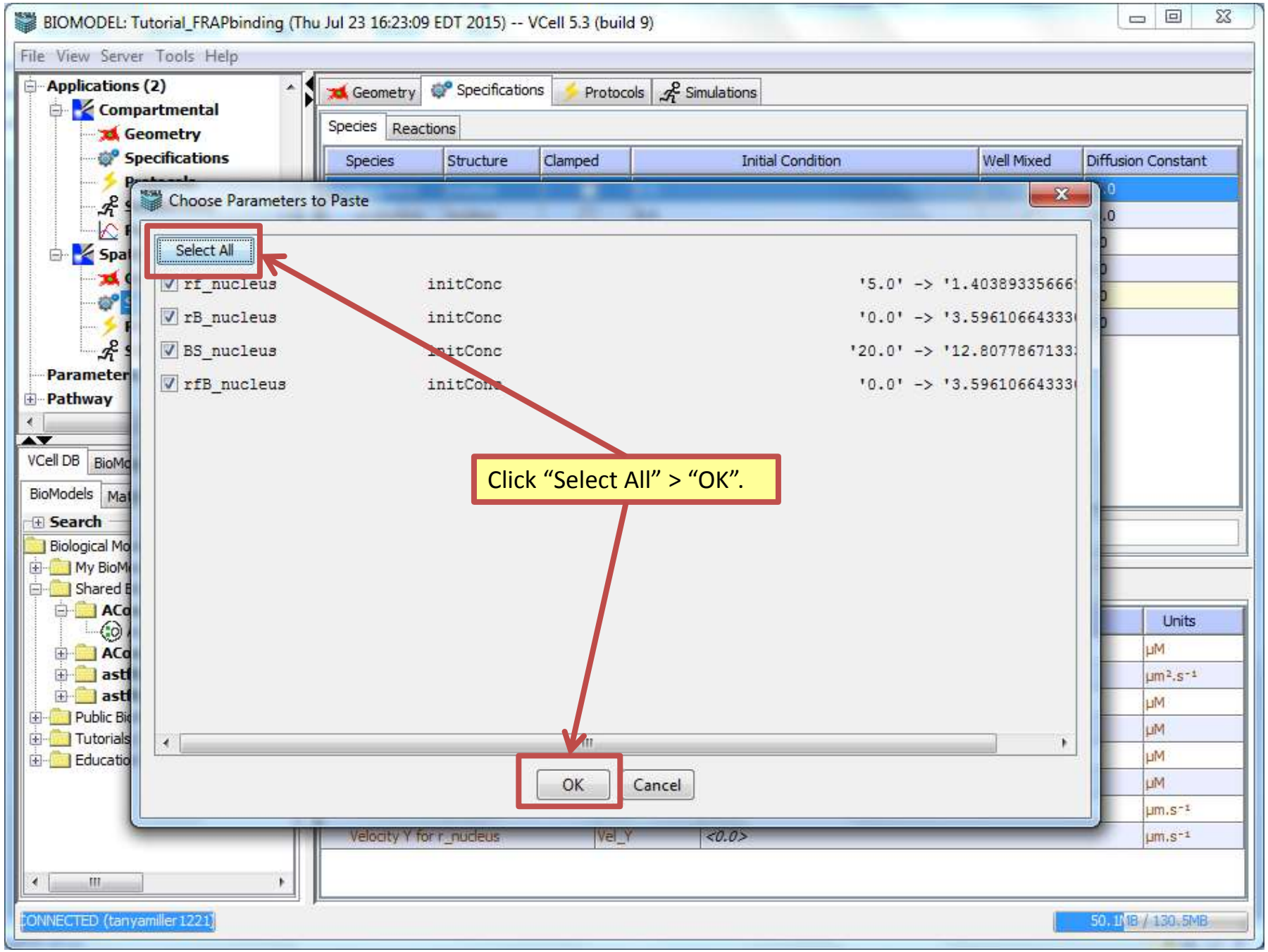

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Spatial
Parameters and Functions
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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
Runge-Kutta-Fehlberg
completed
yes
Click “Compartmental” > “ Simulations” > results icon.
CONNECTED (tanyamiller1221)
42.7MB / 110.1MB

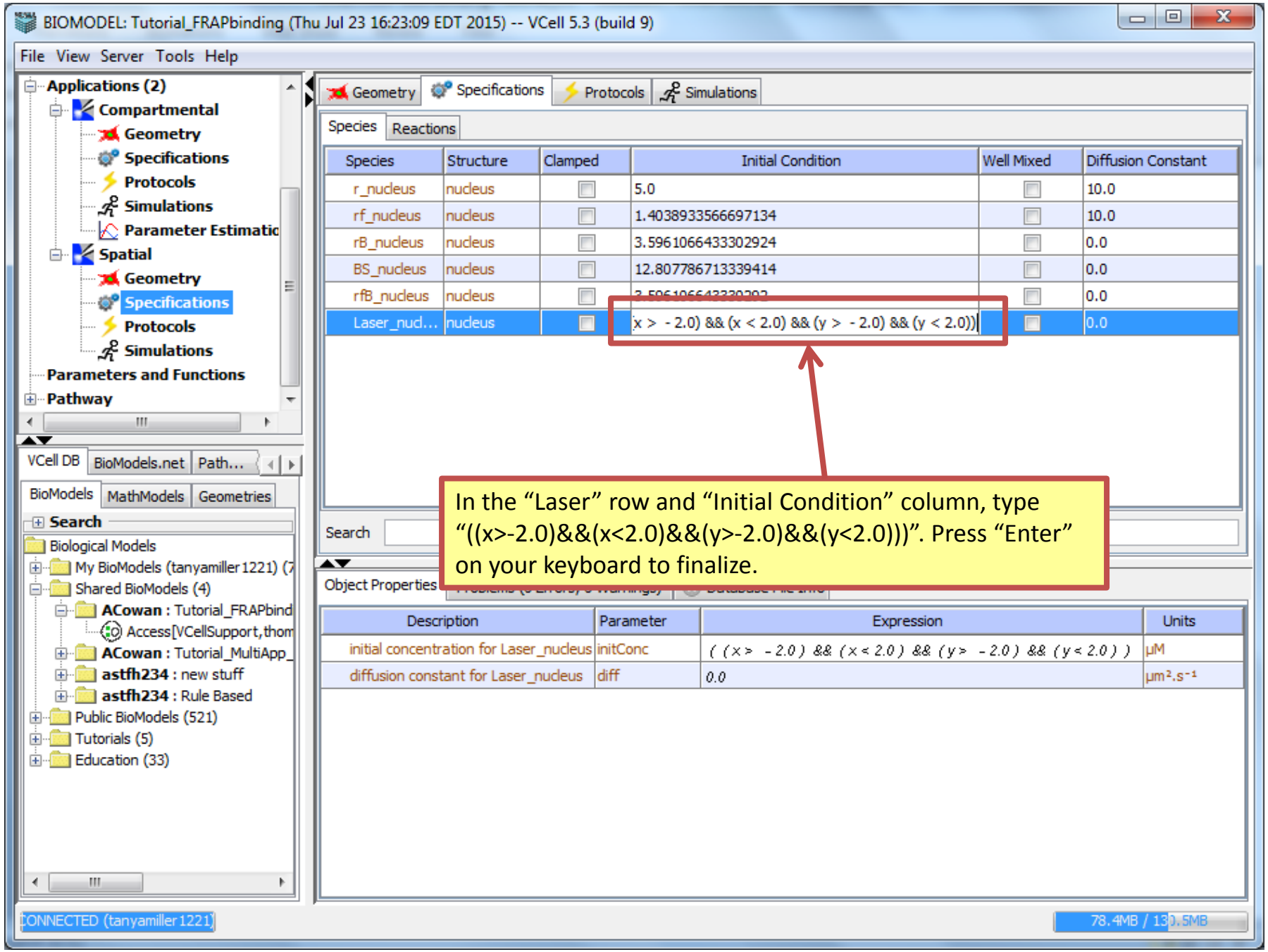

BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 5.3 (build 9)
File View Server Tools
simulation results for Simulation0
X Axis:
t
Y Axis:
Display Options:
Reactions
Species
t
BS
J_bleaching1
J_bleaching2
J_RAN_binding
J_RAN_FITC_binding
Laser
r
rB
rf
rfB
Plot Legend:
r
rB
5.0
4.0
3.0
2.0
1.0
0.0
0.0
10.0
20.0
30.0
t
Click the spreadsheet icon.
Physiology
Reaction Diagr
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartment
Geometry
Specificatio
Protocols
Simulation
Parameter
Spatial
Parameters and Func
VCell DB
BioModels.net
BioModels
MathModels
Search
TIR_FRAP1
TIR_FRAP2
Tutorial_FRAP
Tutorial_FRAPbin
Tutorial_MultiApp
Tutorial_MultiApp
Tutorial_PH-GFP
Utrophin_01
vFRAPtest1_AP
vFRAPtest1_AP
vFRAPtest1_AP
VICE FRAP 3-09
VICE FRAP Nuc
VirtualSensor
Status
Resu
yes
Finest Level
View Level
Scan
CONNECTED (ACowan)

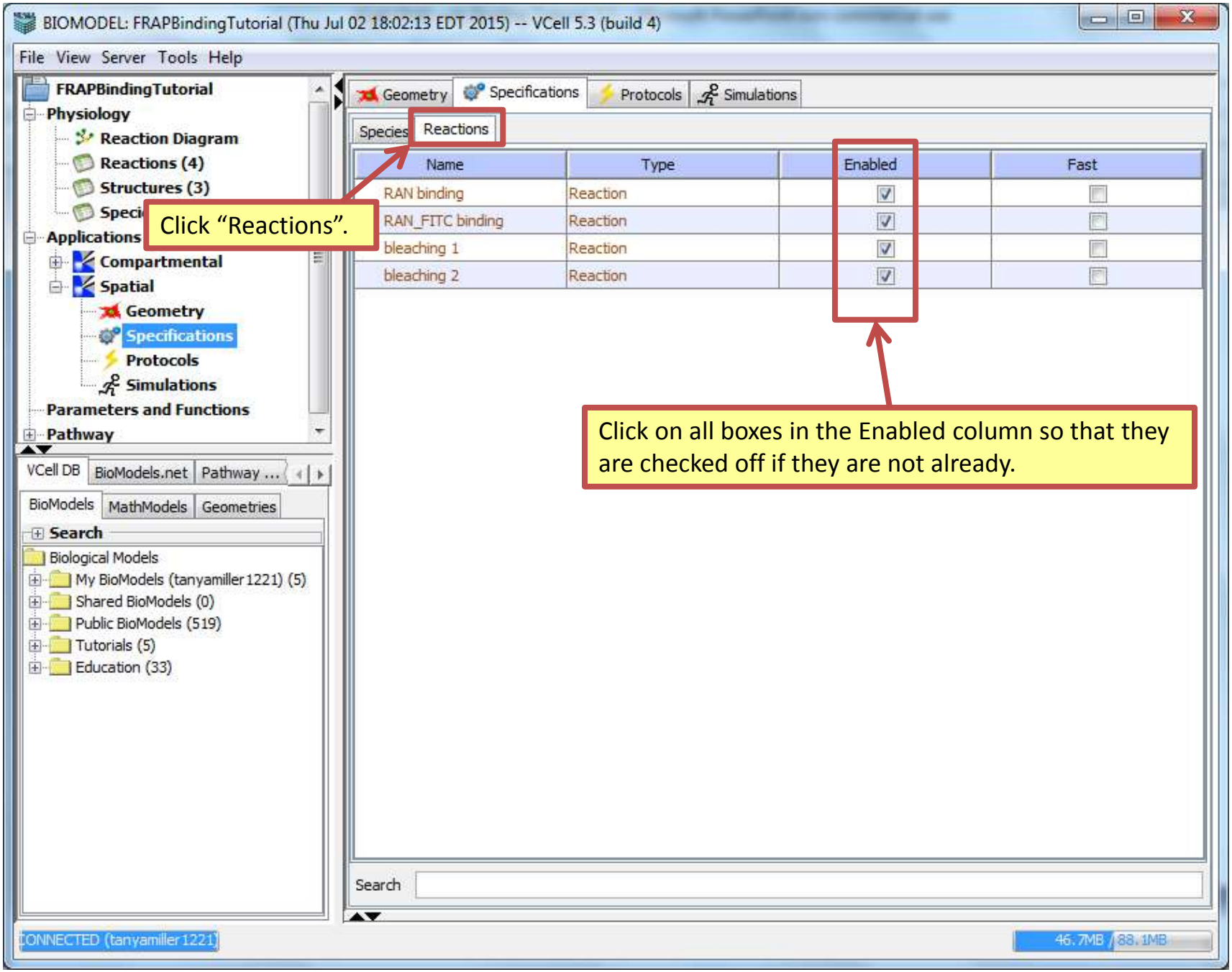

BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 5.3 (build 9)
File View Server Tools
simulation results for Simulation0
X Axis:
t
Y Axis:
Display Options:
Reactions
Species
BS
J_bleaching2
J_RAN_binding
J_RAN_FITC_binding
Laser
r
rB
rf
rfB
t | BS | r | rB | rf | rfB
0 | 20 | 5 | 0 | 5 | 0
4.776259... | 20 | 5 | 9.552535... | 5 | 9.552518...
4.776736... | 19.999998 | 4.999999 | 9.553470... | 4.999999 | 9.553470...
5.253932... | 19.999979 | 4.9999895 | 1.050784... | 4.9999895 | 1.050784...
2.332024... | 19.999907 | 4.9999534 | 4.664007... | 4.9999534 | 4.664007...
.424071... | 19.999743 | 4.9998715 | 1.284784... | 4.9998715 | 1.284784...
1.423373... | 19.999431 | 4.9997153 | 2.846604... | 4.9997153 | 2.846604...
2.825687... | 19.99887 | 4.9994349 | 5.650814... | 4.9994349 | 5.650814...
5.293824... | 19.997883 | 4.9989414 | 1.058568... | 4.9989414 | 1.058568...
9.658910... | 19.996138 | 4.9980689 | 1.931129... | 4.9980689 | 1.931129...
1.801728... | 19.992798 | 4.9963988 | 3.601186... | 4.9963988 | 3.601186...
.409863... | 19.986377 | 4.9931884 | 6.811598... | 4.9931884 | 6.811598...
.017998... | 19.979963 | 4.9899816 | 1.001840... | 4.9899816 | 1.001840...
.626133... | 19.973557 | 4.9867784 | 0.0132216 | 4.9867784 | 0.0132216
8.234268... | 19.967158 | 4.9835788 | 1.642120... | 4.9835788 | 1.642120...
9.842403... | 19.960766 | 4.9803828 | 0.01961721 | 4.9803828 | 0.01961721
1.165139... | 19.953584 | 4.9767919 | 2.320810... | 4.9767919 | 2.320810...
1.346037... | 19.946411 | 4.9732055 | 2.679446... | 4.9732055 | 2.679446...
1.526936... | 19.939247 | 4.9696237 | 3.037630... | 4.9696237 | 3.037630...
0.01817295 | 19.927768 | 4.963884 | 3.611602... | 4.963884 | 3.611602...
2.107653... | 19.916312 | 4.9581559 | 4.184413... | 4.9581559 | 4.184413...
2.398011... | 19.904879 | 4.9524393 | 4.756067... | 4.9524393 | 4.756067...
2.688369... | 19.893469 | 4.9467343 | 5.326566... | 4.9467343 | 5.326566...
3.199124... | 19.873454 | 4.9367269 | 6.327312... | 4.9367269 | 6.327312...
3.709879... | 19.85351 | 4.9267549 | 7.324511... | 4.9267549 | 7.324511...
4.220634... | 19.833636 | 4.9168182 | 8.318182... | 4.9168182 | 8.318182...
5.175343... | 19.796677 | 4.8983384 | 0.10166156 | 4.8983384 | 0.10166156
Press “Ctrl” on your keyboard and click “BS”, “rB”, “rf” and “rfB”.
Physiology
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Spatial
VCell DB
BioModels
Search
CONNECTED (ACowan)

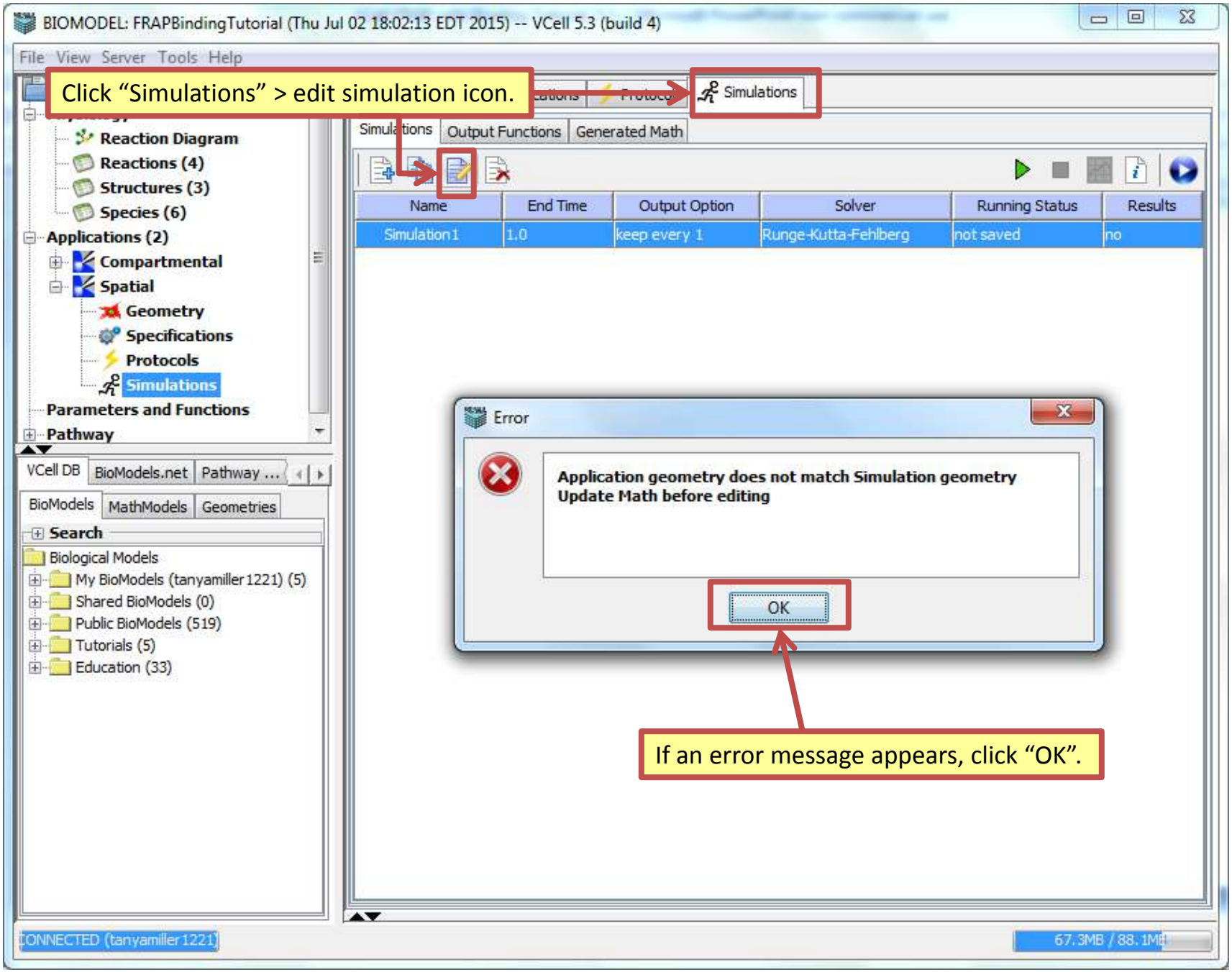

BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 5.3 (build 9)
File View Server Tools
simulation results for Simulation0
X Axis:
t
Y Axis:
Display Options:
Reactions
Species
t
BS
J_bleaching1
J_bleaching2
J_RAN_binding
J_RAN_FITC_binding
Laser
r
rB
rf
rfB
t | BS | rB | rf | rfB
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
28.242627 | 12.807811 | 3.5960946 | 1.4039054 | 3.5960946
28.733706 | 12.807802 | 3.5960989 | 1.4039011 | 3.5960989
29.224785 | 12.807795 | 3.5961024 | 1.4038976 | 3.5961024
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 “Copy”.
Tutorial_FRAPbindin
Physiology
Reaction Diagr
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartment
Geometry
Specificatio
Protocols
Simulations
Parameter
Spatial
Parameters and Func
VCell DB
BioModels.net
BioModels
MathModels
Search
TIR_FRAP1
TIR_FRAP2
Tutorial_FRAP
Tutorial_FRAPbin
Tutorial_MultiApp
Tutorial_MultiApp
Tutorial_PH-GFP
Utrophin_01
vFRAPtest1_AP
vFRAPtest1_AP
vFRAPtest1_AP
VICE FRAP 3-09
VICE FRAP Nuc
VirtualSensor
Status
Results
yes
Finest Level Mesh
View Level Mesh
Scan
CONNECTED (ACowan)
118.5MB
229.1MB

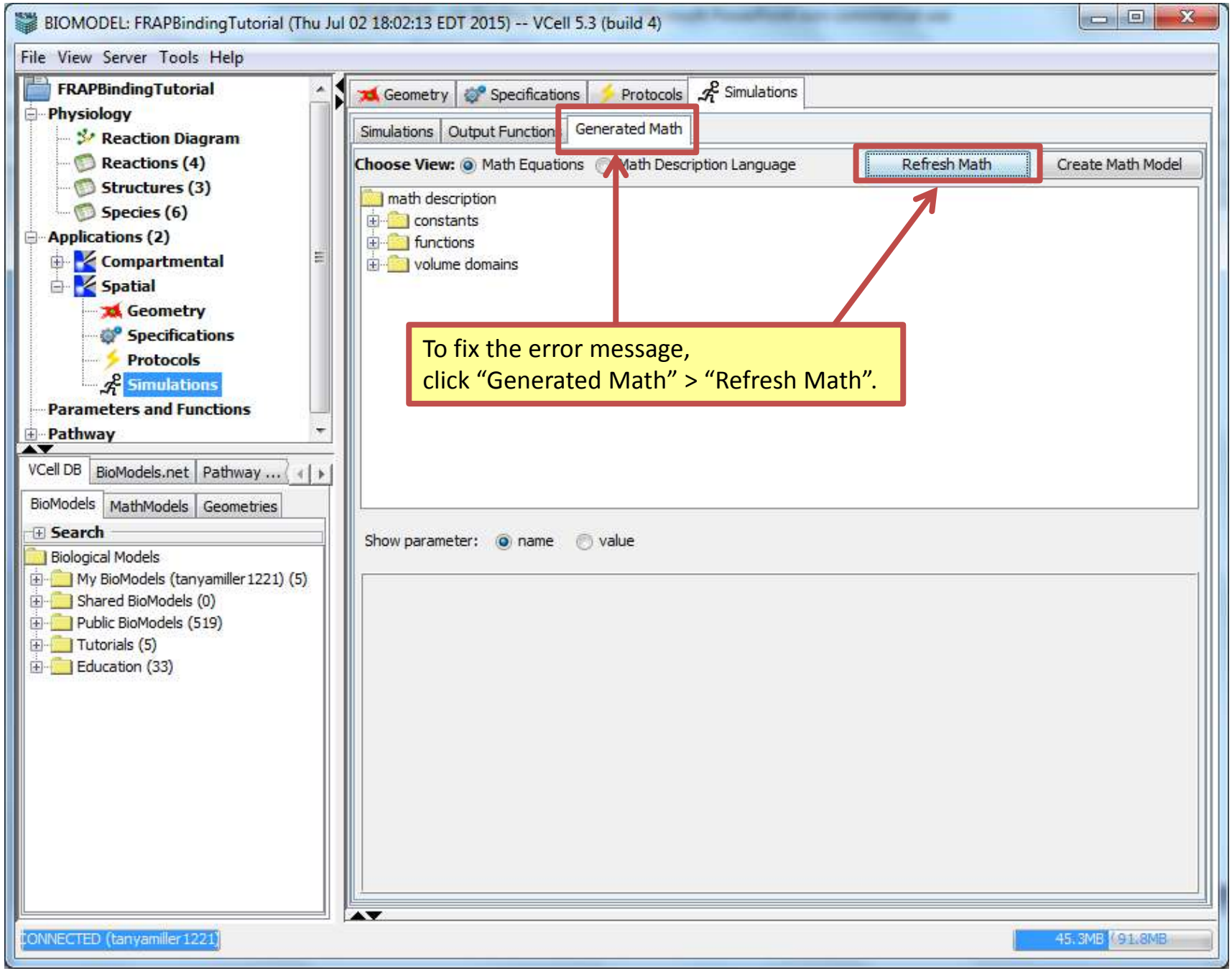

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Geometry
Specifications
Protocols
Simulations
Species
Reactions
Structure
Clamped
Initial Condition
Well Mixed
Diffusion Constant
r
rf
rB
BS
rfB
Laser
Nuc
5.0
Copy
Copy All
Paste
Paste All
Specify Column Value for Selected Row(s)
Clamped
Initial Condition
Well Mixed
Diffusion Constant
Click "Spatial" > "Specifications" > "Species".
Click on the first cell in the Initial Condition column. Right click "Paste All".
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Search
CONNECTED (tanyamiller1221)
71.3MB / 102.8MB

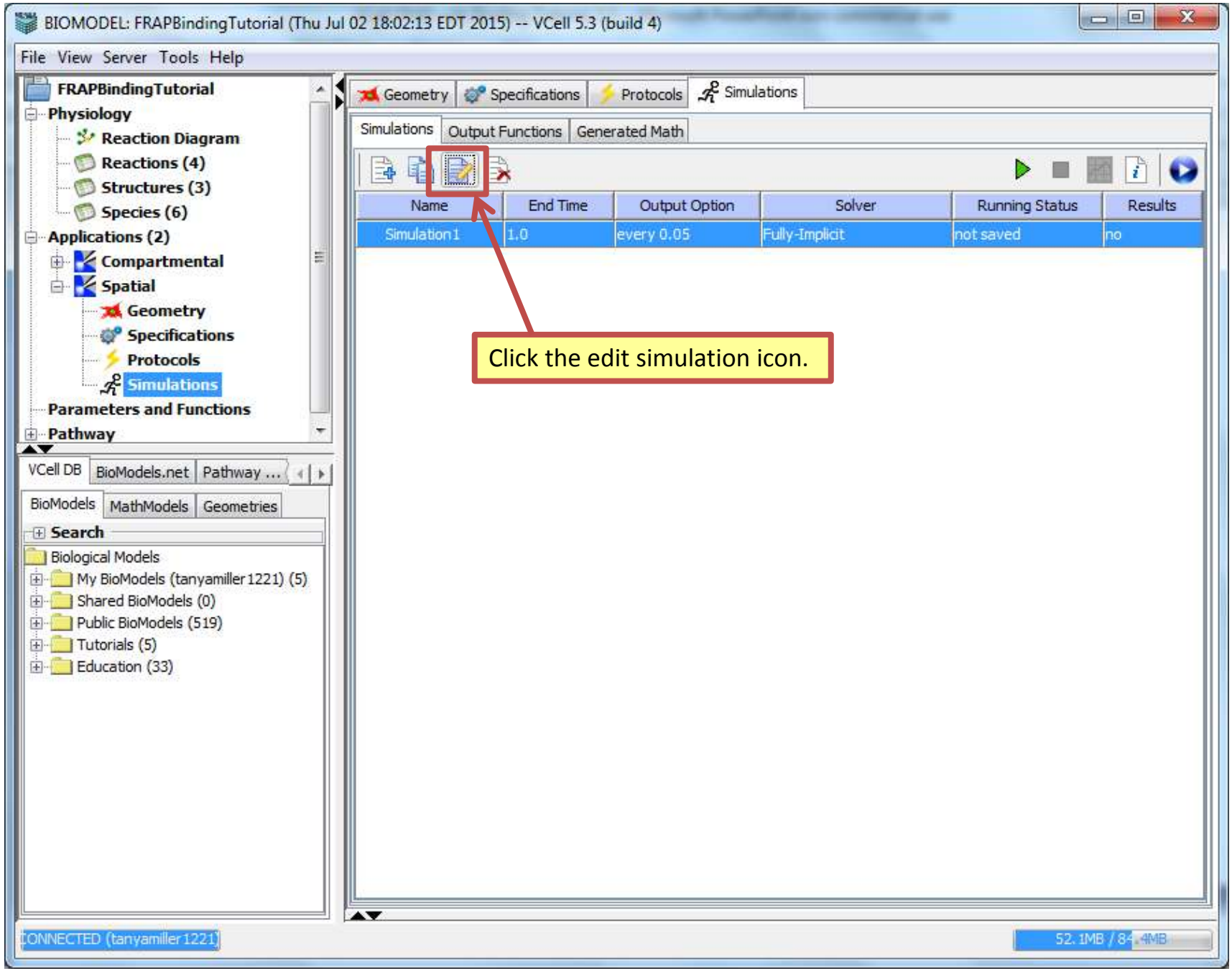

BIOMODEL: Tutorial_FRAPbinding (Thu Jul 23 16:23:09 EDT 2015) -- VCell 5.3 (build 9)
File View Server Tools Help
Applications (2)
Compartmental
Geometry
Specifications
Parameter
Pathway
Geometry
Specifications
Protocols
Simulations
Species
Reactions
Species
Structure
Clamped
Initial Condition
Well Mixed
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” > “OK”.
OK
Cancel
Units
Velocity Y for r_nucleus
Vel_Y
<0.0>
CONNECTED (tanyamiller1221)
50.1MB / 130.5MB

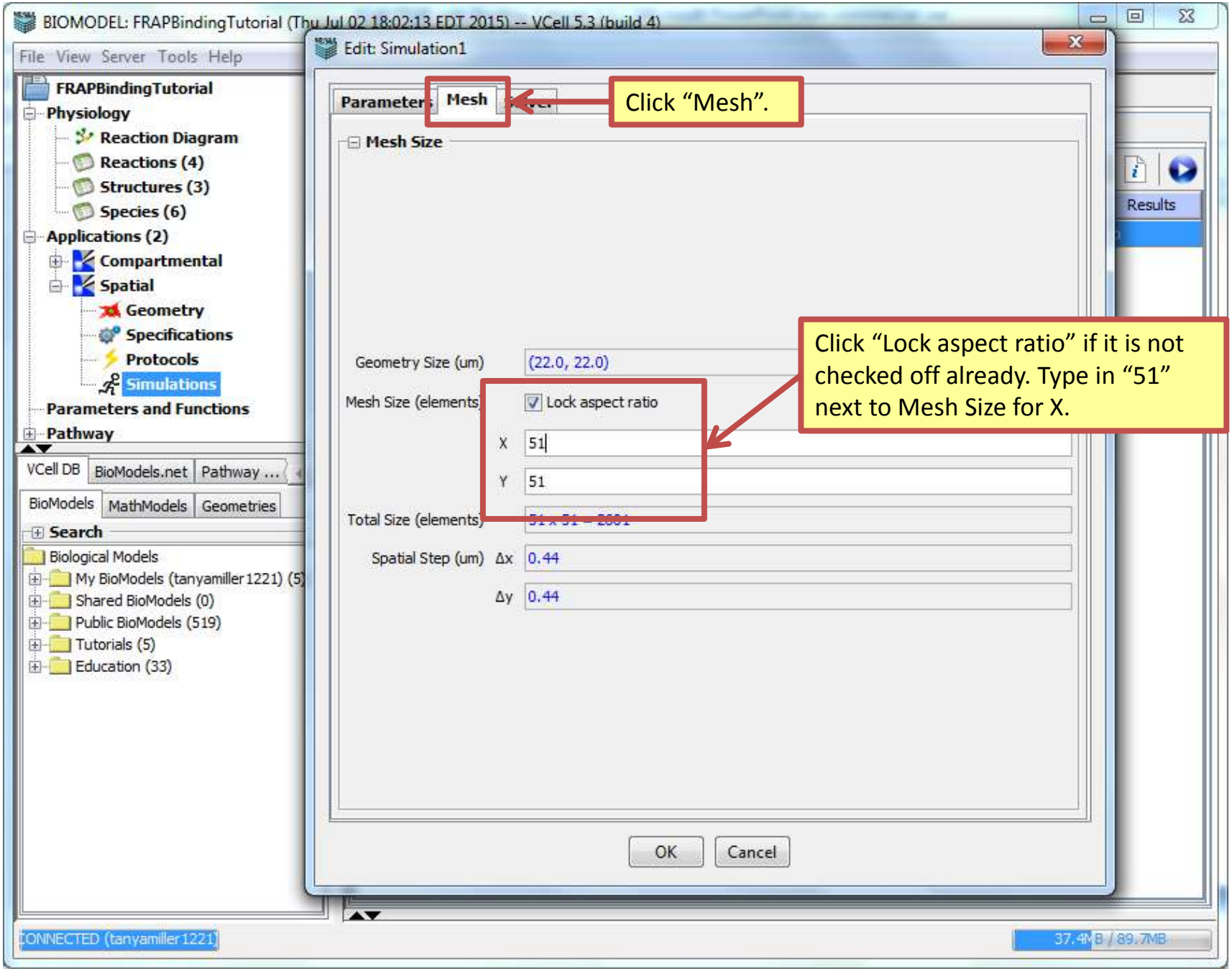

BIOMODEL: Tutorial_FRAPbinding (Thu Jul 23 16:23:09 EDT 2015) -- VCell 5.3 (build 9)
File View Server Tools Help
Applications (2)
Compartmental
Geometry
Specifications
Protocols
Simulations
Parameter Estimatic
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
VCell 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)
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
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.
Object Properties
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

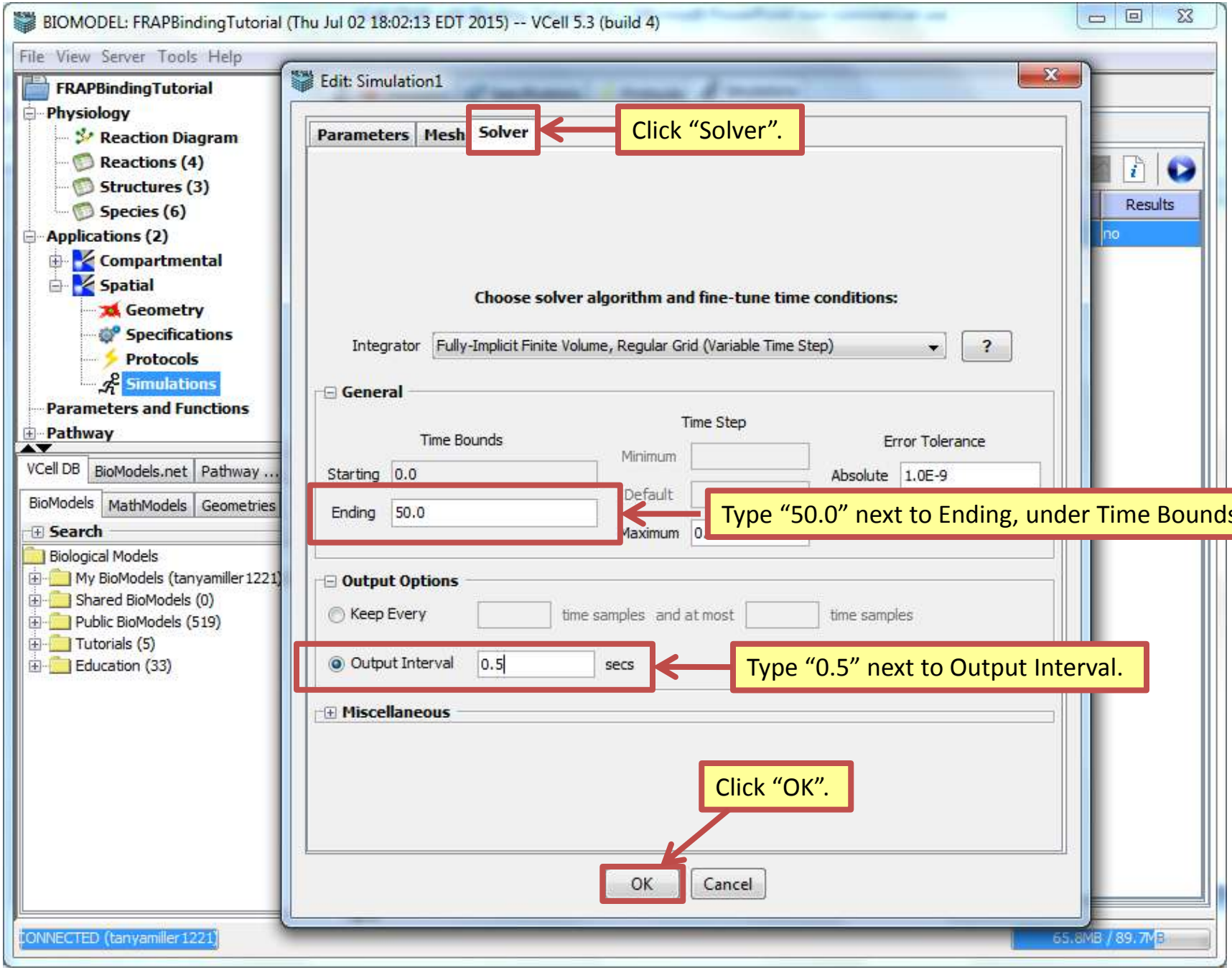

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Applications
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
Geometry
Specifications
Protocols
Simulations
Species
Reactions
Name
Type
Enabled
Fast
RAN binding
Reaction
RAN_FITC binding
Reaction
bleaching 1
Reaction
bleaching 2
Reaction
Click "Reactions".
Click on all boxes in the Enabled column so that they are checked off if they are not already.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Search
CONNECTED (tanyamiller1221)
46.7MB / 88.1MB

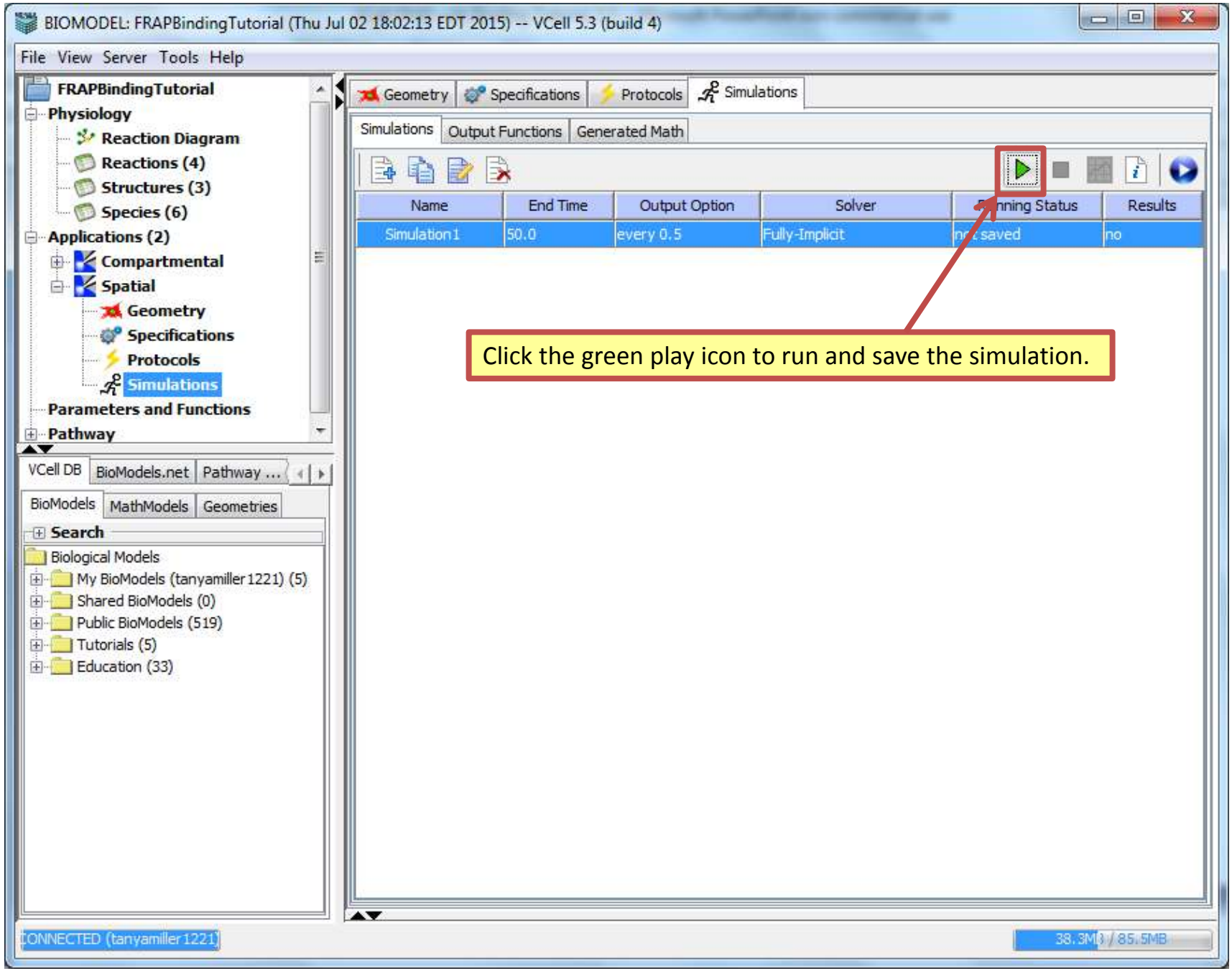

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
Click “Simulations” > edit simulation icon.
Simulations
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation1
1.0
keep every 1
Runge-Kutta-Fehlberg
not saved
no
Error
Application geometry does not match Simulation geometry
Update Math before editing
OK
If an error message appears, click “OK”.
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
67.3MB / 88.1MB

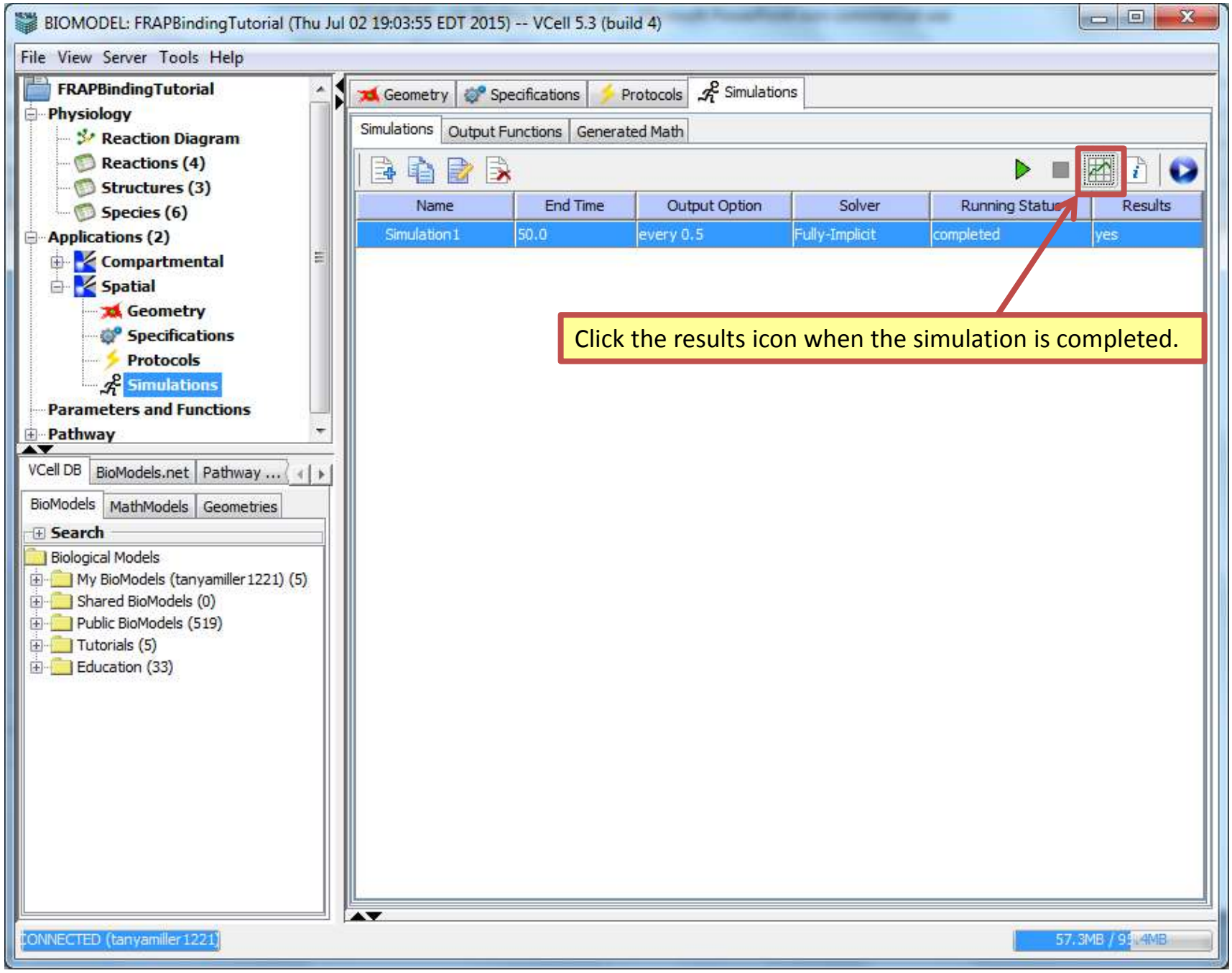

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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
To fix the error message,
click “Generated Math” > “Refresh Math”.
Show parameter: name
value
CONNECTED (tanyamiller1221)
45.3MB
91.8MB

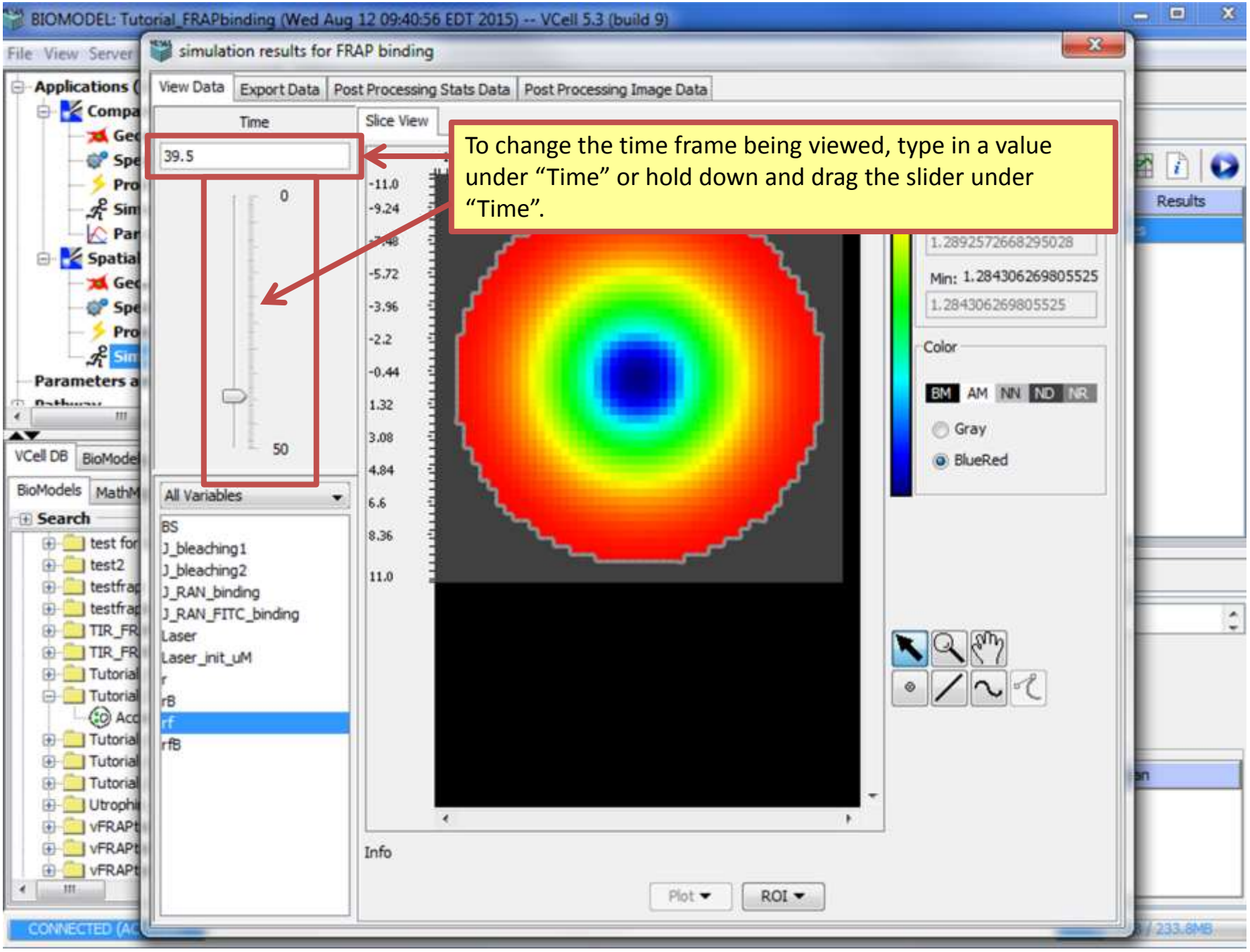

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation1
1.0
every 0.05
Fully-Implicit
not saved
no
Click the edit simulation icon.
CONNECTED (tanyamiller1221)
52.1MB / 84.4MB

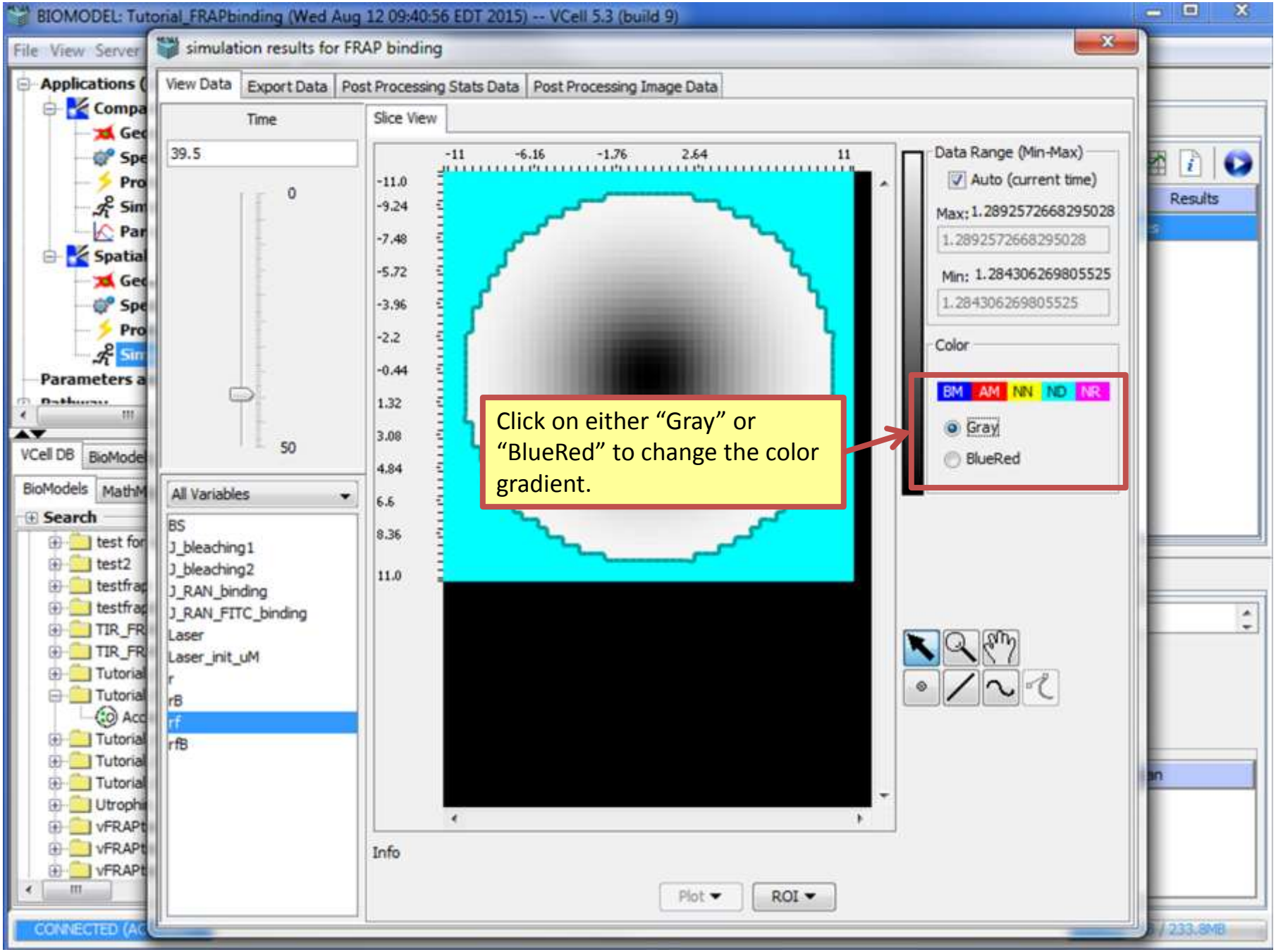

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
Edit: Simulation1
Parameters
Mesh
Click "Mesh".
Mesh Size
Geometry Size (um)
(22.0, 22.0)
Mesh Size (elements)
Lock aspect ratio
X
51
Y
51
Total Size (elements)
Spatial Step (um) Δx
0.44
Δy
0.44
Click "Lock aspect ratio" if it is not checked off already. Type in "51" next to Mesh Size for X.
OK
Cancel
Results
37.4MB / 89.7MB

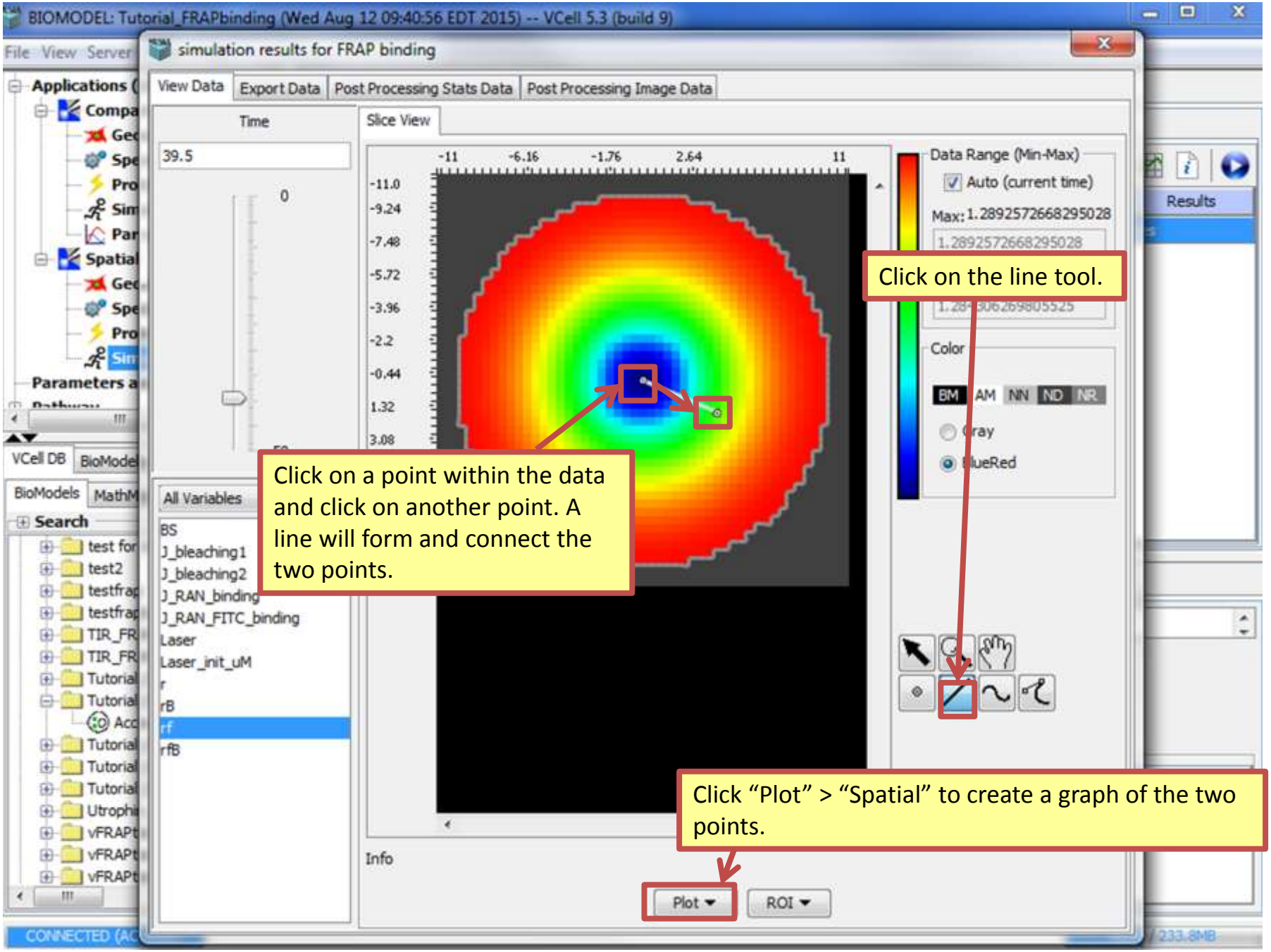

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
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
Error Tolerance
Absolute
1.0E-9
Type "50.0" next to Ending, under Time Bounds.
Output Options
Keep Every
time samples and at most
time samples
Output Interval
0.5
secs
Type "0.5" next to Output Interval.
Miscellaneous
Click "OK".
OK
Cancel
Results
no
65.8MB / 89.7MB

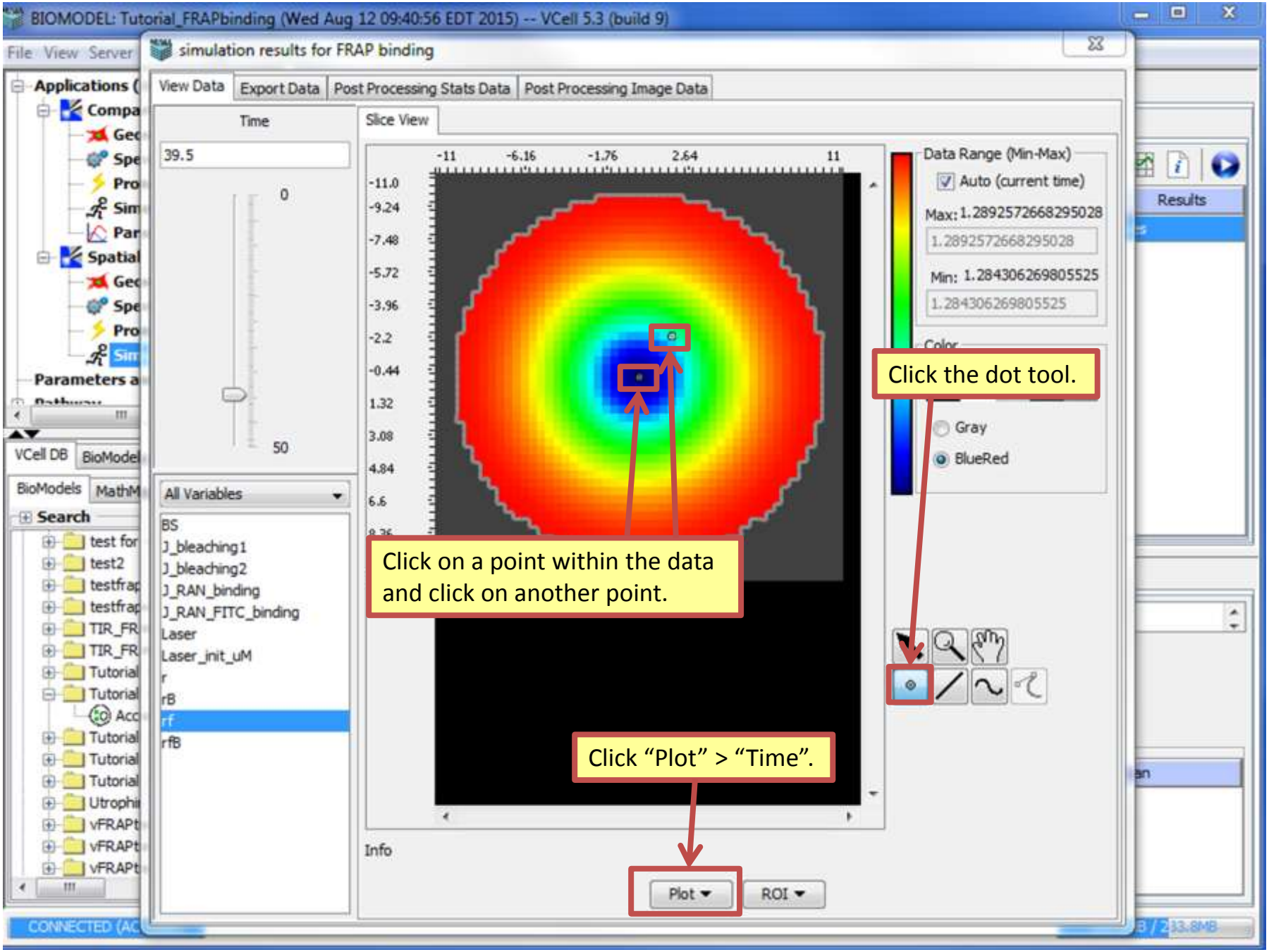

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 18:02:13 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Status
Results
Simulation1
50.0
every 0.5
Fully-Implicit
not saved
no
Click the green play icon to run and save the simulation.
CONNECTED (tanyamiller1221)
38.3M / 85.5MB

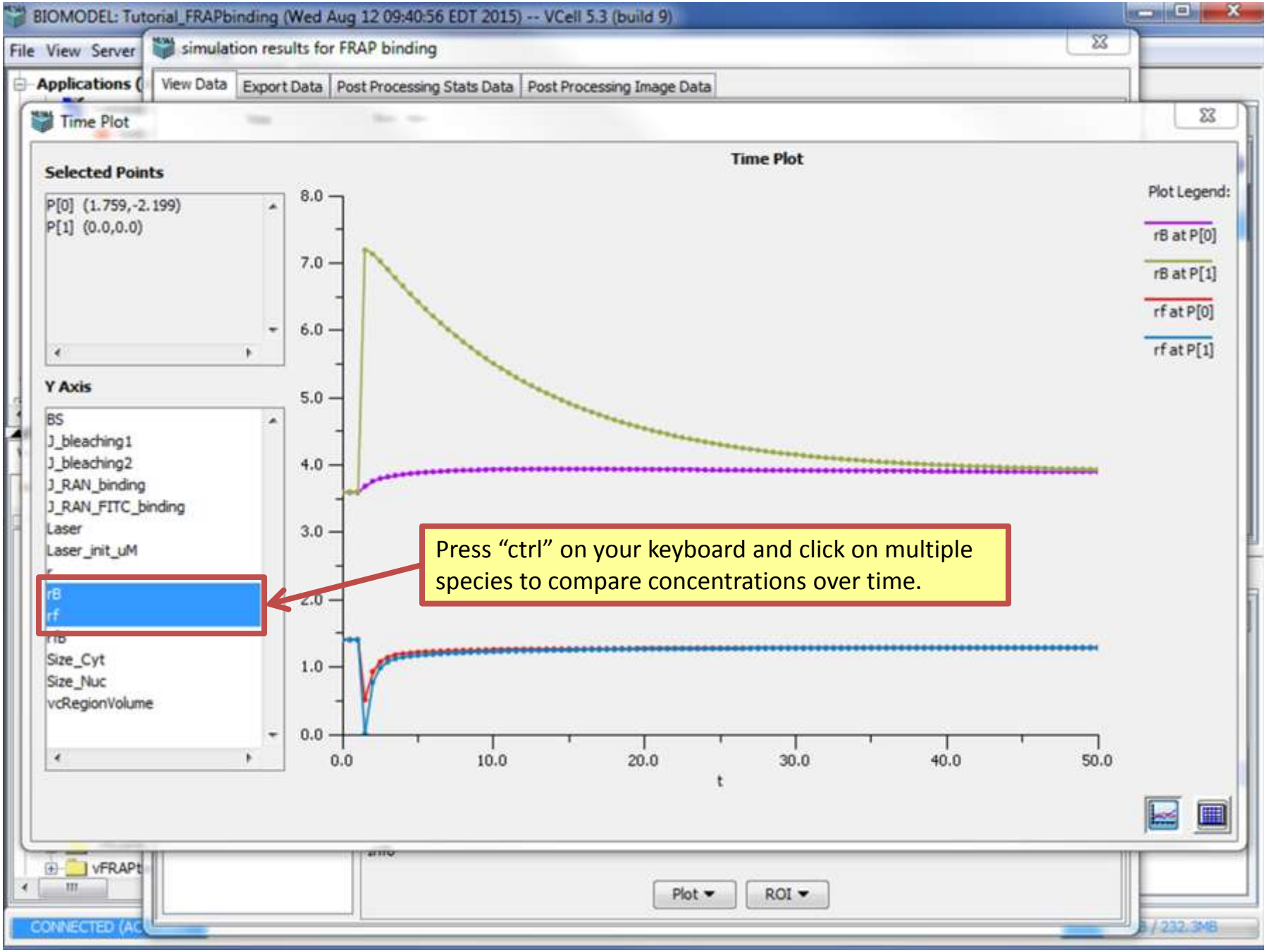

BIOMODEL: FRAPBindingTutorial (Thu Jul 02 19:03:55 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPBindingTutorial
Physiology
Reaction Diagram
Reactions (4)
Structures (3)
Species (6)
Applications (2)
Compartmental
Spatial
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Pathway
VCell DB
BioModels.net
Pathway ...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (5)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Simulations
Output Functions
Generated Math
Name
End Time
Output Option
Solver
Running Statu
Results
Simulation1
50.0
every 0.5
Fully-Implicit
completed
yes
Click the results icon when the simulation is completed.
CONNECTED (tanyamiller1221)
57.3MB / 9


BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 5.3 (build 9)
simulation results for FRAP binding
View Data
Export Data
Post Processing Stats Data
Post Processing Image Data
Time
39.5
0
50
Slice View
To change the time frame being viewed, type in a value under "Time" or hold down and drag the slider under "Time".
All Variables
BS
J_bleaching1
J_bleaching2
J_RAN_binding
J_RAN_FITC_binding
Laser
Laser_init_uM
r
rB
rf
rfB
Color
BM
AM
NN
ND
NR
Gray
BlueRed
Min: 1.284306269805525
Info
Plot
ROI


BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 5.3 (build 9)
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
Min: 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
Click on either “Gray” or “BlueRed” to change the color gradient.
Info
Plot
ROI


BIOMODEL: Tutorial_FRAPbinding (Wed Aug 12 09:40:56 EDT 2015) -- VCell 5.3 (build 9)
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)
Color
BM
AM
NN
ND
NR
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 5.3 (build 9)
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
Min: 1.284306269805525
Color
Gray
BlueRed
All Variables
BS
J_bleaching1
J_bleaching2
J_RAN_binding
J_RAN_FITC_binding
Laser
Laser_init_uM
r
rB
rf
rfB
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 5.3 (build 9)
File View Server
simulation results for FRAP binding
Applications
View Data
Export Data
Post Processing Stats Data
Post Processing Image Data
Time Plot
Time Plot
Selected Points
P[0] (1.759,-2.199)
P[1] (0.0,0.0)
Y Axis
BS
J_bleaching1
J_bleaching2
J_RAN_binding
J_RAN_FITC_binding
Laser
Laser_init_uM
rB
rf
Size_Cyt
Size_Nuc
vcRegionVolume
Plot Legend:
rB at P[0]
rB at P[1]
rf at P[0]
rf at P[1]
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
CONNECTED (AC

Contents

Next VCell tutorial: PIP2 to IP3