The design of individual based model

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% Read parameters

* Read parameters
* Setup initial population

main\_binding.m

tauleap\_singlesir\_ibm\_matrix.m

Step1: Declare global variables

Step2: Simulation of the events

Step2.1: Iteration of Tau-leap

Step2.2: Output

**Output Objects:**

**Data Objects:**

|  |  |
| --- | --- |
| Params | Required parameters |
| VirusesArray | Every virus strains |
| CurrentVirus | Current virus strains |
| Metadata | Column name of viruses |

1.vid

2.birth

3.death

4.parent

5.infectionK

**dat\_viruses**

vid

birth

death

parent (sourceVirus)

infectionK

[beta]

initialV

currentV

antigenicMU

antigenicBP

antigenicTOT

antigenicEXBP

**CurrentVirus**

1.iso\_date

2-301. Ik=1-300

**dat\_sir**

**Beta:**[k x 1]

**VirusArray**

tauleap\_singlesir\_ibm\_matrix.m

**Rate properties:**

|  |  |
| --- | --- |
| Rate\_Birth | Required parameters |
| Rate\_Death\_S | Every virus strains |
| Rate\_Death\_I | Current virus  strains |
| Rate\_Death\_R |  |
| Rate\_Recovery |  |
| Rate\_Wanning |  |

Iteration of Tao Leap Algorithm

1. Setup the number of current viruses
2. Updating Viruses phenotypes
   1. Add mutational effect to each current virus
   2. Calculate binding changes
   3. obtain new immune status k from total antigenic change
3. Calculate transmission rate beta
4. Update epidemiological events
   1. Birth rate
   2. Death rate for S, I and R
   3. Recovery rate
   4. Wanning rate
5. Calculate the number of events
6. Update disease statuses
7. Updating transmission for each viral strain

Detailed steps:

Initialize variables and parameters

* Declare global variables
* Load deltaV Matrix
* Initialize Parameters
* Initialize virus strains

if metadata.ibms.initFlag == 1

create viruses

if metadata.ibms.initFlag == 2

use previous viruses

Simulation of the events

Iteration of tao leap Algorithm

* Setup the number of current viruses
* Updating binding avidity V and beta
* Rate of each epidemiological events
* Number of events happened
  + Birth
  + Death of Susceptible
  + Death of Recovered
  + Death of Infecteds
  + Recovery
  + Infection
  + Wanning
* Updating the status
* Updating Death
* Updating recovery

Auxiliary functions

Producing Output