Contents

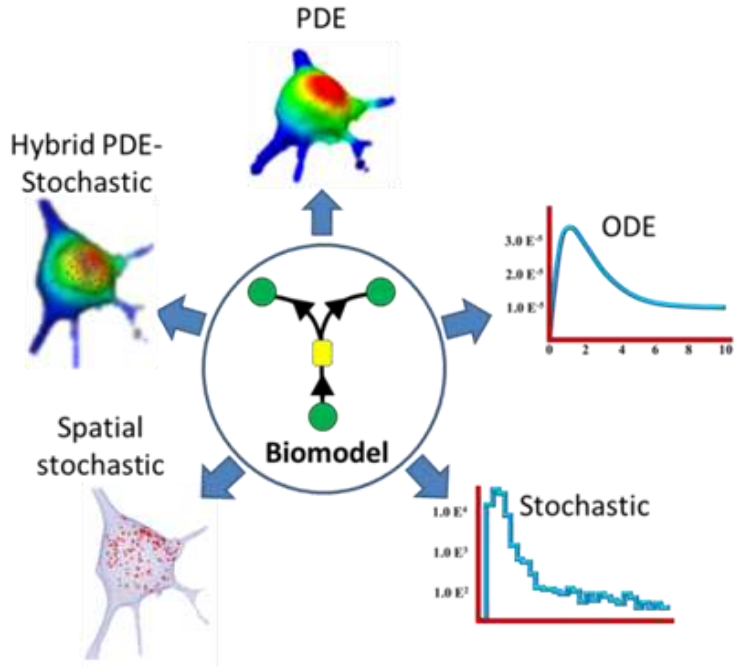
Virtual Cell Tutorials

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: Fluorescence Redistribution After Photo bleaching

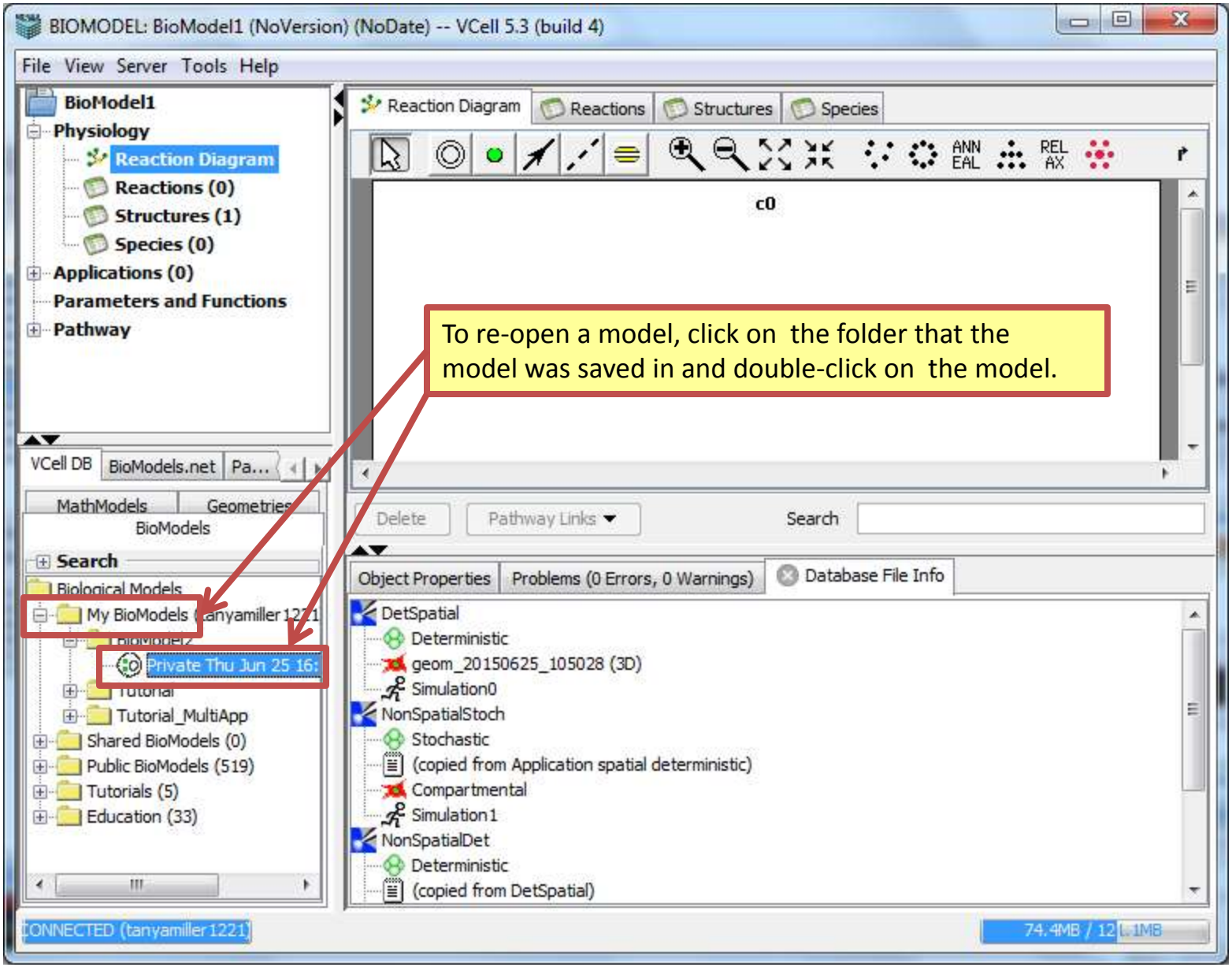
Create a simple biomodel and spatial (PDE) application to simulate a photobleaching experiment and view the results.

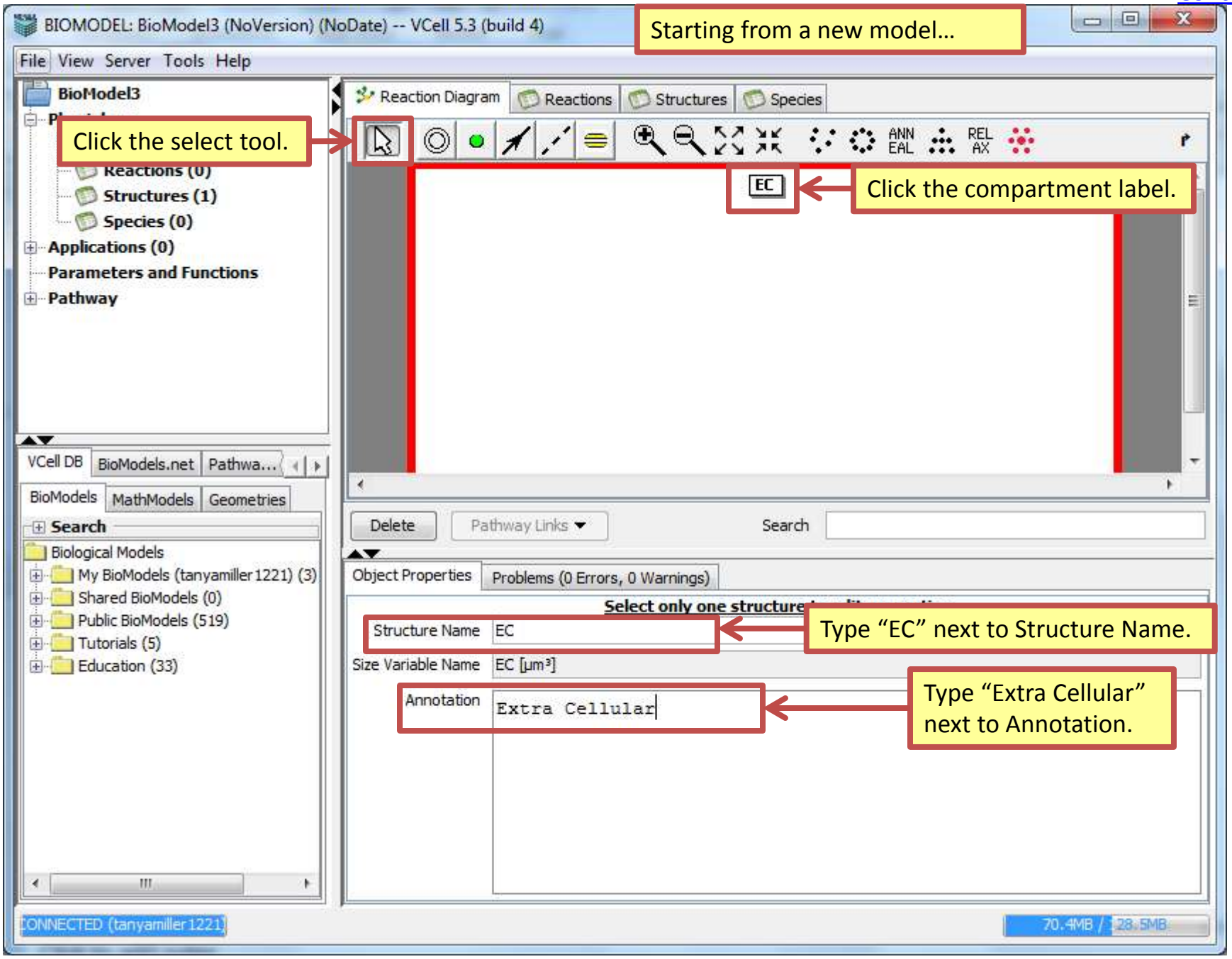
Contents

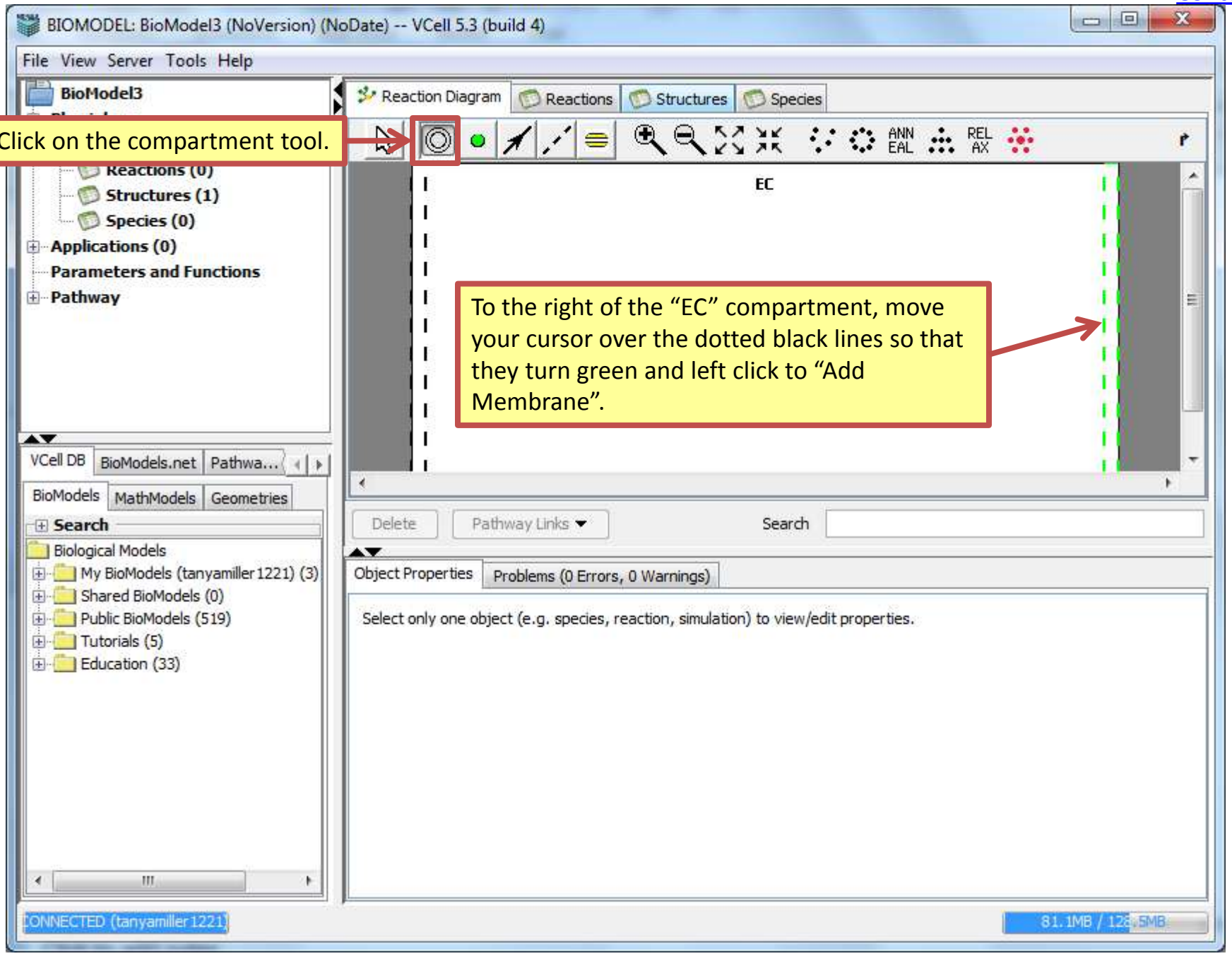
In this tutorial…

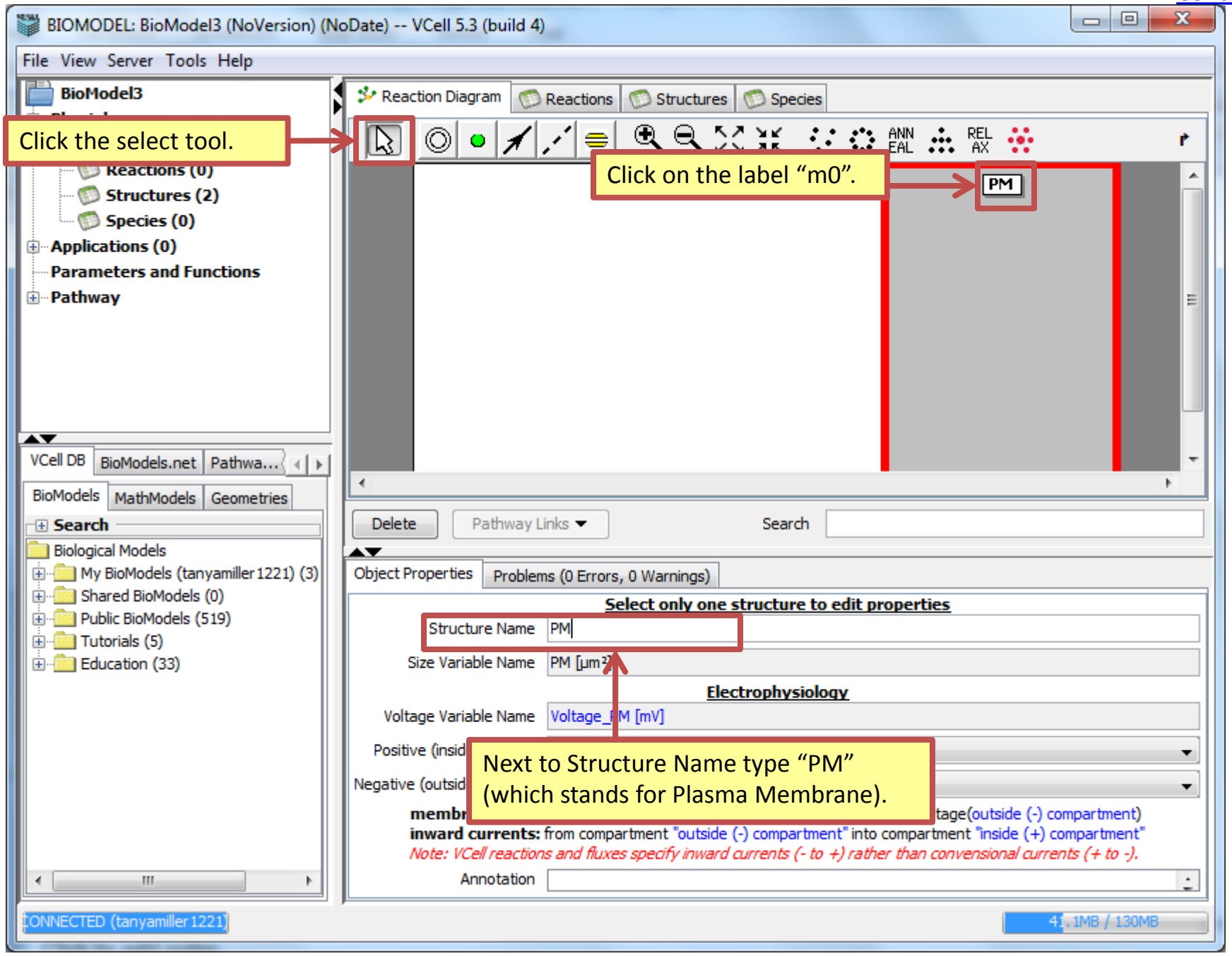
- Gain a basic introduction to the Virtual Cell interface
- Create a very simple biomodel with species but no reactions
- Create a spatial deterministic (PDE) application of a model using analytic equations to create a simple geometry
- Define initial concentrations that are non-uniform using Boolean expressions
- View and analyze results of a spatial simulation

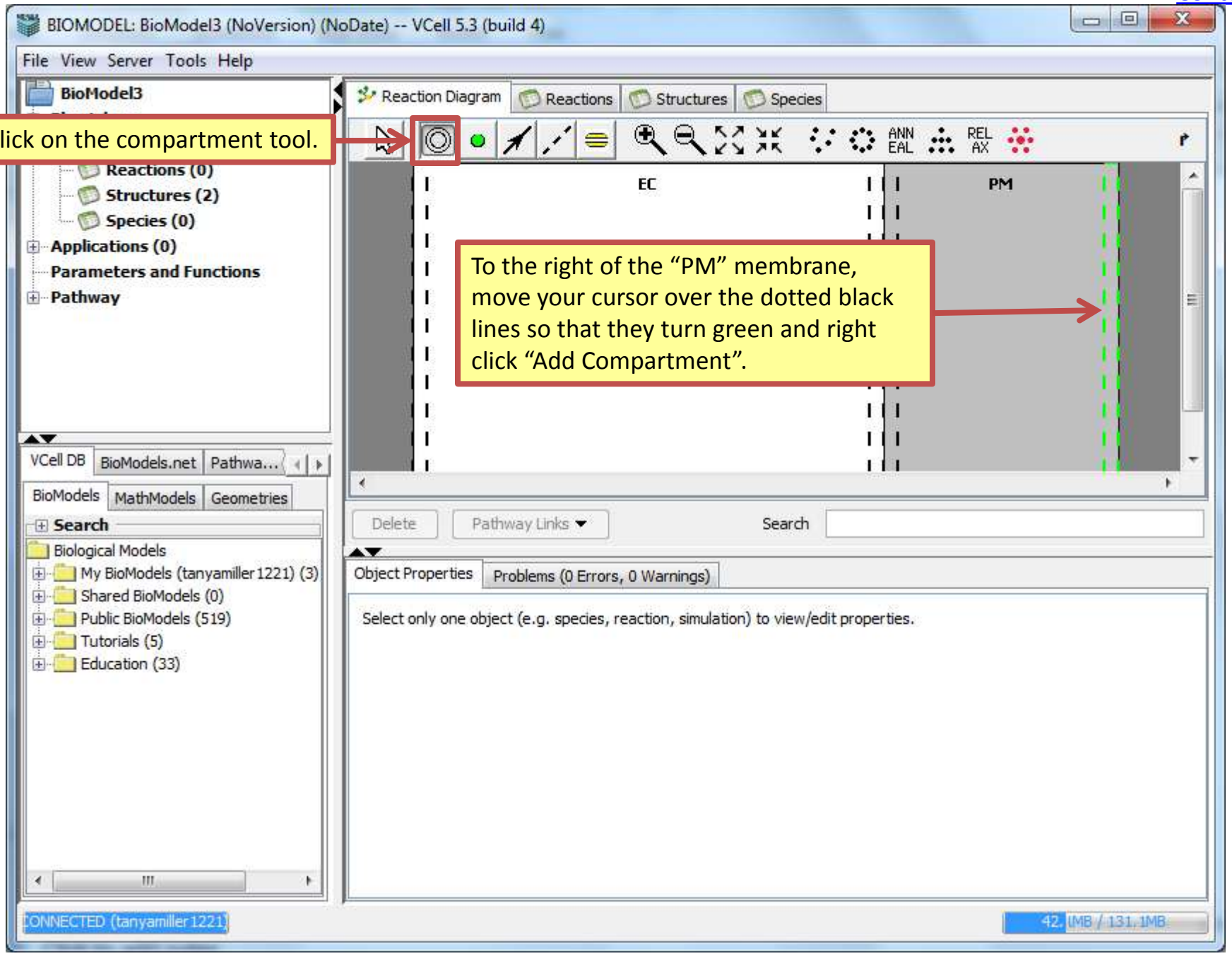
Table of contents

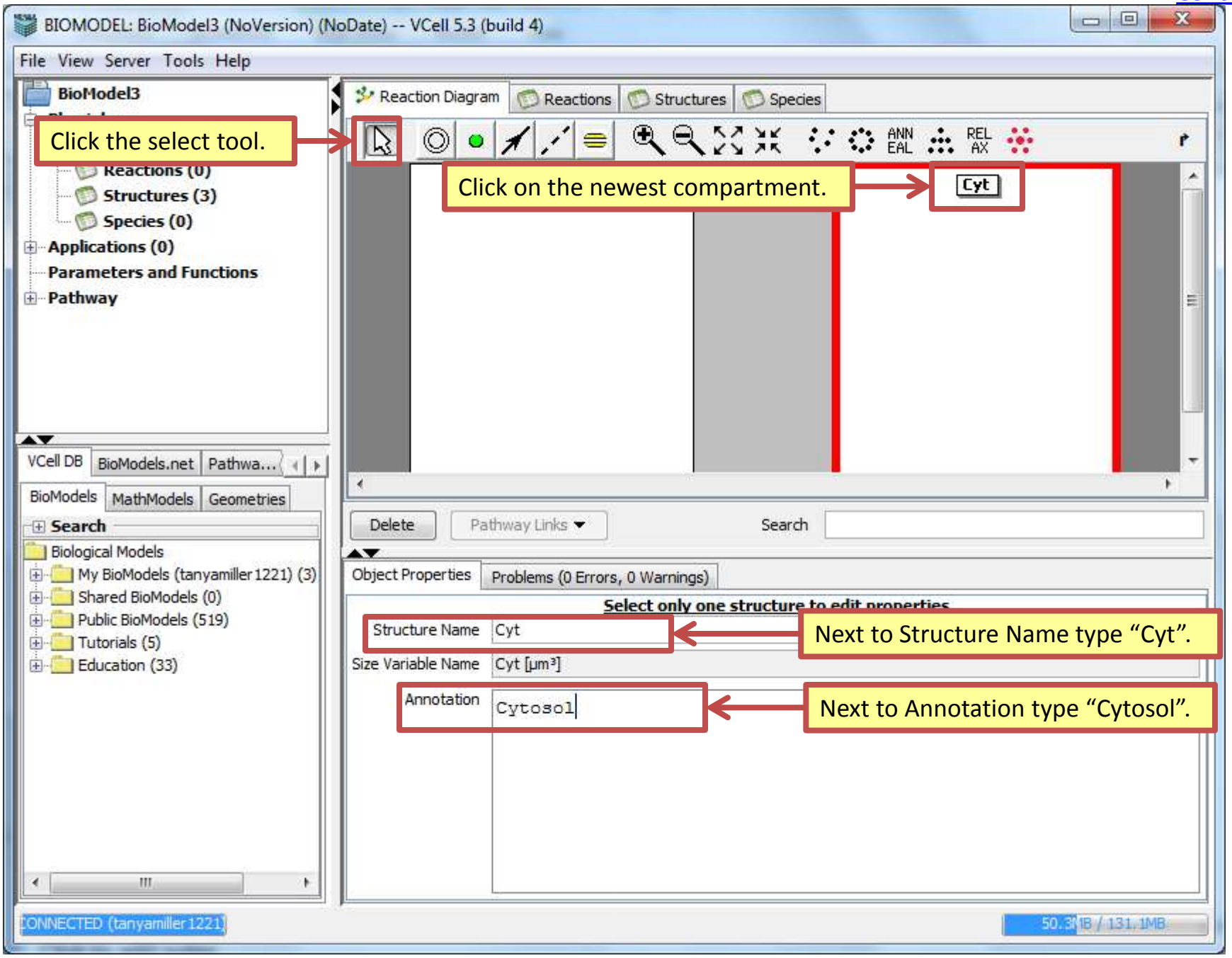

BIOMODEL: BioModel1 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel1
Physiology
Reaction Diagram
Reactions (0)
Structures (1)
Species (0)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
c0
To re-open a model, click on the folder that the model was saved in and double-click on the model.
VCell DB
BioModels.net
MathModels
Geometries
BioModels
Search
Biological Models
My BioModels
Private Thu Jun 25 16:
Tutorial_MultiApp
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Database File Info
DetSpatial
Deterministic
geom_20150625_105028 (3D)
Simulation0
NonSpatialStoch
Stochastic
(copied from Application spatial deterministic)
Compartmental
Simulation1
NonSpatialDet
Deterministic
(copied from DetSpatial)
CONNECTED (tanyamiller1221)

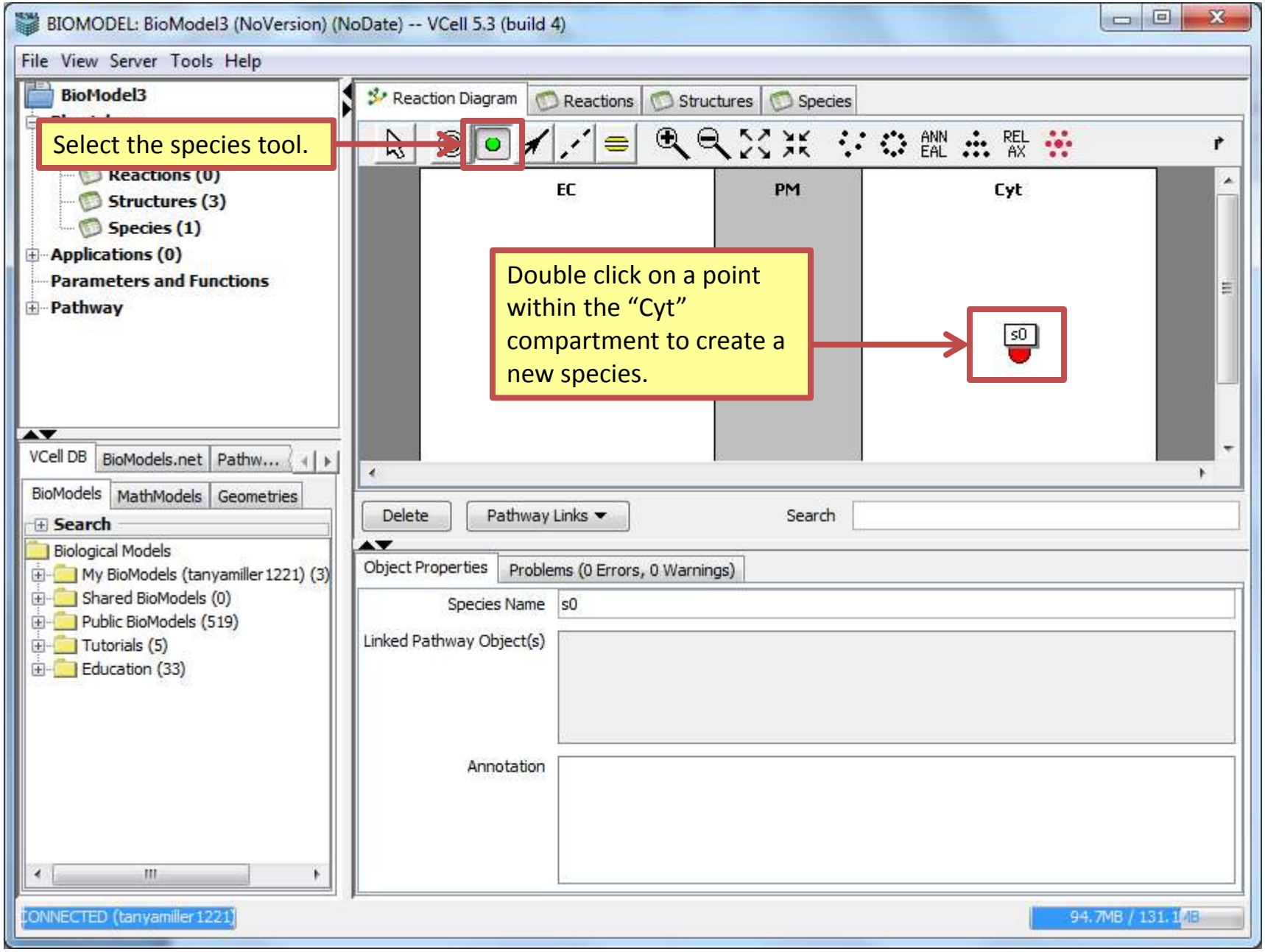

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
Starting from a new model…
File View Server Tools Help
BioModel3
Reactions (0)
Structures (1)
Species (0)
Applications (0)
Parameters and Functions
Pathway
Click the select tool.
Reaction Diagram
Reactions
Structures
Species
EC
Click the compartment label.
VCell DB
BioModels.net
Pathwa...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
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
Structure Name
EC
Type “EC” next to Structure Name.
Size Variable Name
EC [µm³]
Annotation
Extra Cellular
Type “Extra Cellular” next to Annotation.
CONNECTED (tanyamiller1221)
70.4MB / 28.5MB

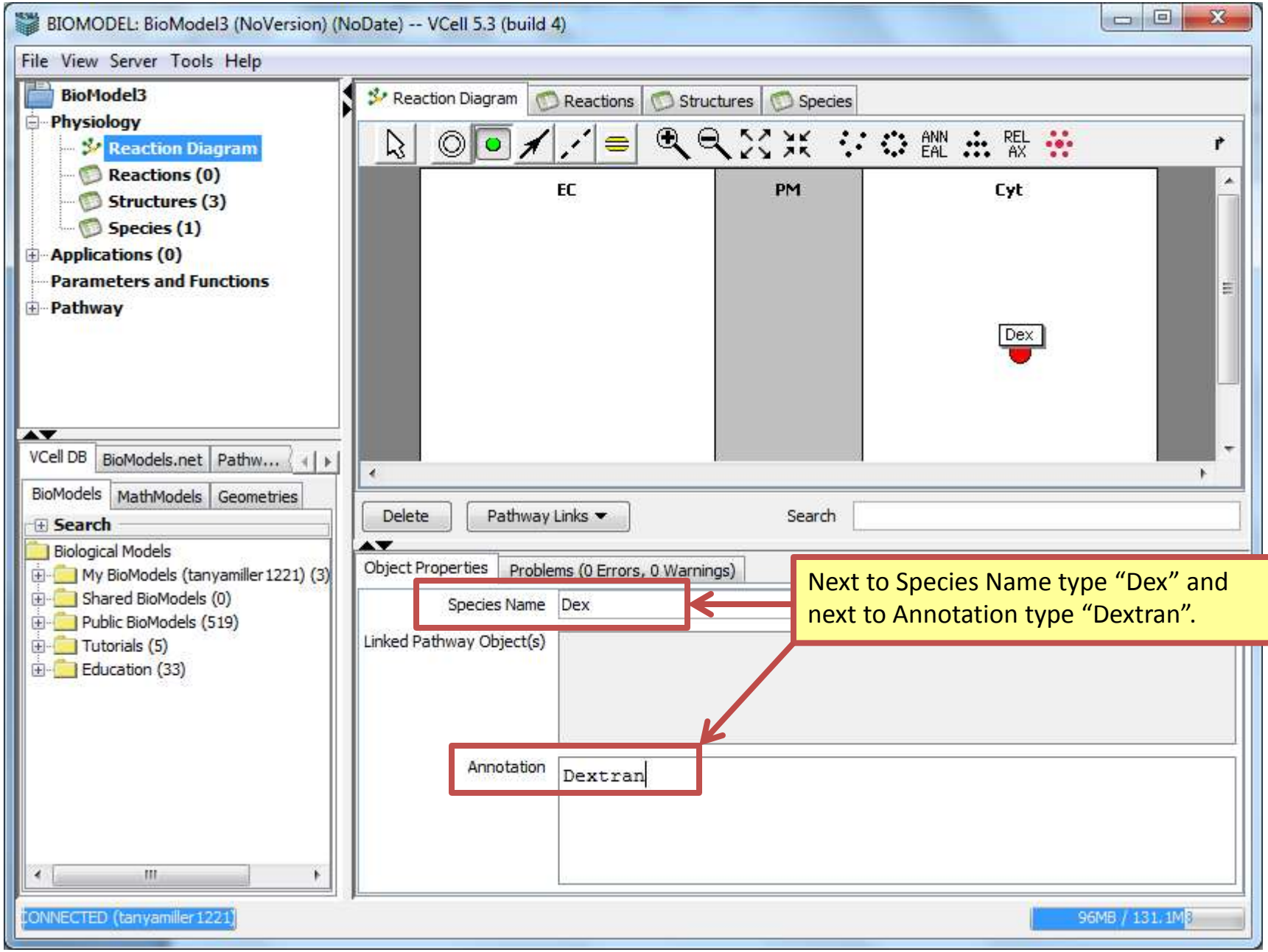

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Reactions (0)
Structures (1)
Species (0)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
EC
Click on the compartment tool.
To the right of the "EC" compartment, move your cursor over the dotted black lines so that they turn green and left click to "Add Membrane".
VCell DB
BioModels.net
Pathwa...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
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)

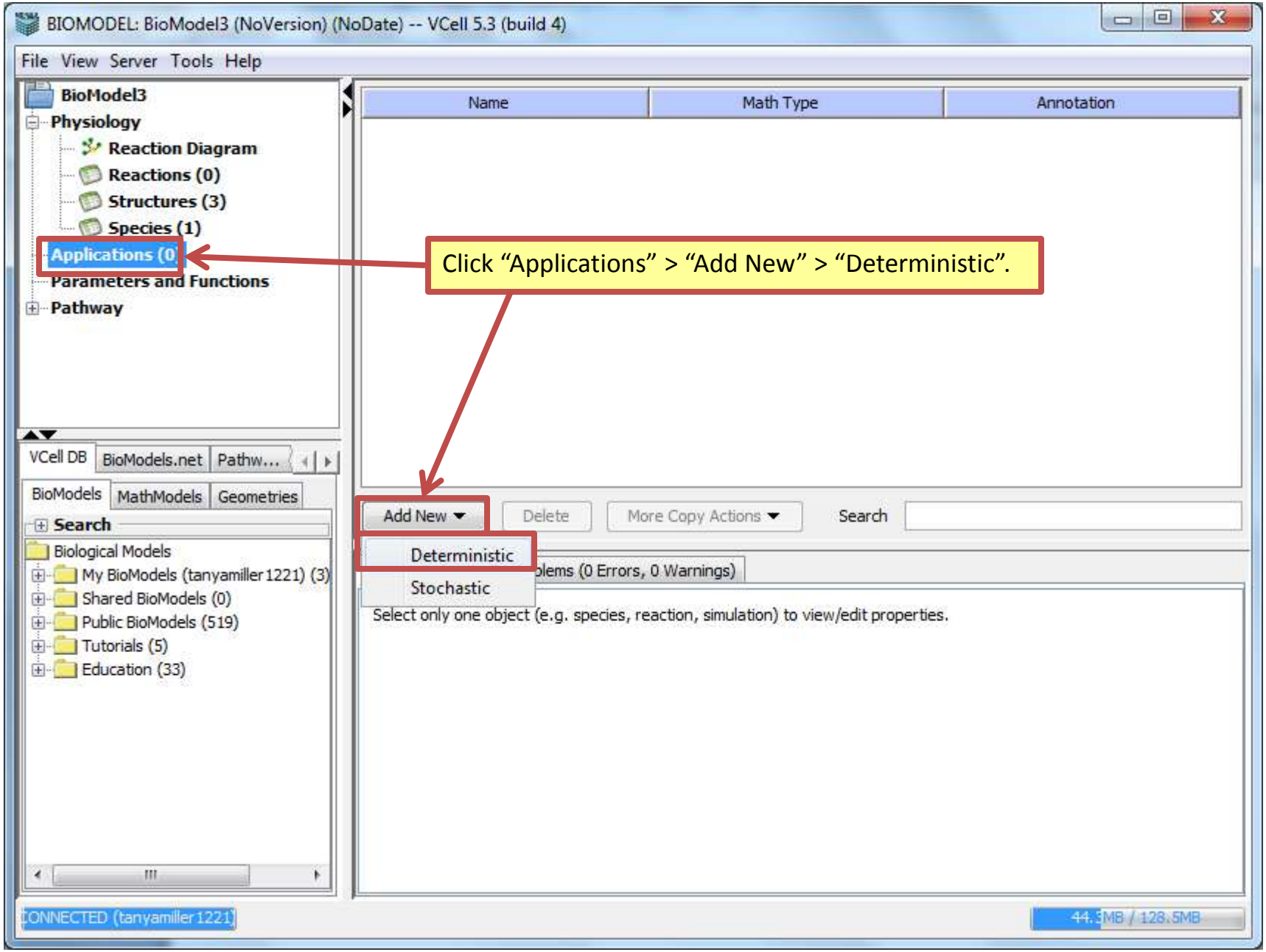

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Reactions (0)
Structures (2)
Species (0)
Applications (0)
Parameters and Functions
Pathway
Click the select tool.
Reaction Diagram
Reactions
Structures
Species
Click on the label "m0".
PM
VCell DB
BioModels.net
Pathwa...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
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
PM
Size Variable Name
PM [µm²]
Electrophysiology
Voltage Variable Name
Voltage_PM [mV]
Positive (insid
Negative (outsid
Next to Structure Name type "PM"
(which stands for Plasma Membrane).
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)
MB / 130MB

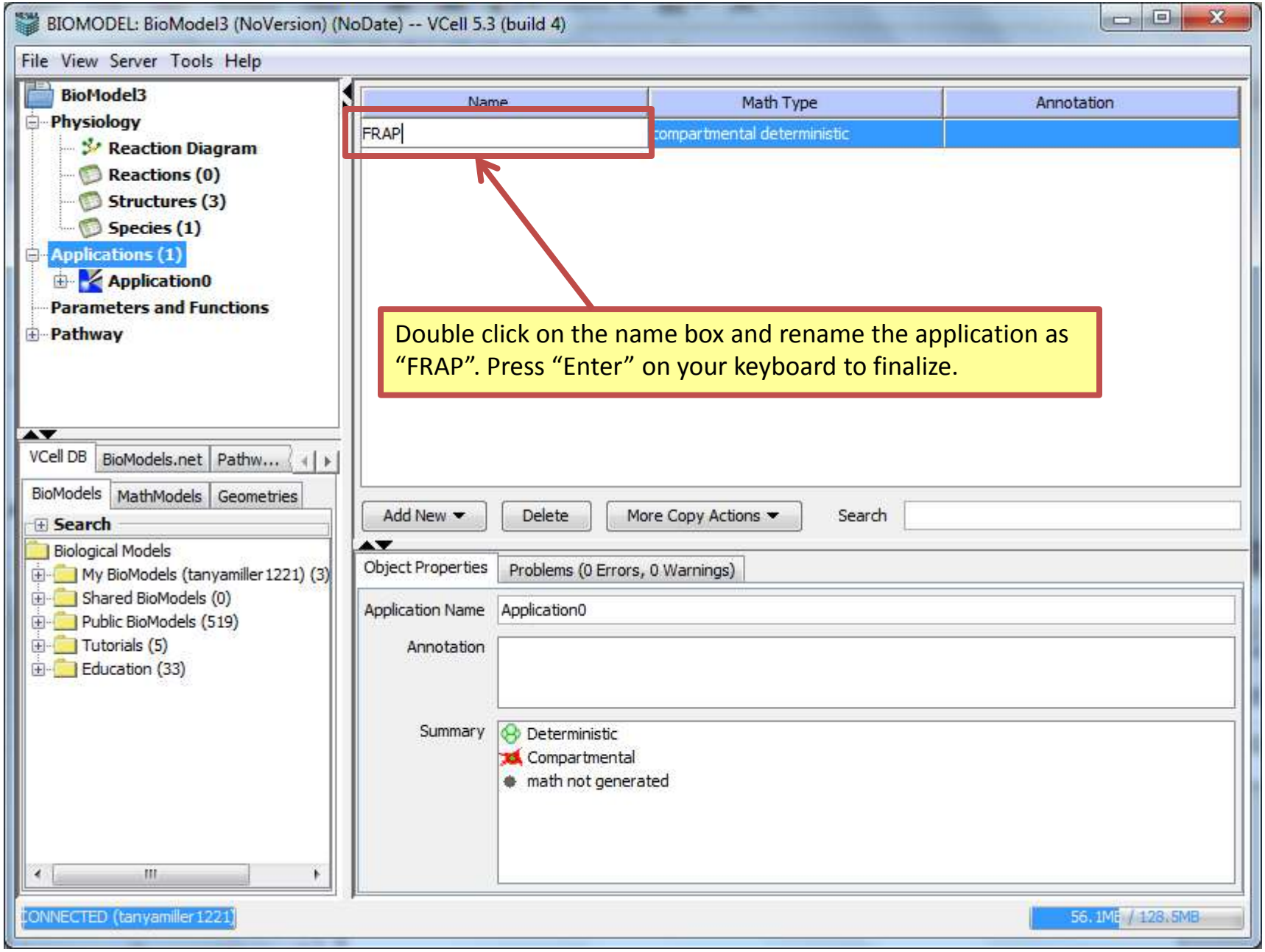

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Reactions (0)
Structures (2)
Species (0)
Applications (0)
Parameters and Functions
Pathway
Click on the compartment tool.
Reaction Diagram
Reactions
Structures
Species
EC
PM
To the right of the "PM" membrane, move your cursor over the dotted black lines so that they turn green and right click "Add Compartment".
Delete
Pathway Links
Search
VCell DB
BioModels.net
Pathwa...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (tanyamiller1221)
42. MB / 131. 1MB

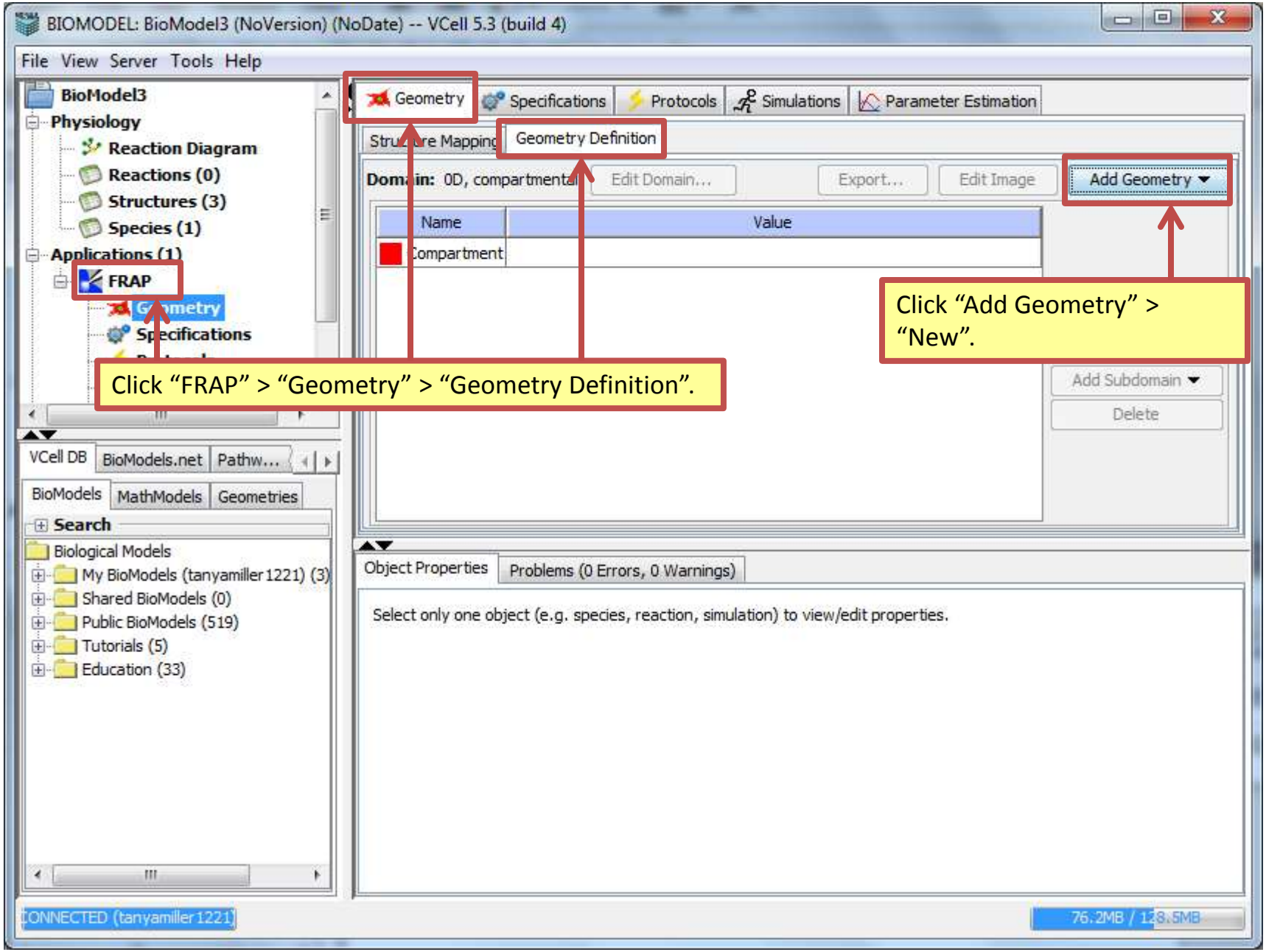

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Reactions (0)
Structures (3)
Species (0)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
Click the select tool.
Click on the newest compartment.
Cyt
VCell DB
BioModels.net
Pathwa...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
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
Cyt
Next to Structure Name type “Cyt”.
Size Variable Name
Cyt [µm³]
Annotation
Cytosol
Next to Annotation type “Cytosol”.
CONNECTED (tanyamiller1221)

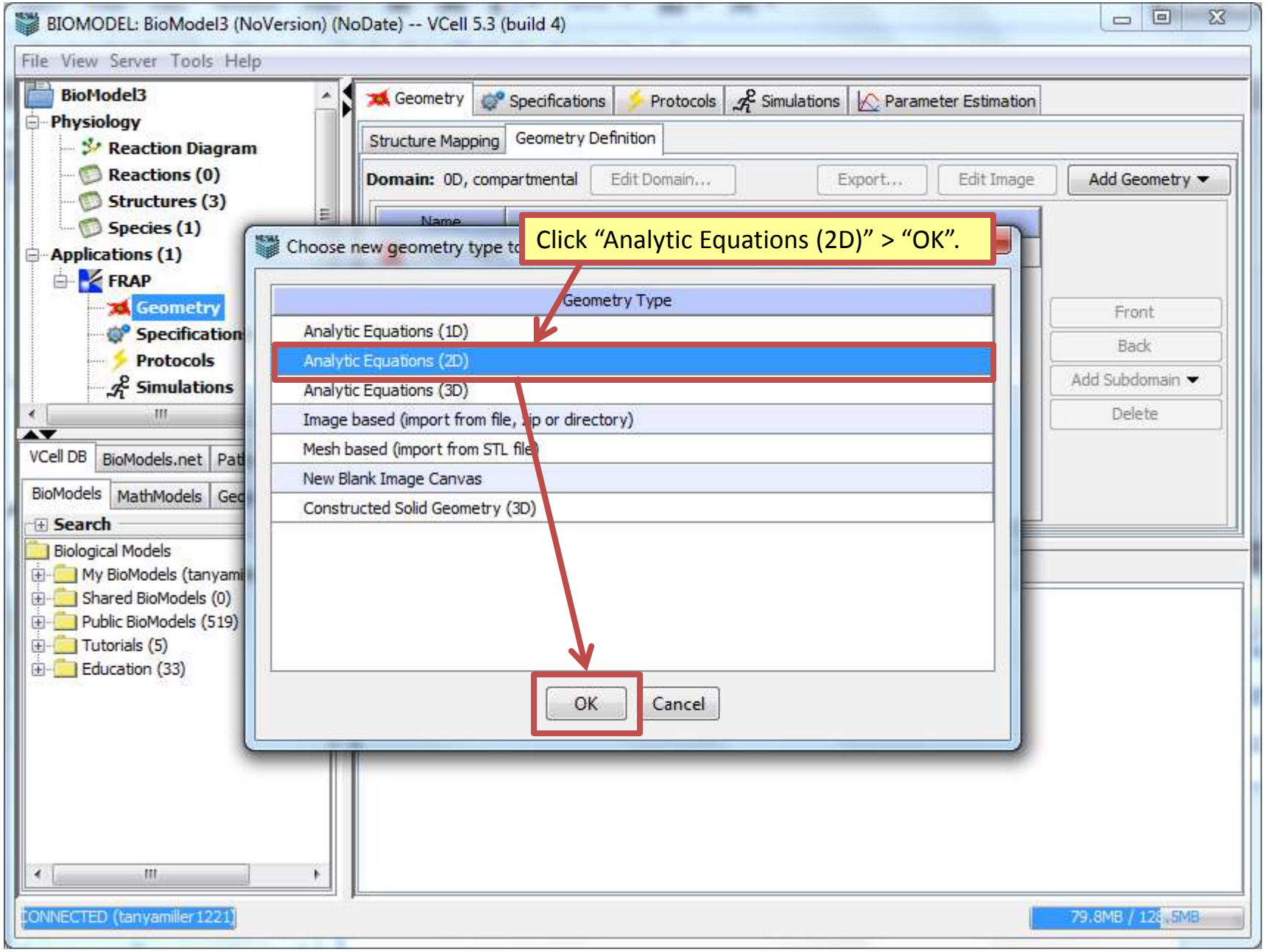

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Reactions (0)
Structures (3)
Species (1)
Applications (0)
Parameters and Functions
Pathway
Select the species tool.
Reaction Diagram
Reactions
Structures
Species
EC
PM
Cyt
Double click on a point within the "Cyt" compartment to create a new species.
s0
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Delete
Pathway Links
Search
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
s0
Linked Pathway Object(s)
Annotation
CONNECTED (tanyamiller1221)
94.7MB / 131.1MB

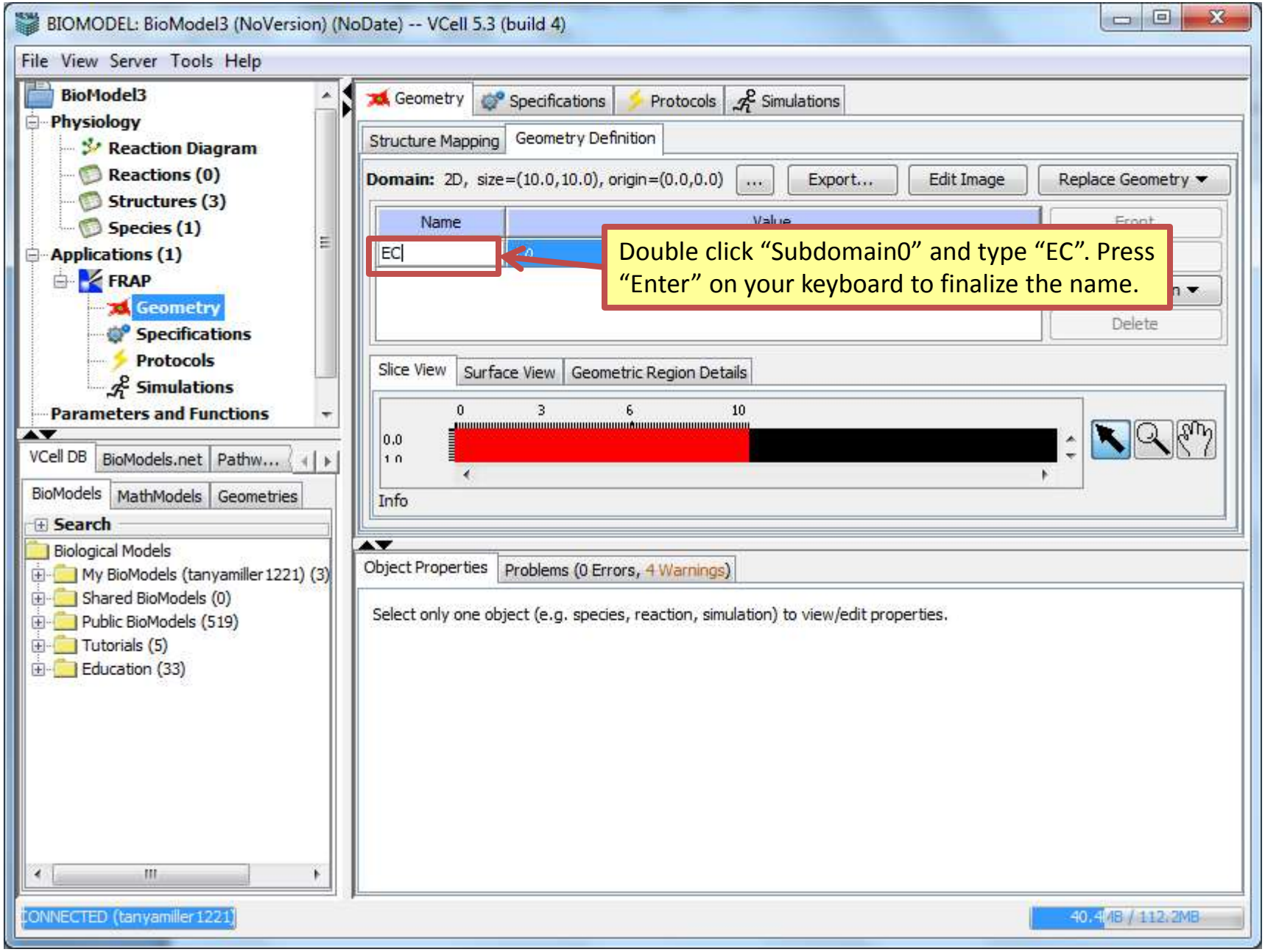

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (0)
Parameters and Functions
Pathway
Reaction Diagram
Reactions
Structures
Species
EC
PM
Cyt
Dex
Delete
Pathway Links
Search
VCell DB
BioModels.net
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Object Properties
Problems (0 Errors, 0 Warnings)
Species Name
Dex
Linked Pathway Object(s)
Annotation
Dextran
Next to Species Name type “Dex” and next to Annotation type “Dextran”.
CONNECTED (tanyamiller1221)
96MB / 131.1MB

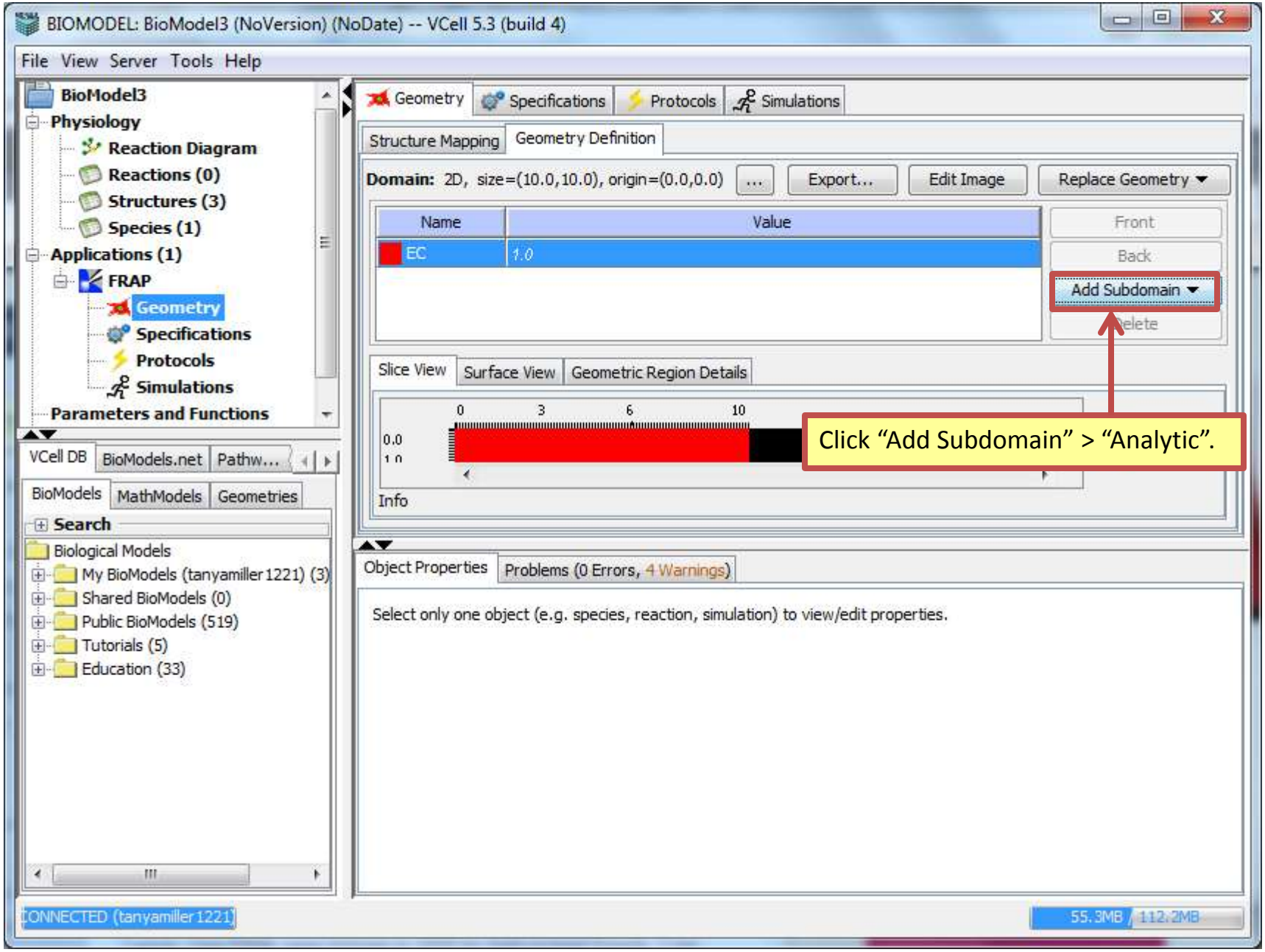

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (0
Parameters and Functions
Pathway
Name
Math Type
Annotation
Click “Applications” > “Add New” > “Deterministic”.
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Add New
Delete
More Copy Actions
Search
Deterministic
Stochastic
lems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (tanyamiller1221)
MB / 128.5MB

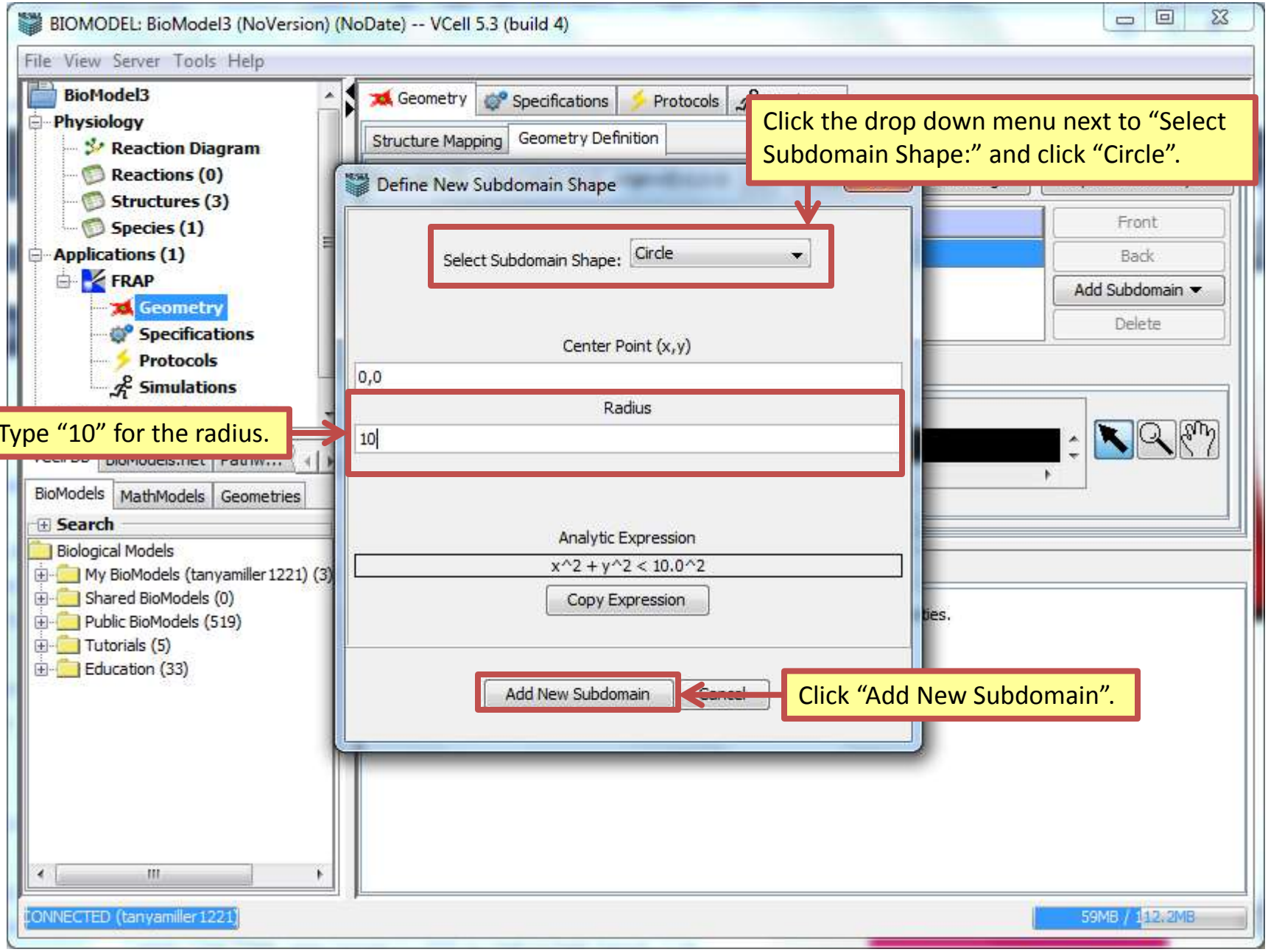

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
Application0
Parameters and Functions
Pathway
Name
Math Type
Annotation
FRAP
compartmental deterministic
Double click on the name box and rename the application as "FRAP". Press "Enter" on your keyboard to finalize.
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
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)
56.1MB / 128.5MB

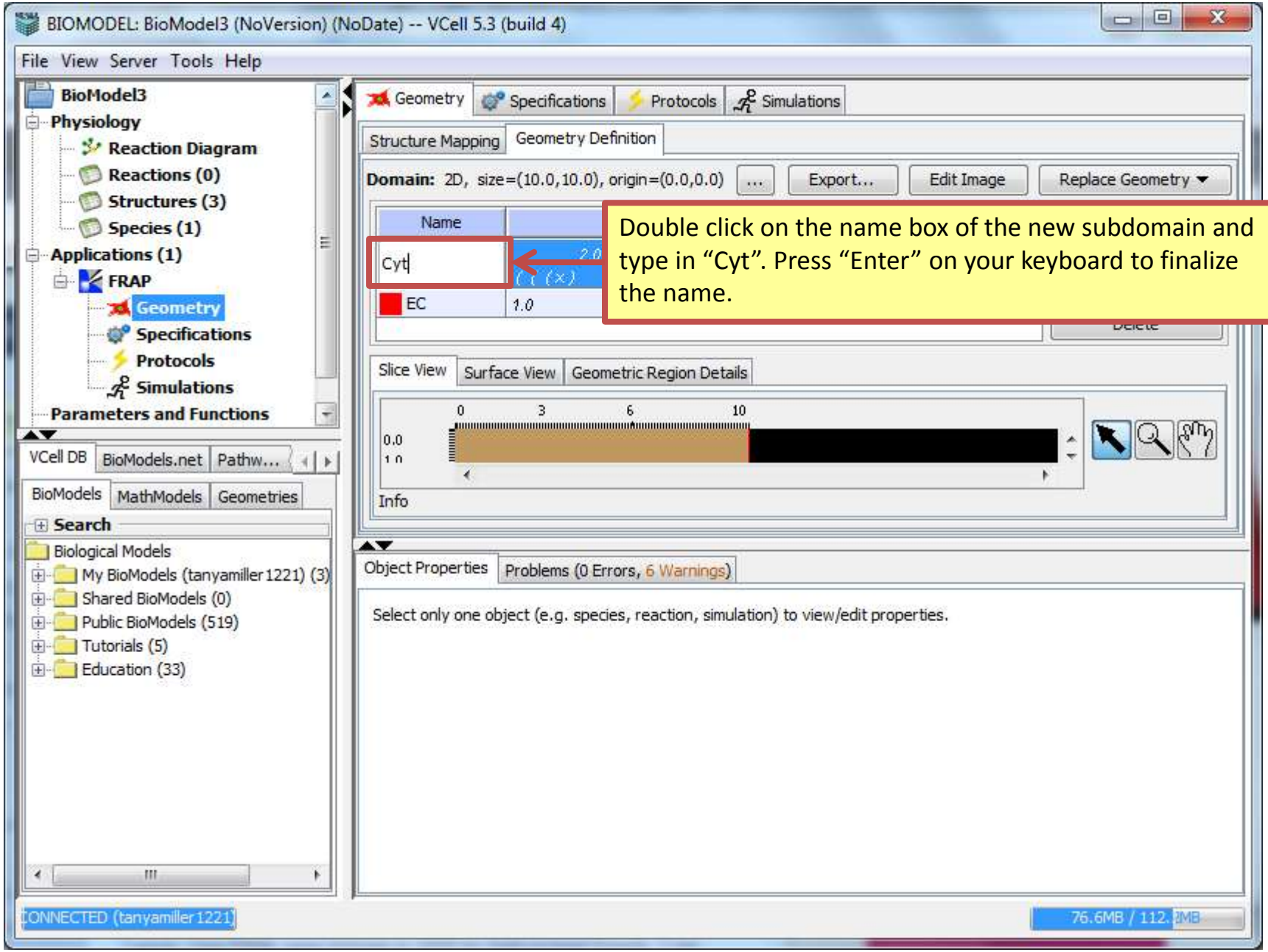

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Geometry Definition
Domain: 0D, compartmental
Edit Domain...
Export...
Edit Image
Add Geometry
Name
Value
Compartment
Add Subdomain
Delete
Click "FRAP" > "Geometry" > "Geometry Definition".
Click "Add Geometry" > "New".
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Object Properties
Problems (0 Errors, 0 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (tanyamiller1221)
76.2MB / 123.5MB


BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specification
Protocols
Simulations
Geometry
Specifications
Protocols
Simulations
Parameter Estimation
Structure Mapping
Geometry Definition
Domain: 0D, compartmental
Edit Domain...
Export...
Edit Image
Add Geometry
Front
Back
Add Subdomain
Delete
Click “Analytic Equations (2D)” > “OK”.
Choose new geometry type to
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)
OK
Cancel
VCell DB
BioModels.net
BioModels
MathModels
Search
Biological Models
My BioModels (tanyami
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
79.8MB / 128.5MB

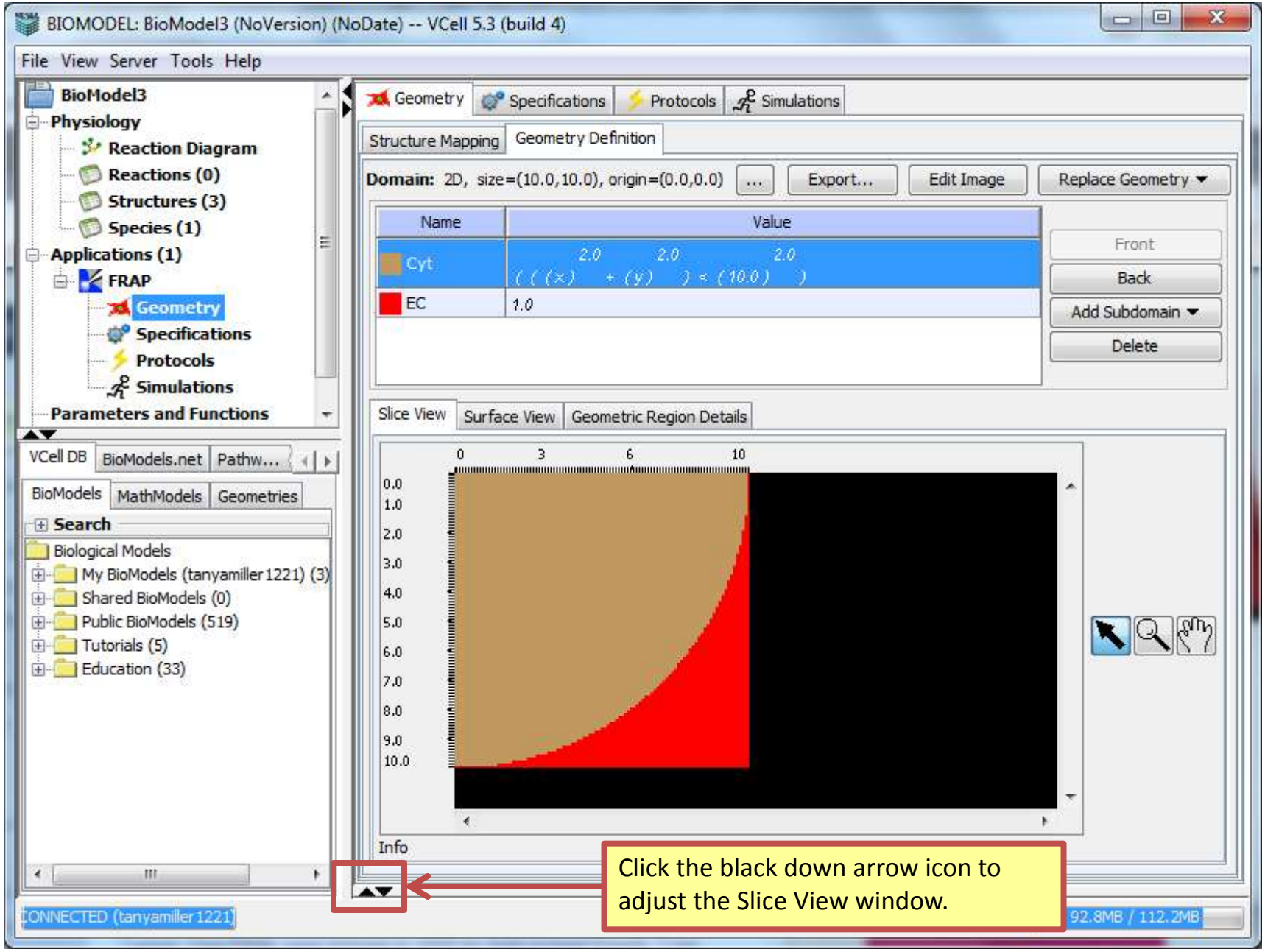

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
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)
...
Export...
Edit Image
Replace Geometry
Name
Value
EC
Front
Delete
Double click “Subdomain0” and type “EC”. Press “Enter” on your keyboard to finalize the name.
Slice View
Surface View
Geometric Region Details
0
3
6
10
0.0
Info
Object Properties
Problems (0 Errors, 4 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (tanyamiller1221)
40.4MB / 112.2MB

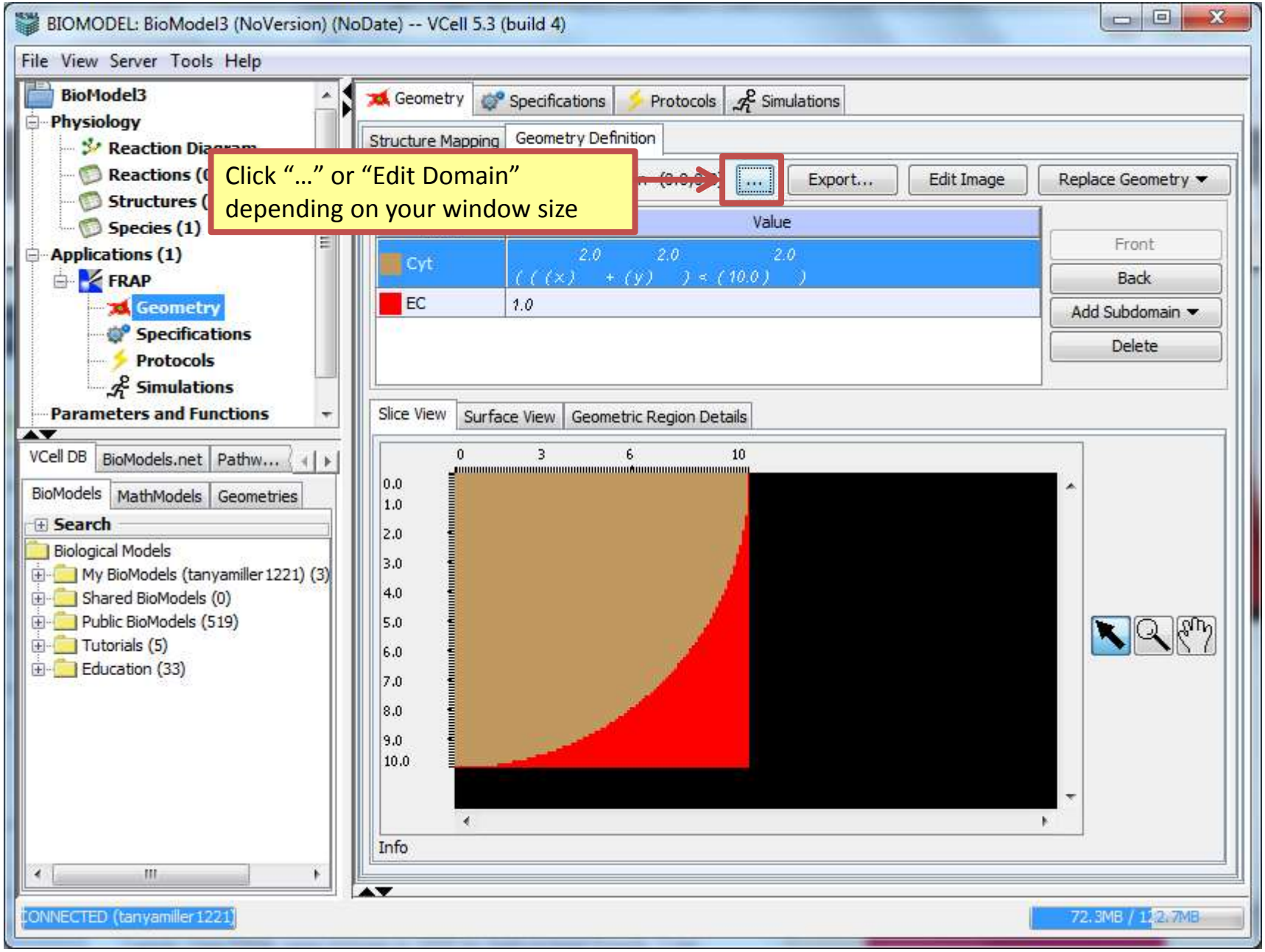

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
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)
...
Export...
Edit Image
Replace Geometry
Name
Value
EC
1.0
Front
Back
Add Subdomain
Delete
Slice View
Surface View
Geometric Region Details
0
3
6
10
0.0
Info
Click “Add Subdomain” > “Analytic”.
Object Properties
Problems (0 Errors, 4 Warnings)
Select only one object (e.g. species, reaction, simulation) to view/edit properties.
CONNECTED (tanyamiller1221)
55.3MB / 112.2MB

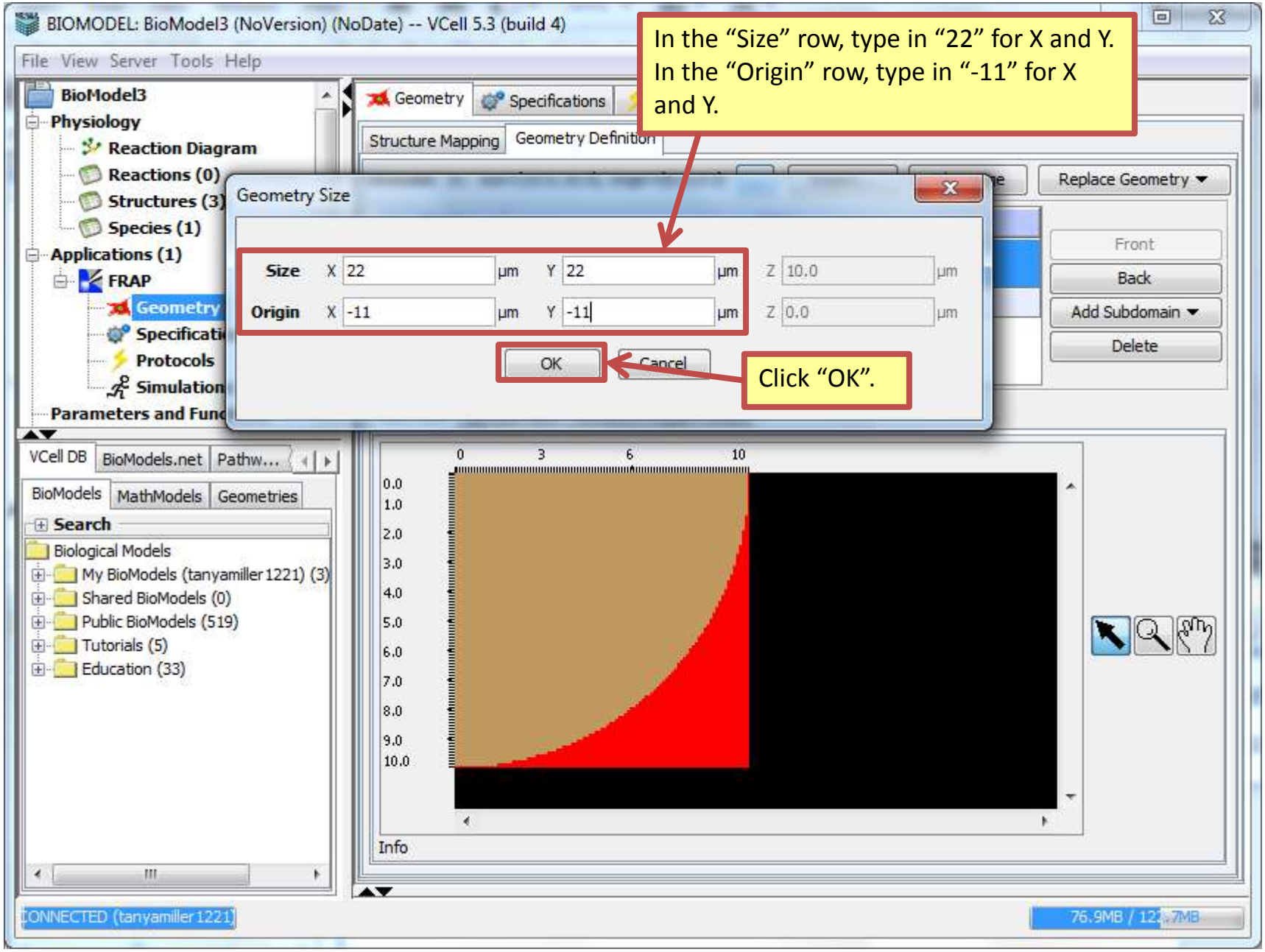

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Geometry
Specifications
Protocols
Structure Mapping
Geometry Definition
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
Front
Back
Add Subdomain
Delete
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
59MB / 112.2MB
Click the drop down menu next to “Select Subdomain Shape:” and click “Circle”.
Type “10” for the radius.
Click “Add New Subdomain”.

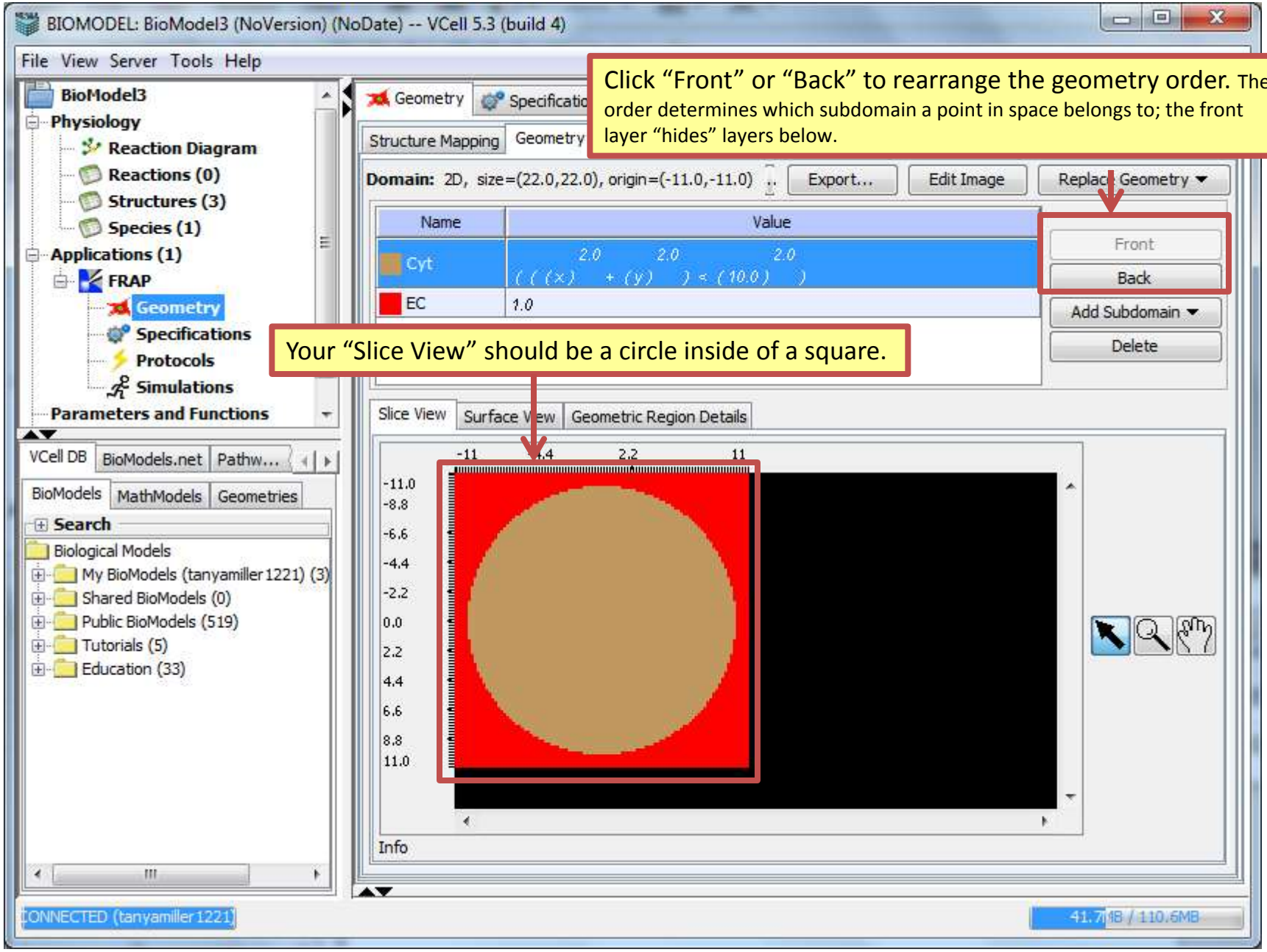


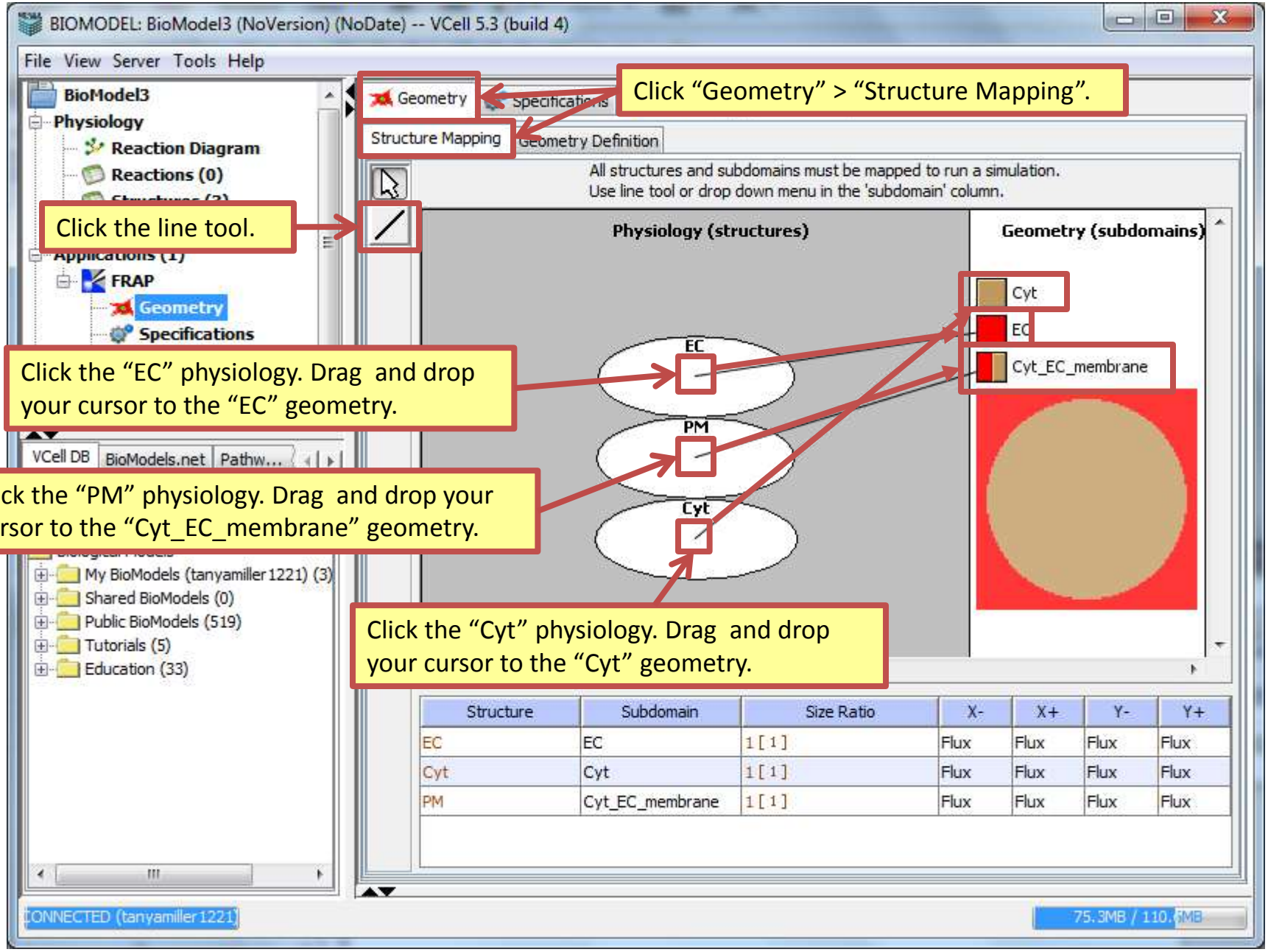
Double click on the name box of the new subdomain and type in “Cyt”. Press “Enter” on your keyboard to finalize the name.

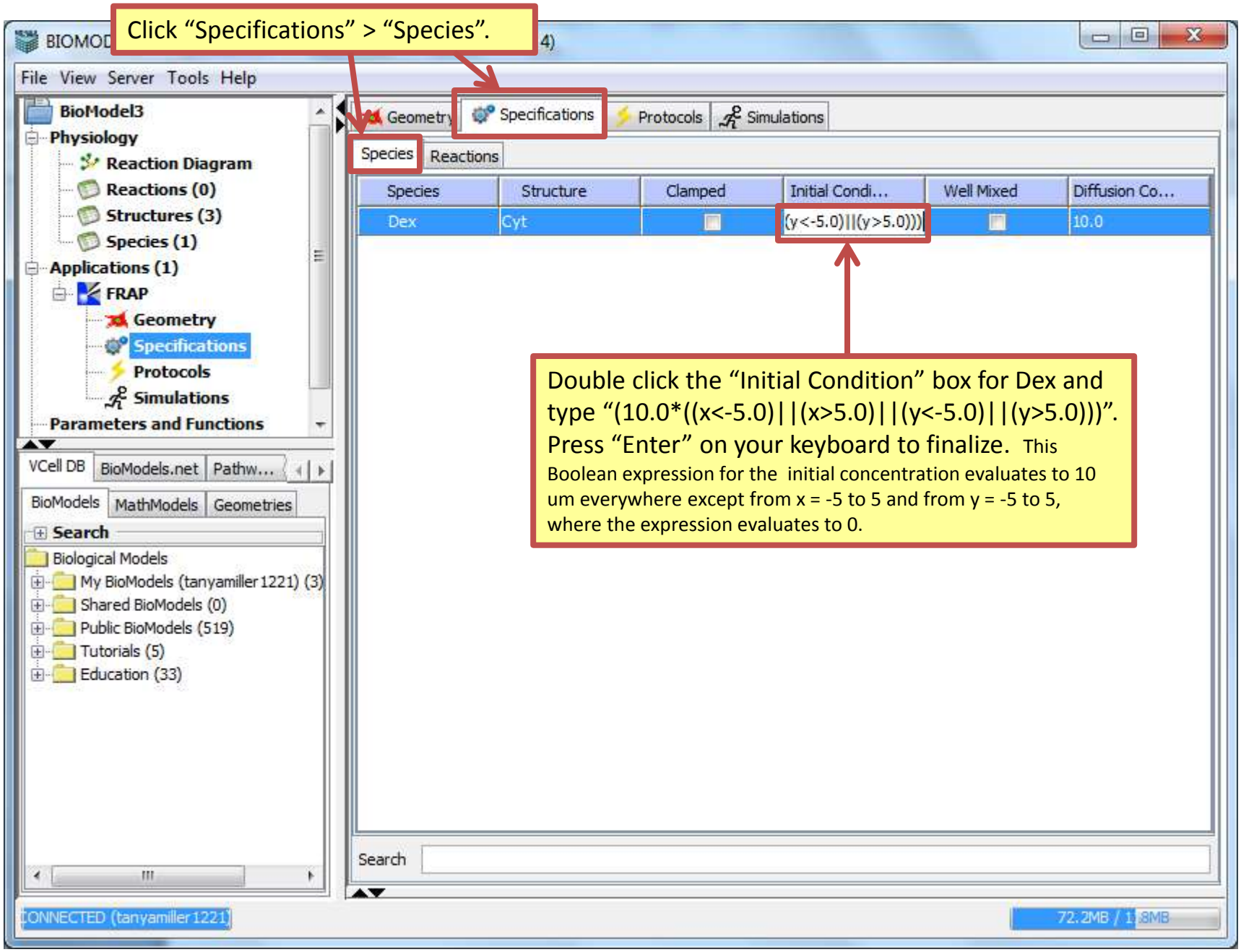

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
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)
...
Export...
Edit Image
Replace Geometry
Name
Value
Cyt
2.0 2.0 2.0
(((x) + (y)) < (10.0))
EC
1.0
Front
Back
Add Subdomain
Delete
Slice View
Surface View
Geometric Region Details
0
3
6
10
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Info
Click the black down arrow icon to adjust the Slice View window.
CONNECTED (tanyamiller1221)
92.8MB / 112.2MB

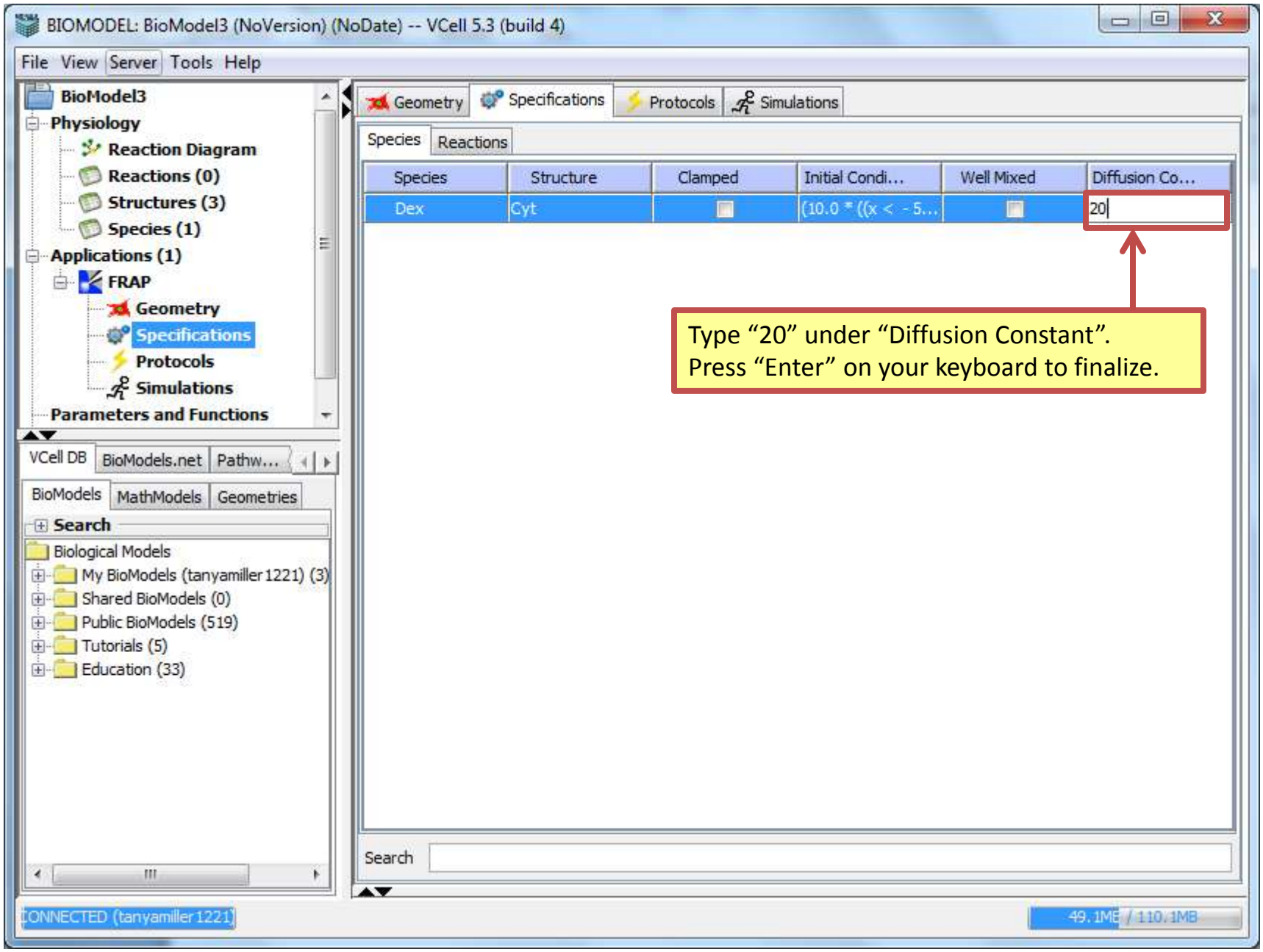

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (1)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Click "..." or "Edit Domain" depending on your window size
Geometry
Specifications
Protocols
Simulations
Structure Mapping
Geometry Definition
...
Export...
Edit Image
Replace Geometry
Value
Cyt
2.0 2.0 2.0
(((x) + (y)) < (10.0))
EC
1.0
Front
Back
Add Subdomain
Delete
Slice View
Surface View
Geometric Region Details
0
3
6
10
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Info
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
72.3MB / 122.7MB

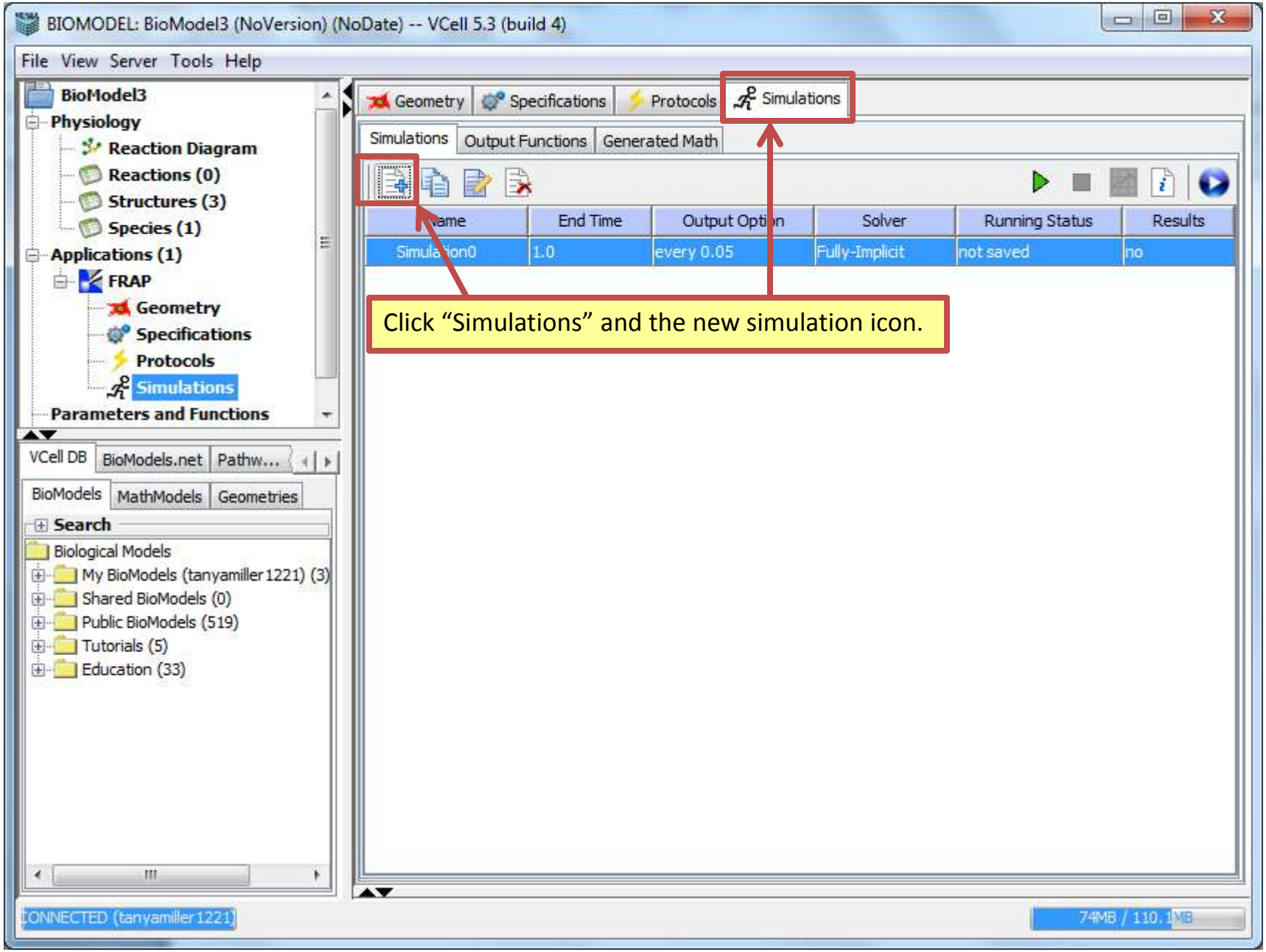

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specificati
Protocols
Simulation
Parameters and Func
Geometry
Specifications
Structure Mapping
Geometry Definition
Replace Geometry
Front
Back
Add Subdomain
Delete
Geometry Size
Size X 22 µm Y 22 µm Z 10.0 µm
Origin X -11 µm Y -11 µm Z 0.0 µm
OK
Cancel
In the "Size" row, type in "22" for X and Y.
In the "Origin" row, type in "-11" for X and Y.
Click "OK".
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
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)
76.9MB / 12

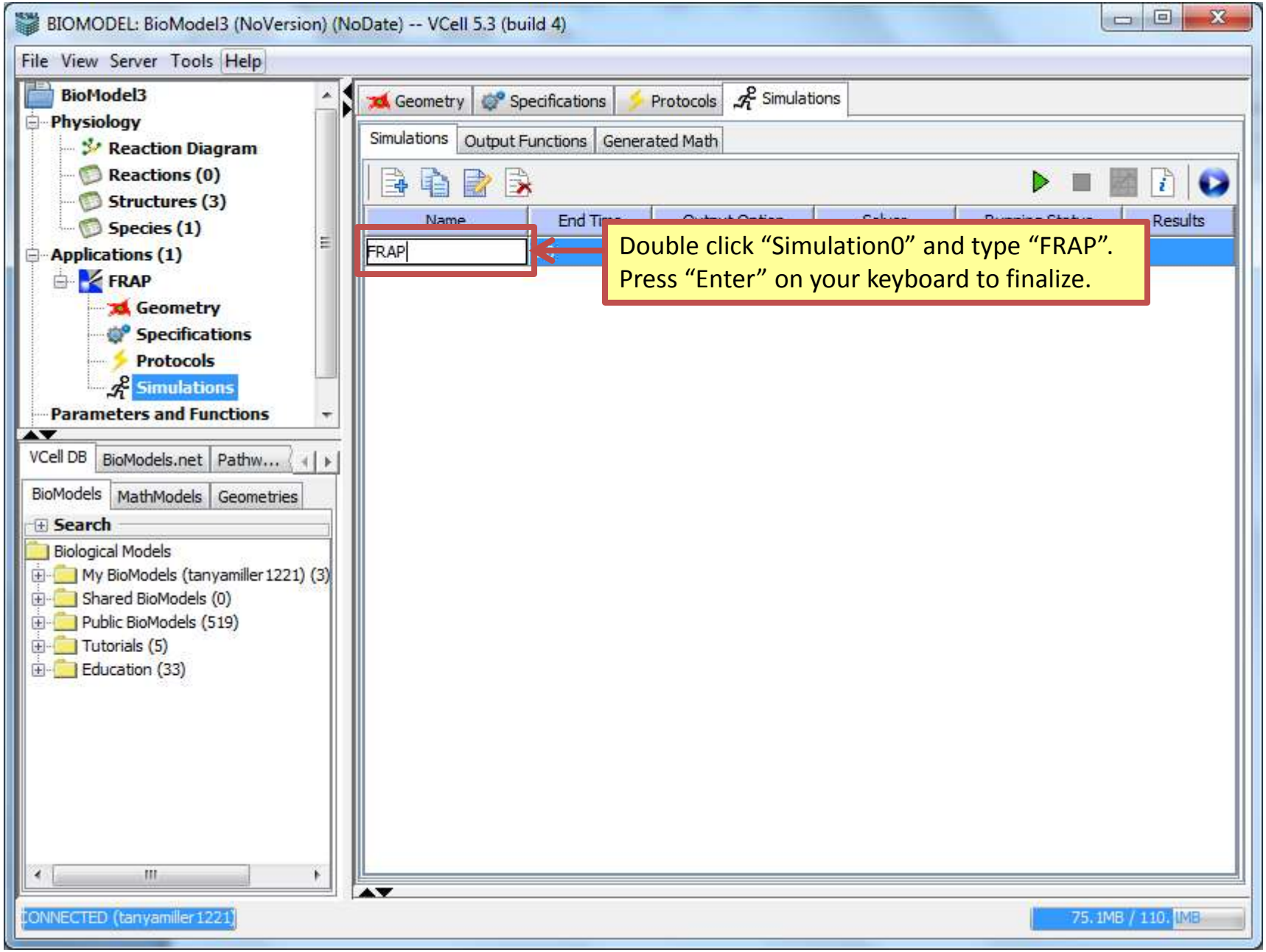

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specificatio
Structure Mapping
Geometry
Domain: 2D, size=(22.0,22.0), origin=(-11.0,-11.0)
Export...
Edit Image
Replace Geometry
Name
Value
Cyt
EC
1.0
Front
Back
Add Subdomain
Delete
Slice View
Surface View
Geometric Region Details
-11
2.2
11
-11.0
-8.8
-6.6
-4.4
-2.2
0.0
2.2
4.4
6.6
8.8
11.0
Info
CONNECTED (tanyamiller1221)
41.7 MB / 110.6MB
Click “Front” or “Back” to rearrange the geometry order. The order determines which subdomain a point in space belongs to; the front layer “hides” layers below.
Your “Slice View” should be a circle inside of a square.

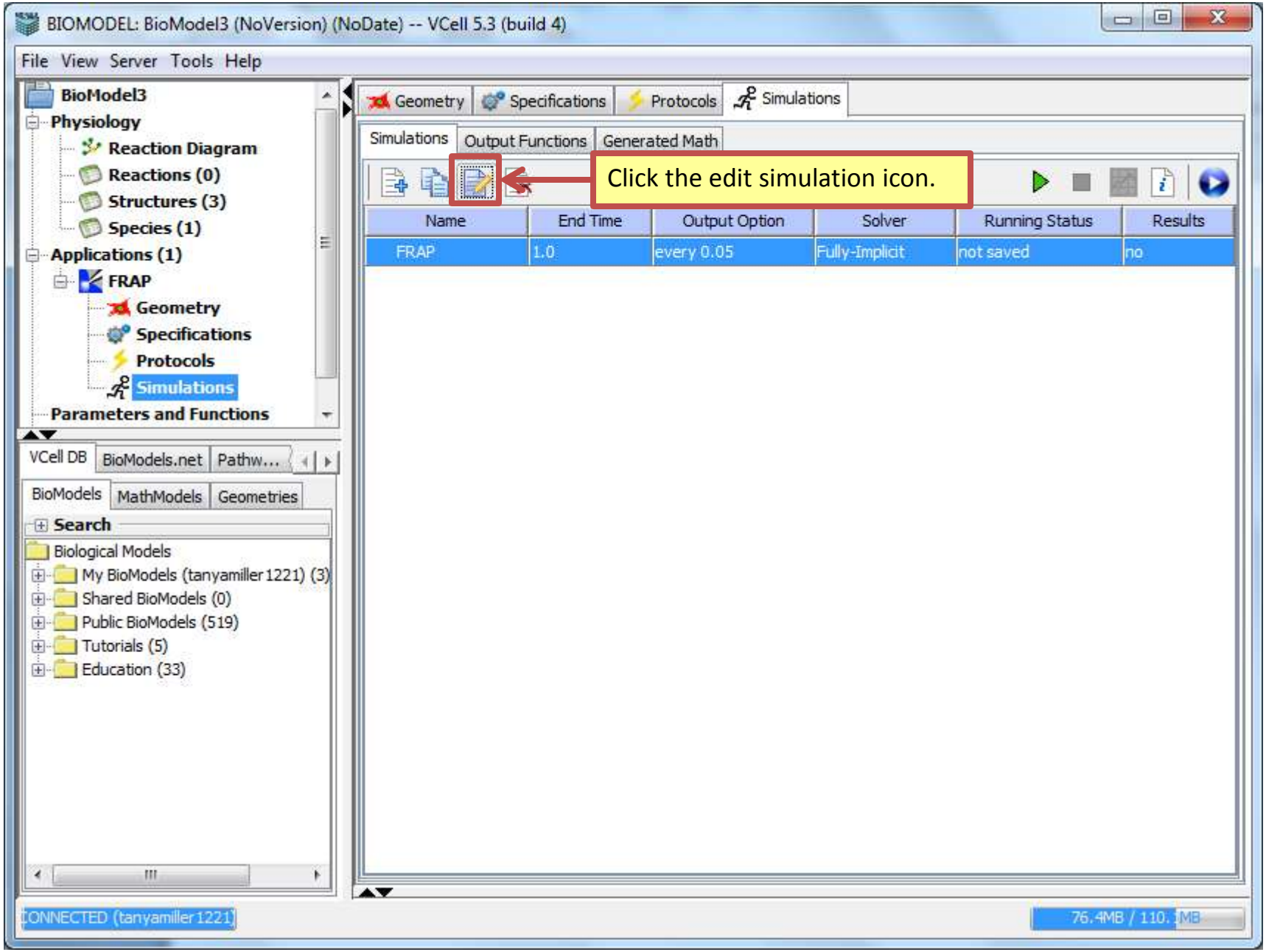

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Applications (1)
FRAP
Geometry
Specifications
Click “Geometry” > “Structure Mapping”.
Geometry
Specifications
Structure Mapping
Geometry Definition
All structures and subdomains must be mapped to run a simulation.
Use line tool or drop down menu in the 'subdomain' column.
Click the line tool.
Physiology (structures)
Geometry (subdomains)
EC
PM
Cyt
Cyt
EC
Cyt_EC_membrane
Click the “EC” physiology. Drag and drop your cursor to the “EC” geometry.
Click the “PM” physiology. Drag and drop your cursor to the “Cyt_EC_membrane” geometry.
Click the “Cyt” physiology. Drag and drop your cursor to the “Cyt” geometry.
VCell DB
BioModels.net
Pathw...
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Structure
Subdomain
Size Ratio
X-
X+
Y-
Y+
EC
EC
1 [1]
Flux
Flux
Flux
Flux
Cyt
Cyt
1 [1]
Flux
Flux
Flux
Flux
PM
Cyt_EC_membrane
1 [1]
Flux
Flux
Flux
Flux
CONNECTED (tanyamiller1221)
75.3MB / 110.

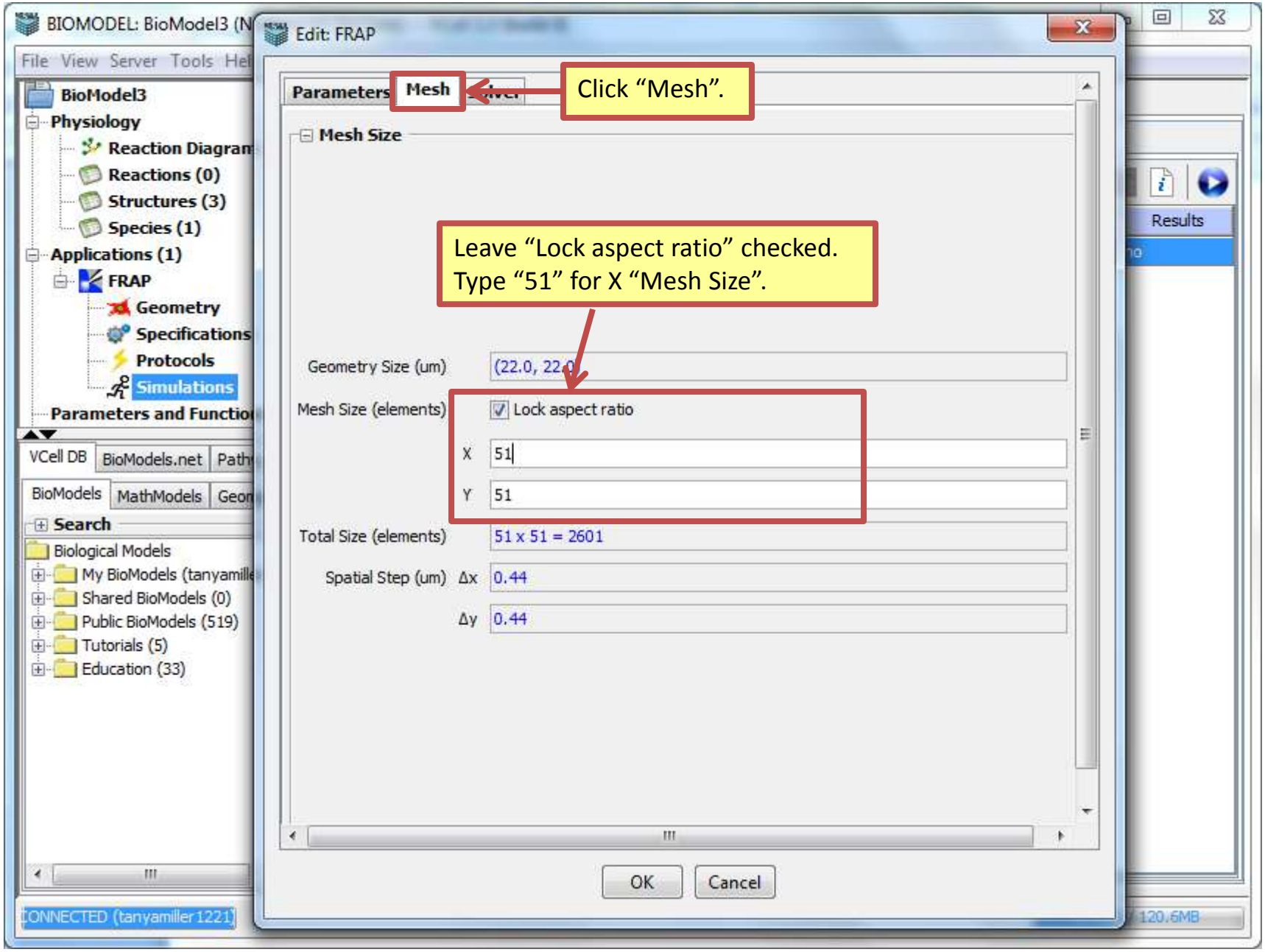

Click “Specifications” > “Species”.
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
Geometry
Specifications
Protocols
Simulations
Species
Reactions
Species
Structure
Clamped
Initial Condi...
Well Mixed
Diffusion Co...
Dex
Cyt
(y<-5.0)||(y>5.0)))
10.0
Double click the “Initial Condition” box for Dex and type “(10.0*((x<-5.0)||(x>5.0)||(y<-5.0)||(y>5.0)))”. Press “Enter” on your keyboard to finalize. This Boolean expression for the initial concentration evaluates to 10 um everywhere except from x = -5 to 5 and from y = -5 to 5, where the expression evaluates to 0.
VCell DB
BioModels.net
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Search
CONNECTED (tanyamiller1221)

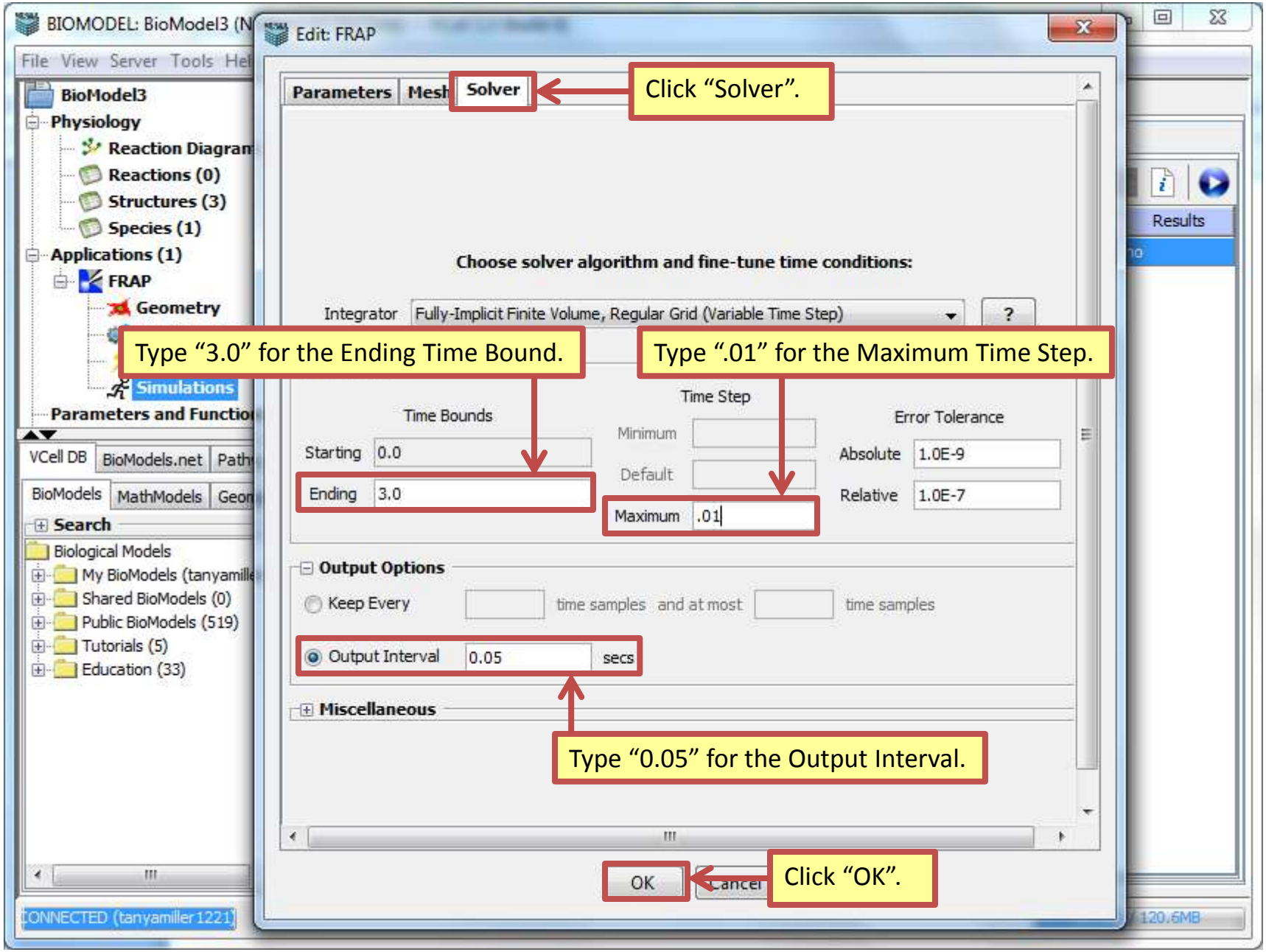

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Species
Reactions
Species
Structure
Clamped
Initial Condi...
Well Mixed
Diffusion Co...
Dex
Cyt
(10.0 * ((x < -5...
20
Type “20” under “Diffusion Constant”.
Press “Enter” on your keyboard to finalize.
Search
CONNECTED (tanyamiller1221)
49.1MB / 110.1MB

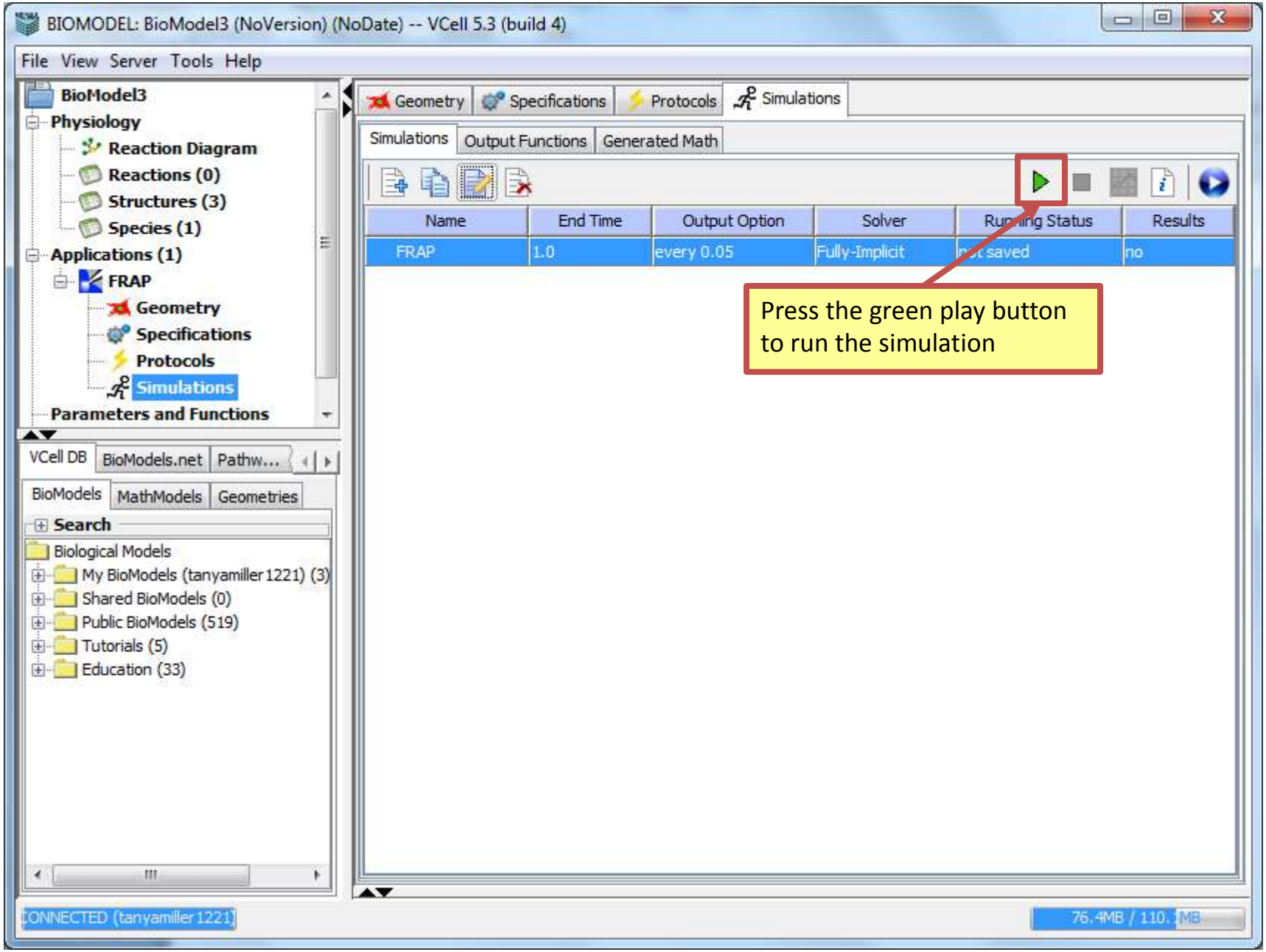

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
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
Simulation0
1.0
every 0.05
Fully-Implicit
not saved
no
Click “Simulations” and the new simulation icon.
CONNECTED (tanyamiller1221)
74MB / 110.1MB

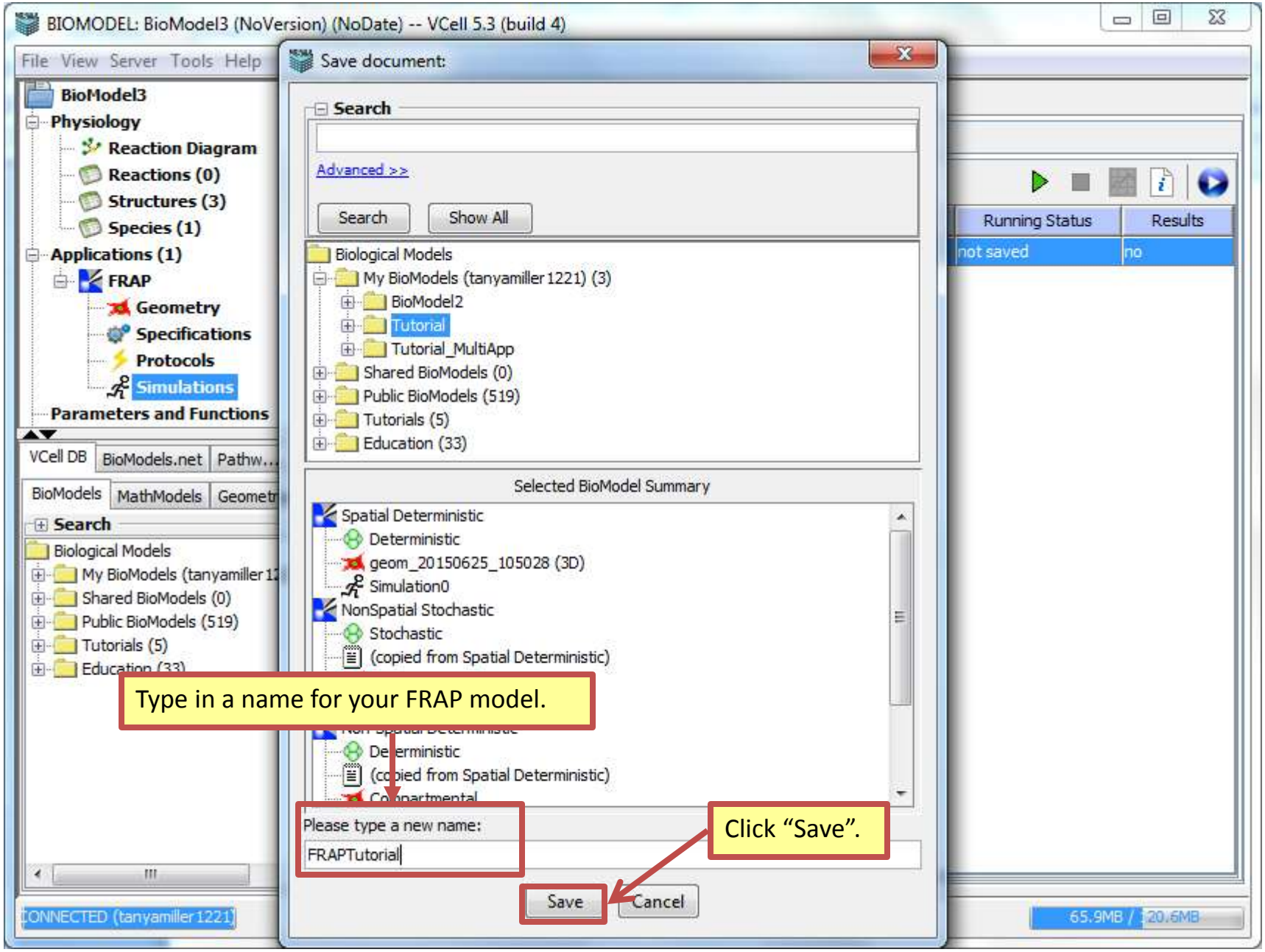

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Simulations
Output Functions
Generated Math
Name
End Time
Results
FRAP
Double click “Simulation0” and type “FRAP”.
Press “Enter” on your keyboard to finalize.
CONNECTED (tanyamiller1221)
75.1MB / 110.1MB

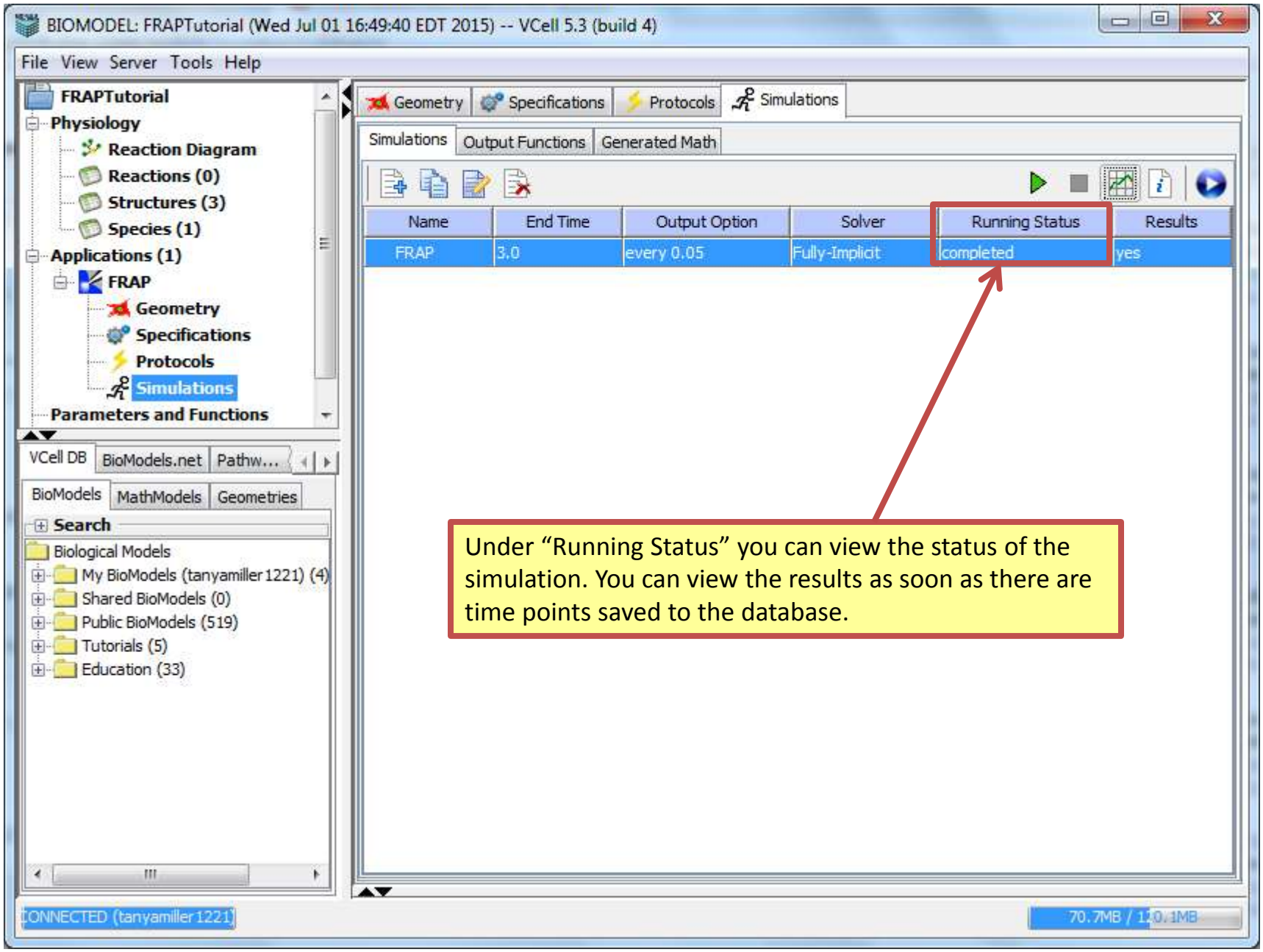

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Simulations
Output Functions
Generated Math
Click the edit simulation icon.
Name
End Time
Output Option
Solver
Running Status
Results
FRAP
1.0
every 0.05
Fully-Implicit
not saved
no
CONNECTED (tanyamiller1221)
76.4MB / 110.1MB

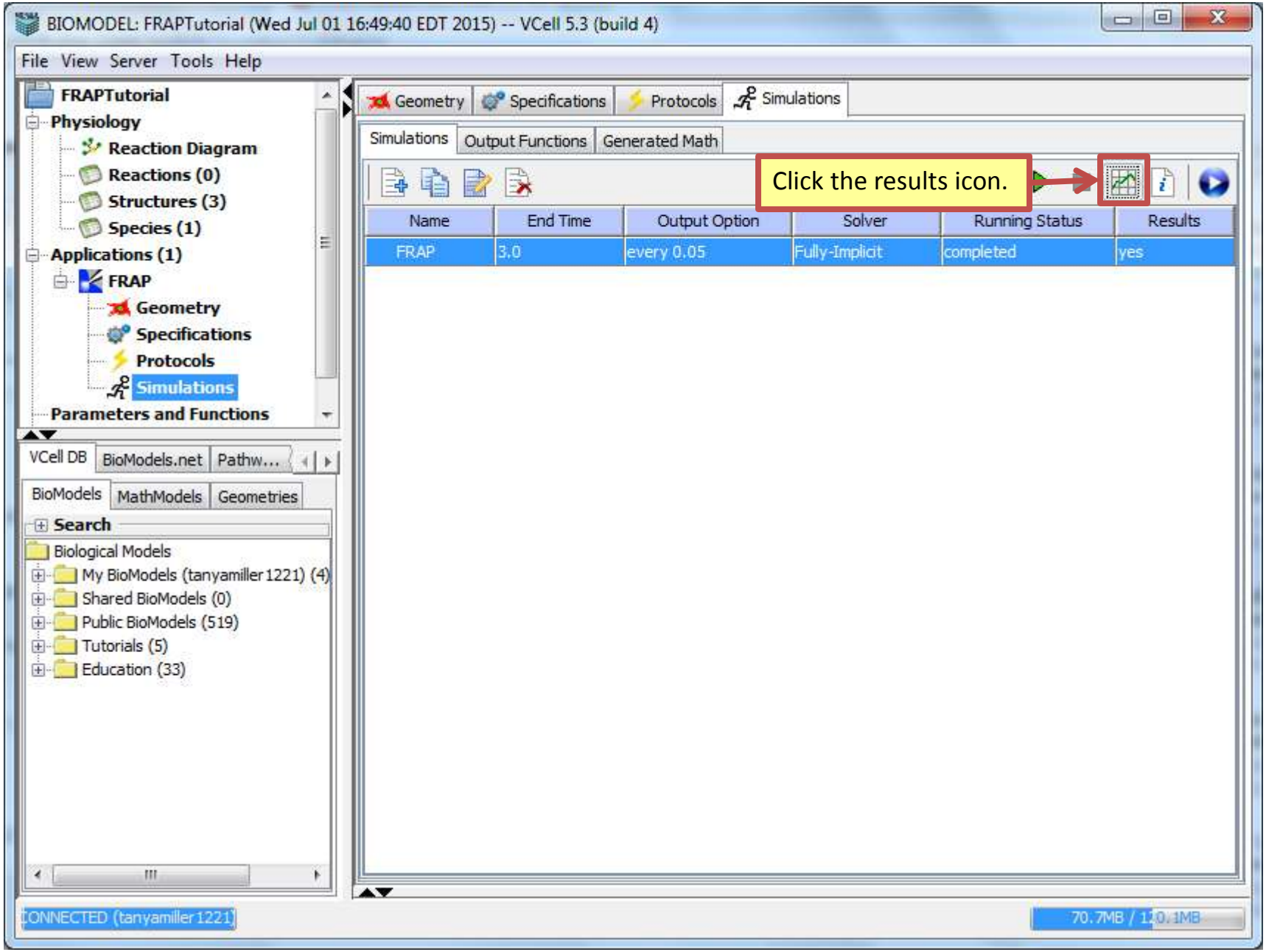

Edit: FRAP
Parameters
Mesh
Click “Mesh”.
Mesh Size
Leave “Lock aspect ratio” checked.
Type “51” for X “Mesh Size”.
Geometry Size (um)
(22.0, 22.0
Mesh Size (elements)
Lock aspect ratio
X
51
Y
51
Total Size (elements)
51 x 51 = 2601
Spatial Step (um)
Δx
0.44
Δy
0.44
OK
Cancel
BIOMODEL: BioModel3
File View Server Tools
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functio
VCell DB
BioModels.net
BioModels
MathModels
Search
Biological Models
My BioModels (tanyamille
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
Results
120.6MB

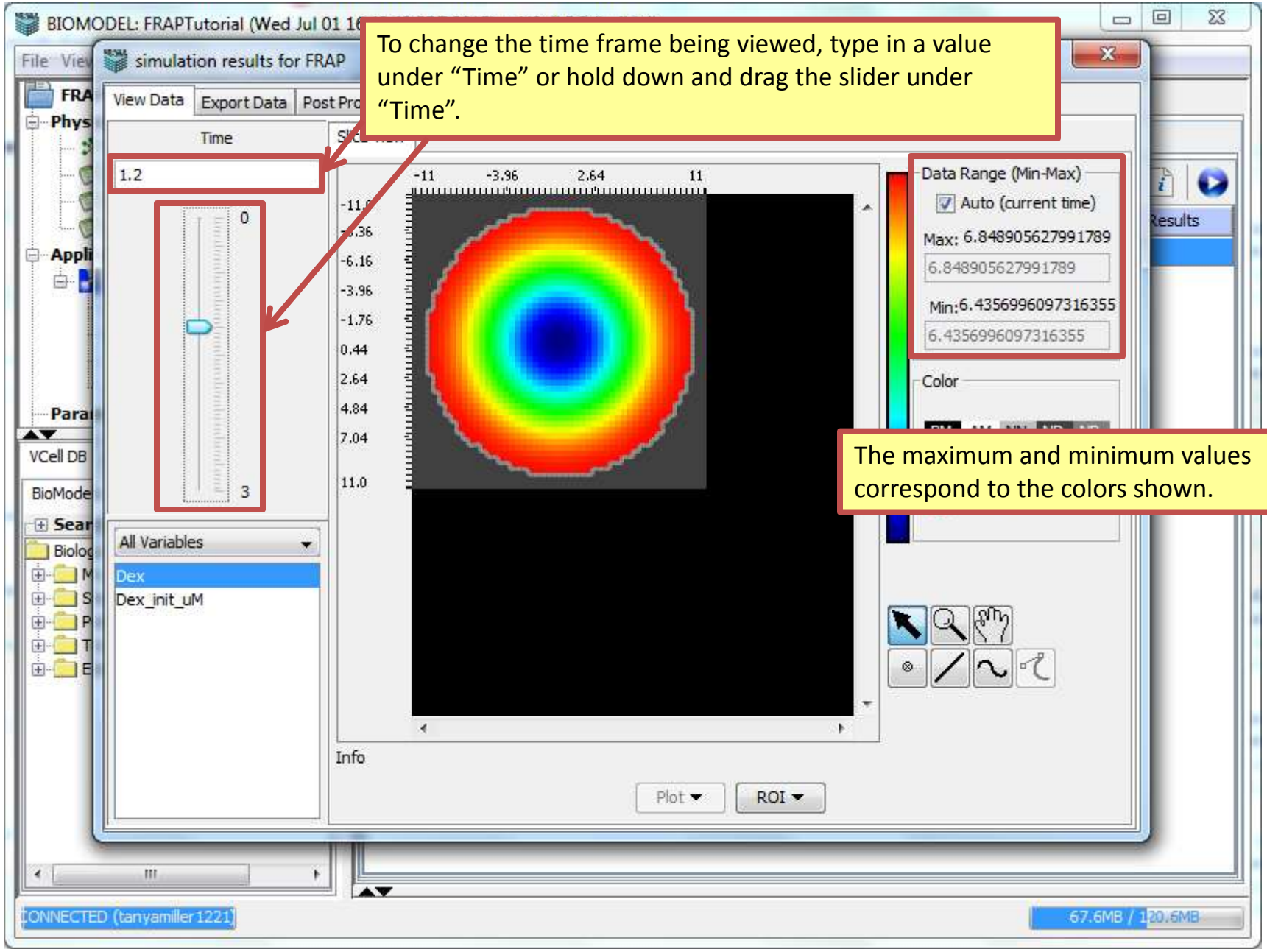

Edit: FRAP
Parameters
Mesh
Solver
Click “Solver”.
Choose solver algorithm and fine-tune time conditions:
Integrator
Fully-Implicit Finite Volume, Regular Grid (Variable Time Step)
Type “3.0” for the Ending Time Bound.
Type “.01” for the Maximum Time Step.
Time Bounds
Starting 0.0
Ending 3.0
Time Step
Minimum
Default
Maximum .01
Error Tolerance
Absolute 1.0E-9
Relative 1.0E-7
Output Options
Keep Every
time samples and at most
time samples
Output Interval 0.05 secs
Miscellaneous
Type “0.05” for the Output Interval.
OK
Cancel
Click “OK”.
BIOMODEL: BioModel3
File View Server Tools
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Simulations
Parameters and Functio
VCell DB
BioModels.net
BioModels
MathModels
Search
Biological Models
My BioModels (tanyamille
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
CONNECTED (tanyamiller1221)
Results
120.6MB

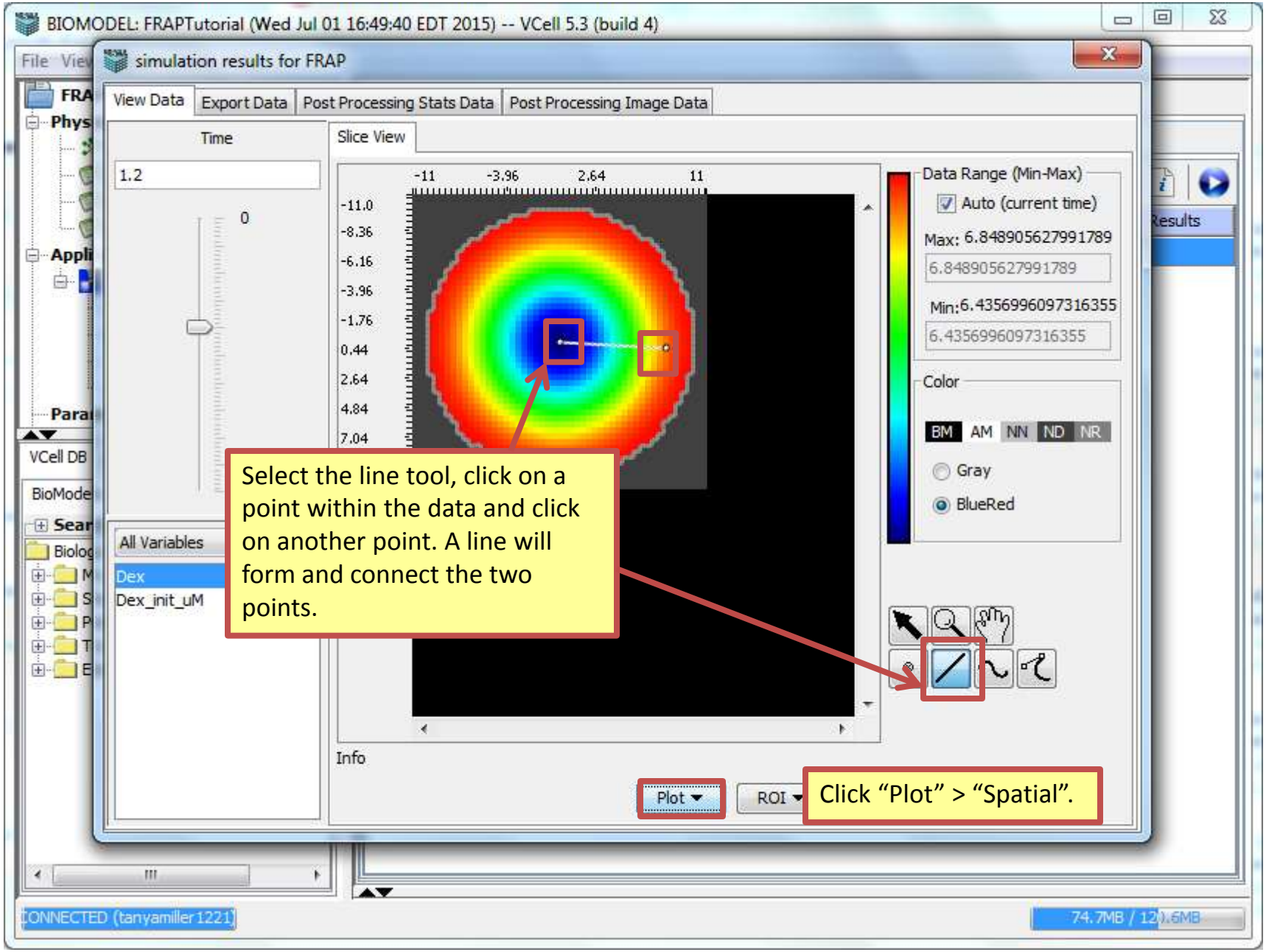

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (3)
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
FRAP
1.0
every 0.05
Fully-Implicit
not saved
no
Press the green play button to run the simulation
CONNECTED (tanyamiller1221)
76.4MB / 110.1MB

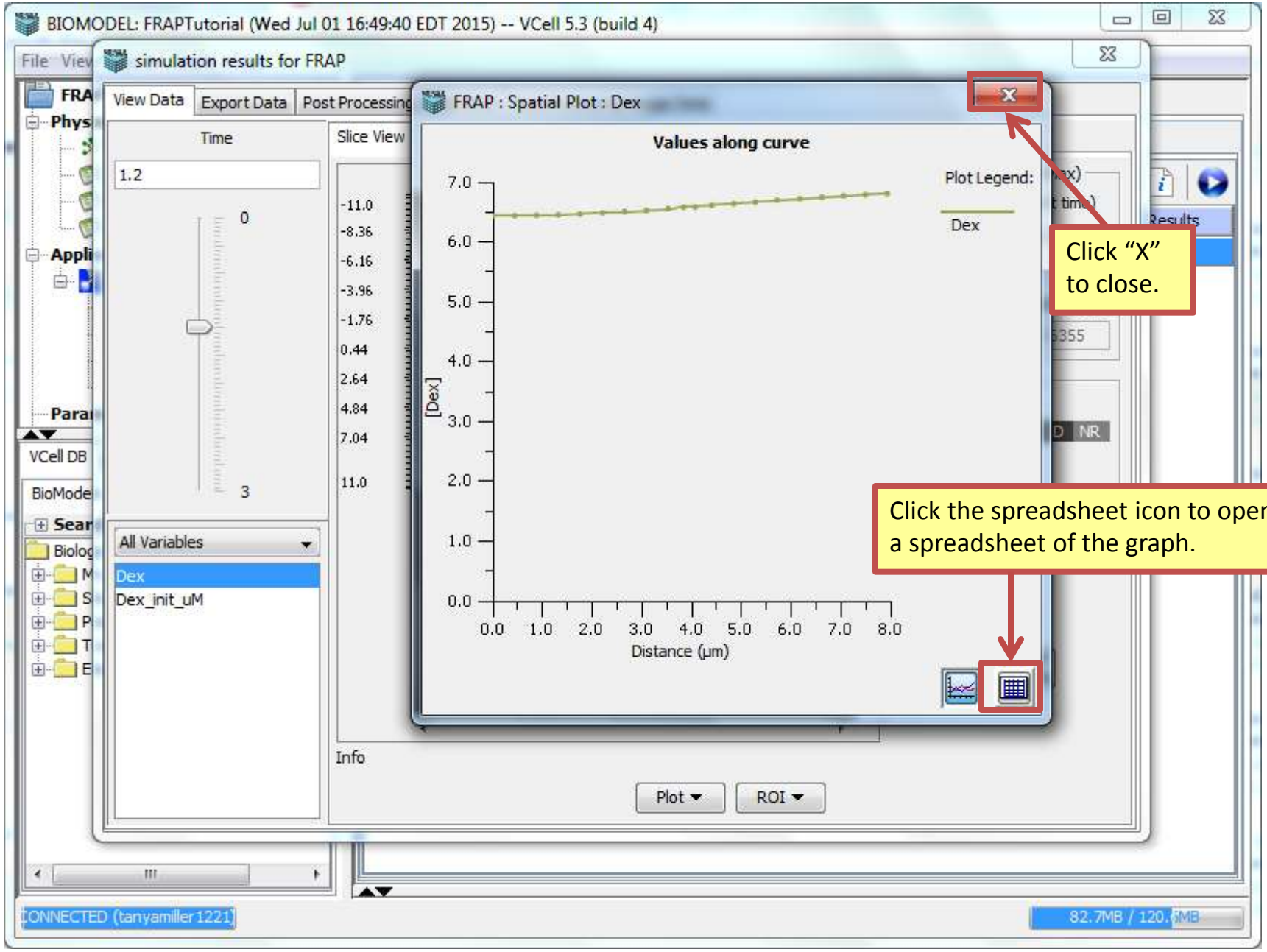

BIOMODEL: BioModel3 (NoVersion) (NoDate) -- VCell 5.3 (build 4)
File View Server Tools Help
BioModel3
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
VCell DB
BioModels.net
BioModels
MathModels
Search
Biological Models
My BioModels (tanyamiller1221) (3)
BioModel2
Tutorial
Tutorial_MultiApp
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Save document:
Search
Advanced >>
Search
Show All
Selected BioModel Summary
Spatial Deterministic
Deterministic
geom_20150625_105028 (3D)
Simulation0
NonSpatial Stochastic
Stochastic
(copied from Spatial Deterministic)
Please type a new name:
FRAPTutorial
Save
Cancel
Type in a name for your FRAP model.
Click "Save".
Running Status
Results
not saved
no
CONNECTED (tanyamiller1221)
65.9MB / 20.6MB

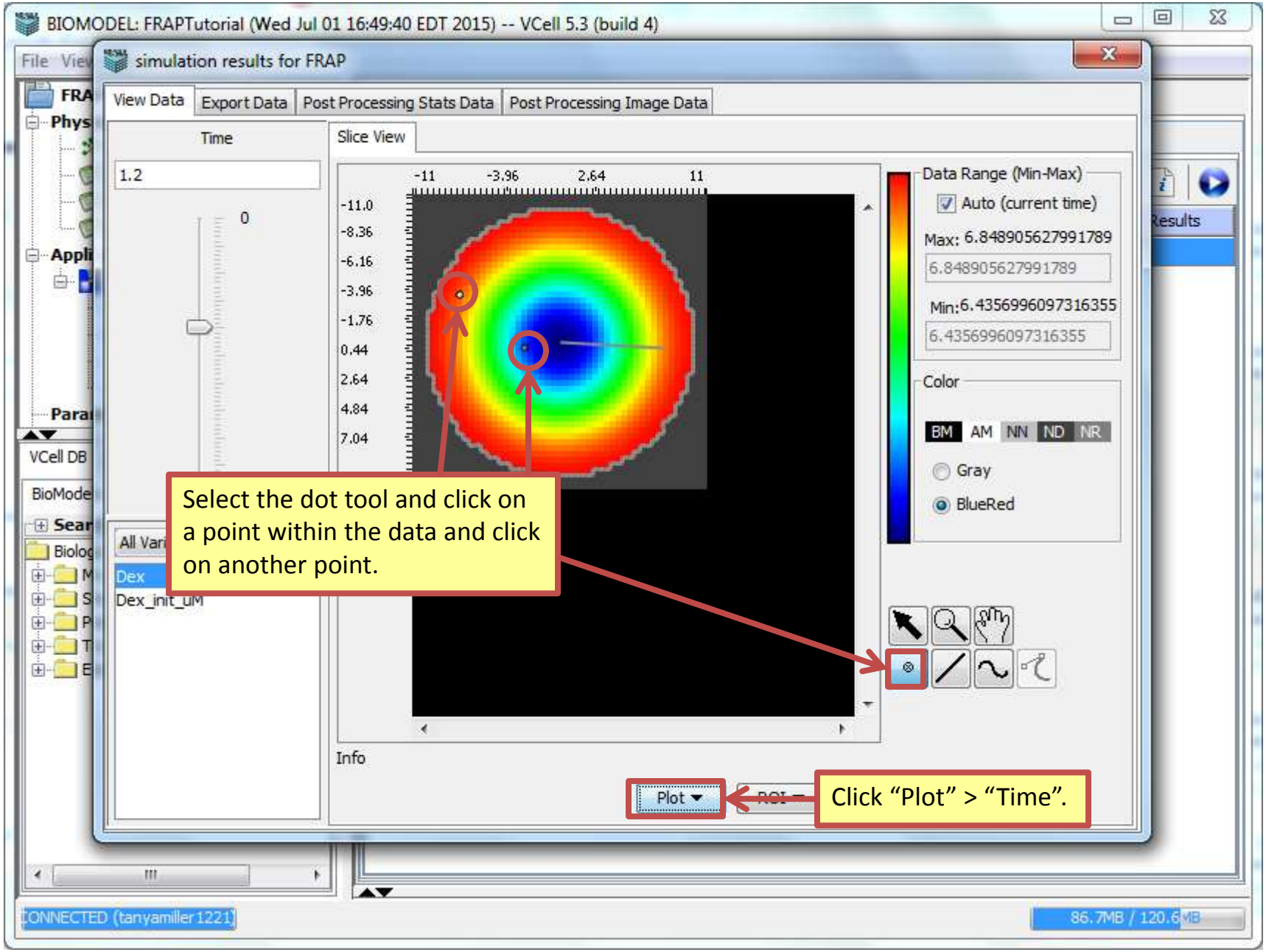

BIOMODEL: FRAPTutorial (Wed Jul 01 16:49:40 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPTutorial
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
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
FRAP
3.0
every 0.05
Fully-Implicit
completed
yes
Under “Running Status” you can view the status of the simulation. You can view the results as soon as there are time points saved to the database.
CONNECTED (tanyamiller1221)
70.7MB / 120.1MB

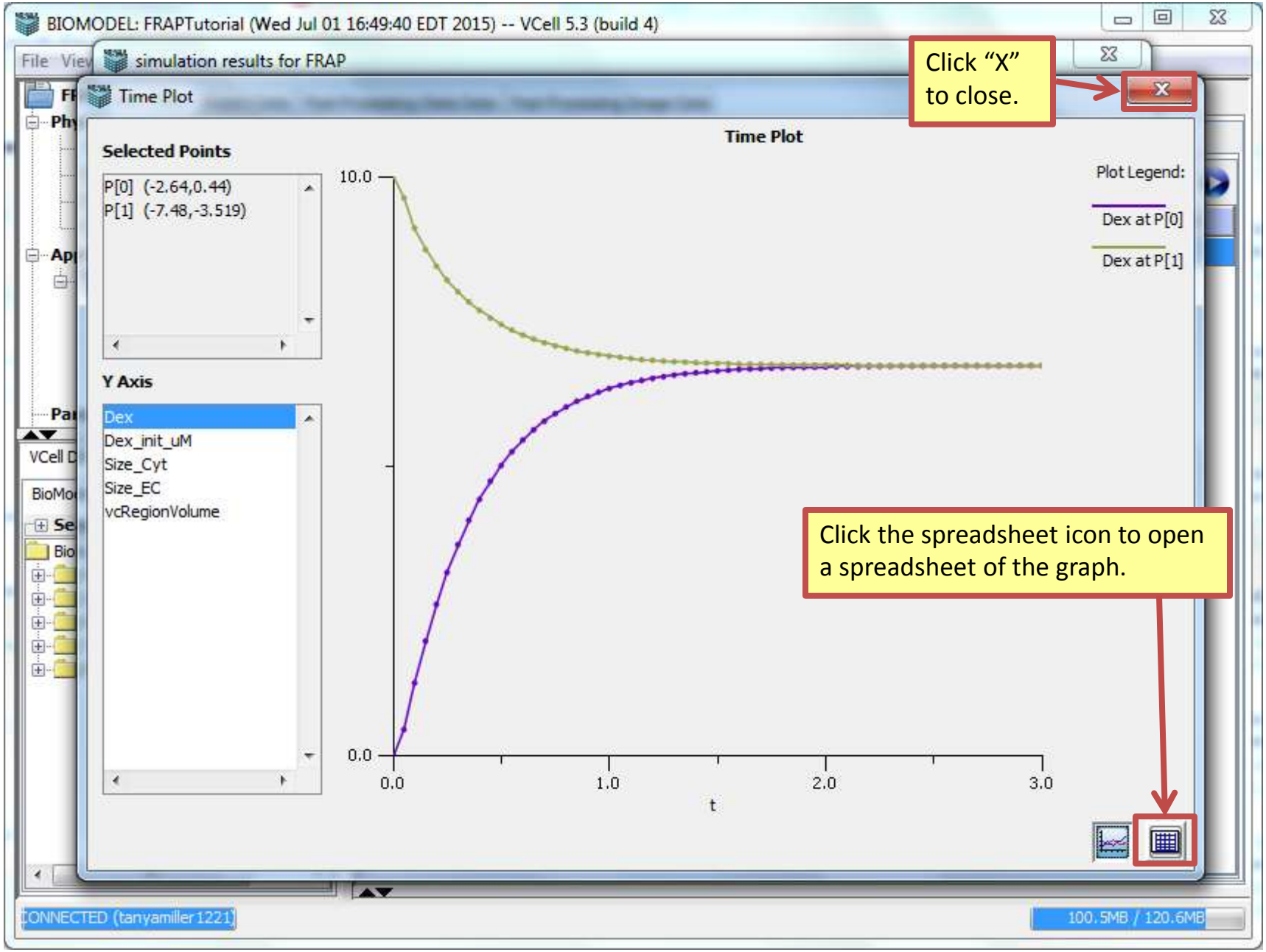

BIOMODEL: FRAPTutorial (Wed Jul 01 16:49:40 EDT 2015) -- VCell 5.3 (build 4)
File View Server Tools Help
FRAPTutorial
Physiology
Reaction Diagram
Reactions (0)
Structures (3)
Species (1)
Applications (1)
FRAP
Geometry
Specifications
Protocols
Simulations
Parameters and Functions
VCell DB
BioModels.net
Pathw...
BioModels
MathModels
Geometries
Search
Biological Models
My BioModels (tanyamiller1221) (4)
Shared BioModels (0)
Public BioModels (519)
Tutorials (5)
Education (33)
Geometry
Specifications
Protocols
Simulations
Simulations
Output Functions
Generated Math
Click the results icon.
Name
End Time
Output Option
Solver
Running Status
Results
FRAP
3.0
every 0.05
Fully-Implicit
completed
yes
CONNECTED (tanyamiller1221)
70.7MB / 120.1MB


To change the time frame being viewed, type in a value under “Time” or hold down and drag the slider under “Time”.
The maximum and minimum values correspond to the colors shown.
BIOMODEL: FRAPTutorial (Wed Jul 01 16
simulation results for FRAP
View Data
Export Data
Post Pro
Time
1.2
0
3
All Variables
Dex
Dex_init_uM
-11
-3.96
2.64
11
-6.16
-3.96
-1.76
0.44
2.64
4.84
7.04
11.0
Info
Plot
ROI
Data Range (Min-Max)
Auto (current time)
Max: 6.848905627991789
6.848905627991789
Min: 6.4356996097316355
6.4356996097316355
Color
VCell DB
BioMode
Sear
Biolog
Results
CONNECTED (tanyamiller1221)
67.6MB / 120.6MB


BIOMODEL: FRAPTutorial (Wed Jul 01 16:49:40 EDT 2015) -- VCell 5.3 (build 4)
simulation results for FRAP
View Data
Export Data
Post Processing Stats Data
Post Processing Image Data
Time
1.2
Slice View
-11
-3.96
2.64
11
-11.0
-8.36
-6.16
-3.96
-1.76
0.44
2.64
4.84
7.04
Data Range (Min-Max)
Auto (current time)
Max: 6.848905627991789
6.848905627991789
Min: 6.4356996097316355
6.4356996097316355
Color
BM
AM
NN
ND
NR
Gray
BlueRed
All Variables
Dex
Dex_init_uM
Info
Plot
ROI
Select 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”.
VCell DB
CONNECTED (tanyamiller1221)


BIOMODEL: FRAPTutorial (Wed Jul 01 16:49:40 EDT 2015) -- VCell 5.3 (build 4)
simulation results for FRAP
View Data
Export Data
Post Processing
Time
1.2
0
3
Slice View
-11.0
-8.36
-6.16
-3.96
-1.76
0.44
2.64
4.84
7.04
11.0
All Variables
Dex
Dex_init_uM
Info
Plot
ROI
FRAP : Spatial Plot : Dex
Values along curve
Plot Legend:
Dex
[Dex]
Distance (µm)
Click "X" to close.
Click the spreadsheet icon to open a spreadsheet of the graph.
VCell DB
CONNECTED (tanyamiller1221)


BIOMODEL: FRAPTutorial (Wed Jul 01 16:49:40 EDT 2015) -- VCell 5.3 (build 4)
simulation results for FRAP
View Data
Export Data
Post Processing Stats Data
Post Processing Image Data
Time
1.2
Slice View
-11
-3.96
2.64
11
-11.0
-8.36
-6.16
-3.96
-1.76
0.44
2.64
4.84
7.04
Data Range (Min-Max)
Auto (current time)
Max: 6.848905627991789
6.848905627991789
Min: 6.4356996097316355
6.4356996097316355
Color
BM
AM
NN
ND
NR
Gray
BlueRed
Dex
Dex_init_uM
Info
Plot
ROI
Select the dot tool and click on a point within the data and click on another point.
Click “Plot” > “Time”.
CONNECTED (tanyamiller1221)
86.7MB / 120.6MB


BIOMODEL: FRAPTutorial (Wed Jul 01 16:49:40 EDT 2015) -- VCell 5.3 (build 4)
simulation results for FRAP
Time Plot
Click "X" to close.
Time Plot
Selected Points
P[0] (-2.64,0.44)
P[1] (-7.48,-3.519)
Y Axis
Dex
Dex_init_uM
Size_Cyt
Size_EC
vcRegionVolume
10.0
0.0
0.0
1.0
2.0
3.0
t
Plot Legend:
Dex at P[0]
Dex at P[1]
Click the spreadsheet icon to open a spreadsheet of the graph.
CONNECTED (tanyamiller1221)
100.5MB / 120.6MB

Contents

Next VCell tutorial: FRAP with Binding