Dr. Hana Dobrovolny's Lab

Viral Agent-Based Model Interface Use Cases

Version 1.0

Revision History

Date	Version	Description	Author
09/29/2025	1.0	Original identified use cases from requirements meeting.	Dhanani, Aqil

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Use Cases

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Use Case 1: User Defines Simulation Parameters

UC ID and Name:	UC-1: User Defines Simulation Parameters		
Created By:	Gabby Campos	Date Created:	10/3
Primary Actor:	User	Secondary Actors:	
Trigger:	User intends to run a simulation with specific rate values.		
Description:	To set continuous variables that control the biological and physical rates within the Agent-Based Model (ABM).		
Preconditions:	PRE-1. The User has launched the System.		
Postconditions:	POST-1. All primary continuous simulation parameters are validated within acceptable ranges and stored for the next simulation run.		
Main Success Scenario:	1. The User enters information for the continuous variables (e.g., Infection Rate, Probability of Cell-to-Cell Transmission, Viral Clearance Rate, Mean Eclipse Duration). 2. The System validates the continuous variables (e.g., ensures probability is between 0 and 1). 3. The System stores the values to be used for the next simulation.		
Extensions:	**2a. Input validation rule violation:** 2a1. The System displays a warning/error message. 2a2. The User corrects the mistake and returns to step 4 of the normal flow.		
Priority:	High		
Frequency of Use:	1 user, average of 5 usages per week.		
Business Rules:			
Associated Information:			
Related Use Cases			
Assumptions:	All required fields have default values.		
Open Issues:	None.		

Use Case 2: User Sets Initial Cell Conditions

UC ID and Name:	UC-2 User Sets Initial Cell Conditions		
Created By:	Gabby Campos	Date Created:	10/3
Primary Actor:	User	Secondary Actors:	
Trigger:	User intends to run a simulation from a specific starting state.		
Description:	To define the starting counts for Eclipse cells, Infected cells, and the initial amount of virus.		
Preconditions:	PRE-1. The User has launched the system and defined the total number of cells.		
Postconditions:	POST-1. Initial conditions (Eclipse Cells, Infected Cells, Virus Amount) are validated and stored for the next simulation run.		
Main Success Scenario:	1. The User enters information for the desired total number of cells (integer). 2. The User enters information for the initial number of Eclipse Cells (integer) and Infected Cells (integer). 3. The User enters information for the initial amount of Virus (continuous). 4. The System verifies that the sum of initial Eclipse and Infected Cells does not exceed the total cell count. 5. The System prepares to pass these initial condition values to run the simulation.		
Extensions:	**4a. Invalid cell count (sum exceeds total or non-integer input)** 4a1. The System warns the user. 4a2. The User corrects the input.		
Priority:	High		
Frequency of Use:	1 user, average of 5 usages per week.		
Business Rules:			
Associated Information:			
Related Use Cases:			
Assumptions:	The total cell count has been set.		
Open Issues:	None		

Use Case 3: User Toggles Cell-to-Cell Transmission

UC ID and Name:	UC-3: User Toggles Cell-to-Cell Transmission		
Created By:	Bereket Mezgebu	Date Created:	10/3
Primary Actor:	User	Secondary Actors:	
Trigger:	User interacts with the transmission mode settings.		
Description:	The user should be able to enable/disable the cell-to-cell infection process.		
Preconditions:	PRE-1. The User has launched the GUI.		
Postconditions:	POST-1. The binary flag for cell-to-cell transmission is set to the desired state in the simulation parameters.		
Main Success Scenario:	1. The User enters information for the desired state (Cell-to-Cell Transmission or No Cell-to-Cell Transmission). 2. The system updates the parameter to reflect the chosen state.		
Extensions:			
Priority:	High		
Frequency of Use:	1 user, average of 5 usages per week.		
Business Rules:			
Associated Information:			
Related Use Cases:			
Assumptions:	N/A		
Open Issues:	None		

Use Case 4: User Toggles Cell-Free Transmission

UC ID and Name:	UC-4: User Toggles Cell-Free Transmission		
Created By:	Bereket Mezgebu	Date Created:	10/3
Primary Actor:	User	Secondary Actors:	
Trigger:	The User interacts with the transmission mode settings.		
Description:	The user should be able to enable/disable the cell-free infection process.		
Preconditions:	PRE-1. The User has launched the GUI.		
Postconditions:	POST-1. The binary flag for cell-free transmission is set to the desired state in the simulation parameters.		
Main Success Scenario:	1. The User enters information the desired state (Cell-Free Transmission or No Cell-Free Transmission). 2. The system updates the parameter to reflect the chosen state.		
Extensions:			
Priority:	High		
Frequency of Use:	1 user, average of 5 usages per week.		
Business Rules:			
Associated Information:			
Related Use Cases			
Assumptions:	N/A		
Open Issues:	None		

Use Case 5: User Runs a Simulation

UC ID and Name:	UC-5 User Runs a Simulation		
Created By:	Hebert Alvarez	Date Created:	10/3/2025
Primary Actor:	User	Secondary Actors:	
Trigger:	The User starts the model.		
Description:	To execute the Agent-Based Model (ABM) using the defined parameters and visualize the output.		
Preconditions:	PRE-1. All mandatory simulation parameters and initial conditions have been set and validated.		
Postconditions:	POST-1. The simulation runs to completion, and all requested data is saved and/or displayed.		
Main Success Scenario:	1. The User initiates the start of the model. 2. The system initiates the simulation procedure. 3. The system displays the results in a plot as the simulation progresses. 4. Upon completion, the system saves the data.		
Extensions:	**2a Simulation failure/error during execution:** 2a1. The system displays the error message. 2a2. The simulation is terminated (UC-11)..		
Priority:	High		
Frequency of Use:	1 user, average of 5 usages per week.		
Business Rules:			
Associated Information:			
Related Use Cases:	UC-11		
Assumptions:	The system has proper permissions to execute the backend code.		
Open Issues:	None.		

Use Case 6: The User Views Time Series Plot of Infected Cells

UC ID and Name:	UC-6: The User Views Time Series Plot of Infected Cells		
Created By:	Hebert Alvarez	Date Created:	10/3/2025
Primary Actor:	User	Secondary Actors:	
Trigger:	A simulation is running, or the User selects the variable to plot (UC-7).		
Description:	The User wants to observe how the count of Infectious cells changes over the course of the simulation.		
Preconditions:	PRE-1. A simulation is running or a completed simulation's data is loaded. PRE-2. The Infectious cells variable is selected for plotting.		
Postconditions:	POST-1. A line graph displaying the Infectious cells count vs. time is rendered successfully.		
Main Success Scenario:	1. The User initiates a simulation run (UC-5). 2. The System continuously generates time series data. 3. The system receives this data and updates the plot area. 4. The **Infectious cells** line is displayed on the main plot.		
Extensions:	None documented.		
Priority:	High		
Frequency of Use:	1 user, 12 usages per month.		
Business Rules:			
Associated Information:			
Related Use Cases	UC-7		
Assumptions:	N/A		
Open Issues:	None		

Use Case 7: The User Selects Time Series Variables to Plot

UC ID and Name:	UC-7: The User Selects Time Series Variables to Plot		
Created By:	Stefan Saba	Date Created:	10/03/2025
Primary Actor:	User	Secondary Actors:	
Trigger:	User interacts with the line graph control panel.		
Description:	The User wants to select which specific global variables are displayed on the line graph (Uninfected, Eclipse, Infectious, Dead cells, Virus).		
Preconditions:	PRE-1. The System is displaying a plot area and a simulation is running or data is loaded.		
Postconditions:	POST-1. The line graph is updated to display only the selected variables.		
Main Success Scenario:	1. The User enters information for the variable selection controls. 2. The System instantly updates the line graph to show only the selected data series.		
Extensions:			
Priority:	High		
Frequency of Use:	2 users, average of 2 usages per week.		
Business Rules:			
Associated Information:			
Related Use Cases:	UC-6		
Assumptions:	N/A		
Open Issues:	None		

Use Case 8: The User Specifies a File Name for Time Series Data

UC ID and Name:	UC-8: The User Specifies a File Name for Time Series Data		
Created By:	Stefan Saba	Date Created:	10/03/2025
Primary Actor:	User	Secondary Actors:	
Trigger:	The User inputs the wanted file name.		
Description:	The User wants to set a user-defined file name for saving the time series data upon simulation completion.		
Preconditions:	PRE-1. The User has launched the System.		
Postconditions:	POST-1. A valid file name is stored, and the time series data will be saved to this file upon successful simulation completion.		
Main Success Scenario:	1. The User confirms to store the time series data file name. 2. The User enters the desired file name. 3. The System validates and stores the file name.		
Extensions:	**2a. Invalid file name/path entered**: 2a.1. The System displays an error or warning. 2a.2. The User corrects the input.		
Priority:	High		
Frequency of Use:	2 users, average of 2 usages per week.		
Business Rules:			
Associated Information:			
Related Use Cases:			
Assumptions:	The User has write permission to the specified path/directory.		
Open Issues:	None.		

Use Case 9: The User Enables Spatial Data Saving

UC ID and Name:	UC-9: The User Enables Spatial Data Saving		
Created By:	Ellion Norwood	Date Created:	03/OCT/2025
Primary Actor:	User	Secondary Actors:	
Trigger:	The User interacts with the spatial data saving control.		
Description:	To turn On the option to save the full spatial state of the simulation as image files.		
Preconditions:	PRE-1. The User is configuring the simulation before running.		
Postconditions:	POST-1. The System is instructed to save the full spatial image files during the simulation.		
Main Success Scenario:	1. The User confirms to save full spatial data. 2. The System displays additional inputs for frequency and base file name (UC-10). 3. The System confirms that full spatial data is being saved for the simulation.		
Extensions:	**3a. User chooses not to enable the feature:** 3a1. The System confirms the parameter switch is set to OFF. 3a2. The User corrects the mistake and returns to step 1 of the normal flow.		
Priority:	High		
Frequency of Use:	2 users, 5-10 usages per year.		
Business Rules:			
Associated Information:			
Related Use Cases	UC-10		
Assumptions:	The spatial data output is computationally expensive.		
Open Issues:	None.		

Use Case 10: The User Stops Running a Simulation

UC ID and Name:	UC-10: The User Stops Running a Simulation		
Created By:	Ellion Norwood	Date Created:	03/OCT/2025
Primary Actor:	User	Secondary Actors:	
Trigger:	The User aborts a running simulation.		
Description:	To terminate an in-progress simulation prematurely.		
Preconditions:	PRE-1. A simulation is currently running (UC-5)		
Postconditions:	POST-1. The backend CUDA/C++ process is safely terminated, and the System returns to the configuration state.		
Main Success Scenario:	1. The User confirms stopping the simulation. 2. The System process stops and releases resources. 3. The System clears the current visualization and waits for new input.		
Extensions:	None documented.		
Priority:	High		
Frequency of Use:	2 users, average of 10 usages per month.		
Business Rules:			
Associated Information:			
Related Use Cases:			
Assumptions:	The backend is designed to respond to a termination signal gracefully.		
Open Issues:	None.		

Use Case 12: The User Sets Eclipse Time Distribution Parameter

UC ID and Name:	UC-12: The User Sets Eclipse Time Distribution Parameter		
Created By:	Derek Le	Date Created:	10/03/2025
Primary Actor:	User	Secondary Actors:	Simulation Engines
Trigger:	The User intends to model biological variability in the eclipse phase of infected cells by adjusting the distribution parameter.		
Description:	This use case describes how the User sets a continuous variable representing the eclipse time distribution parameter within the GUI. This parameter governs how long cells remain in the non-infectious eclipse phase before becoming infectious, allowing simulation of heterogeneous biological timing among cells.		
Preconditions:	PRE-1: The User has launched the System and navigated to the Simulation Parameters section. PRE-2: The System has successfully loaded default simulation configuration values.		
Postconditions:	POST-1: The entered continuous value for the eclipse time distribution parameter is validated and stored in the model configuration for the next simulation run. POST-2: The System updates the GUI to reflect the saved parameter value.		
Main Success Scenario:	1. The User navigates to the Eclipse Time Distribution input field under Simulation Parameters. 2. The User enters a continuous numerical value (e.g., mean and/or standard deviation for a Gamma or Normal distribution). 3. The User confirms the entry by clicking “Apply” or pressing Enter. 4. The System validates the input type and range (e.g., must be > 0). 5. The System displays a confirmation message and updates the stored configuration. 6. The System retains the parameter for the next simulation run.		
Extensions:	**3a. Invalid input detected:** 3a1. The System alerts the User with a warning (e.g., “Input must be a positive number”). 3a2. The User corrects the input and resubmits.		
Priority:	High		
Frequency of Use:	2 users, 14 usages per month.		
Business Rules:	BR-1: All distribution parameters must be positive real numbers.		
Associated Information:			
Related Use Cases:	UC-1: Define Simulation Parameters UC-2: User Sets Initial Cell Conditions UC-5: User Runs a Simulation UC-13: The User Sets Infectious Lifespan Distribution Parameter		
Assumptions:	N/A		
Open Issues:	Consider adding a dropdown to select distribution type (e.g., Gamma, Normal) in future iterations.		

Use Case 13: The User Sets Infectious Lifespan Distribution Parameter

UC ID and Name:	UC-13: The User Sets Infectious Lifespan Distribution Parameter		
Created By:	Derek Le	Date Created:	10/03/2025
Primary Actor:	User	Secondary Actors:	Simulation Engine
Trigger:	The User wants to capture variability in how long infected cells remain infectious by adjusting the infectious lifespan distribution parameter.		
Description:	This use case describes how the User specifies a continuous variable controlling the infectious lifespan distribution parameter through the GUI. This parameter defines the statistical distribution of infectious durations among infected cells, reflecting biological diversity in infection progression and immune response.		
Preconditions:	PRE-1: The User has launched the System and navigated to the Simulation Parameters section. PRE-2: Default simulation configuration values have been loaded successfully.		
Postconditions:	POST-1: The entered continuous value for the infectious lifespan distribution parameter is validated and stored in the simulation configuration. POST-2: The System updates the GUI and parameter file to reflect the confirmed input.		
Main Success Scenario:	1. The User locates the Infectious Lifespan Distribution field within the Simulation Parameters panel. 2. The User enters a continuous numerical value (e.g., mean or standard deviation) corresponding to the infectious lifespan distribution. 3. The User confirms the entry via the "Apply" button or by pressing Enter. 4. The System validates that the input is within an acceptable range. 5. The System displays confirmation that the value has been stored. 6. The System saves the parameter to be used in the next simulation run.		
Extensions:	**3a. Invalid input detected:** 3a1. The System alerts the User with a warning (e.g., "Value must be a positive number"). 3a2. The User re-enters the input and confirms.		
Priority:	High		
Frequency of Use:	2 users, 14 usages per month.		
Business Rules:	BR-1: Parameter values must be positive and within biologically reasonable limits.		
Associated Information:			
Related Use Cases:	UC-1: Define Simulation Parameters UC-2: User Sets Initial Cell Conditions UC-5: User Runs a Simulation UC-12: The User Sets Eclipse Time Distribution Parameter		
Assumptions:	The User understands the biological meaning of infectious lifespan in the model context. The System performs input validation and provides feedback immediately after entry.		
Open Issues:	Allow the User to specify both mean and variance for the infectious lifespan distribution via a dual-field input or slider interface.		