Influenza in the Lung

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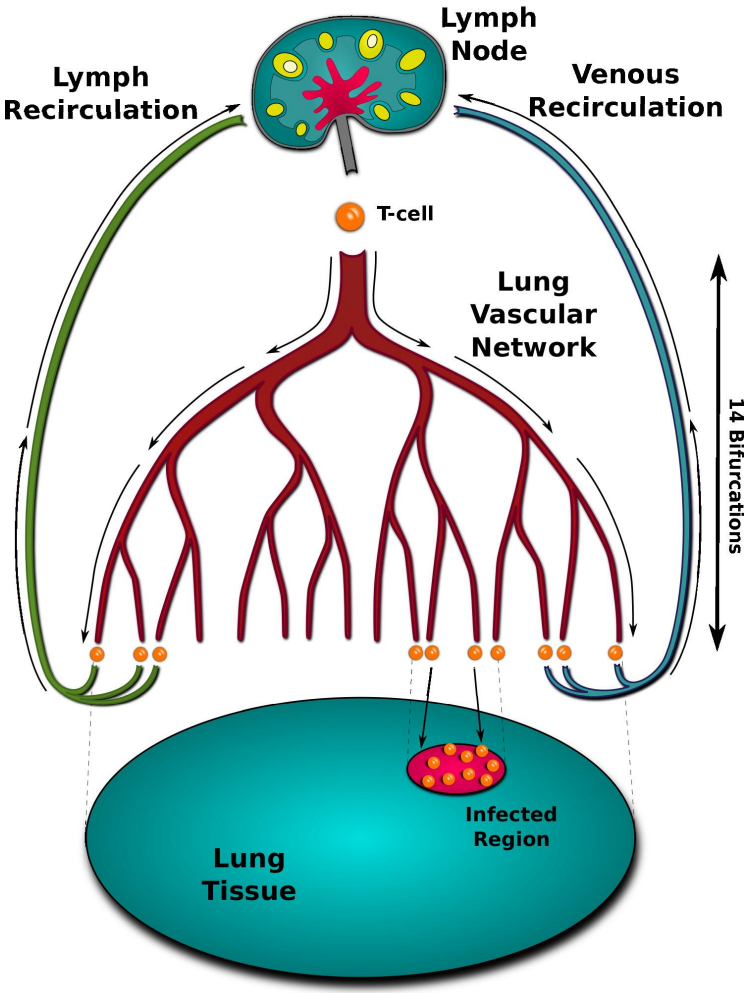
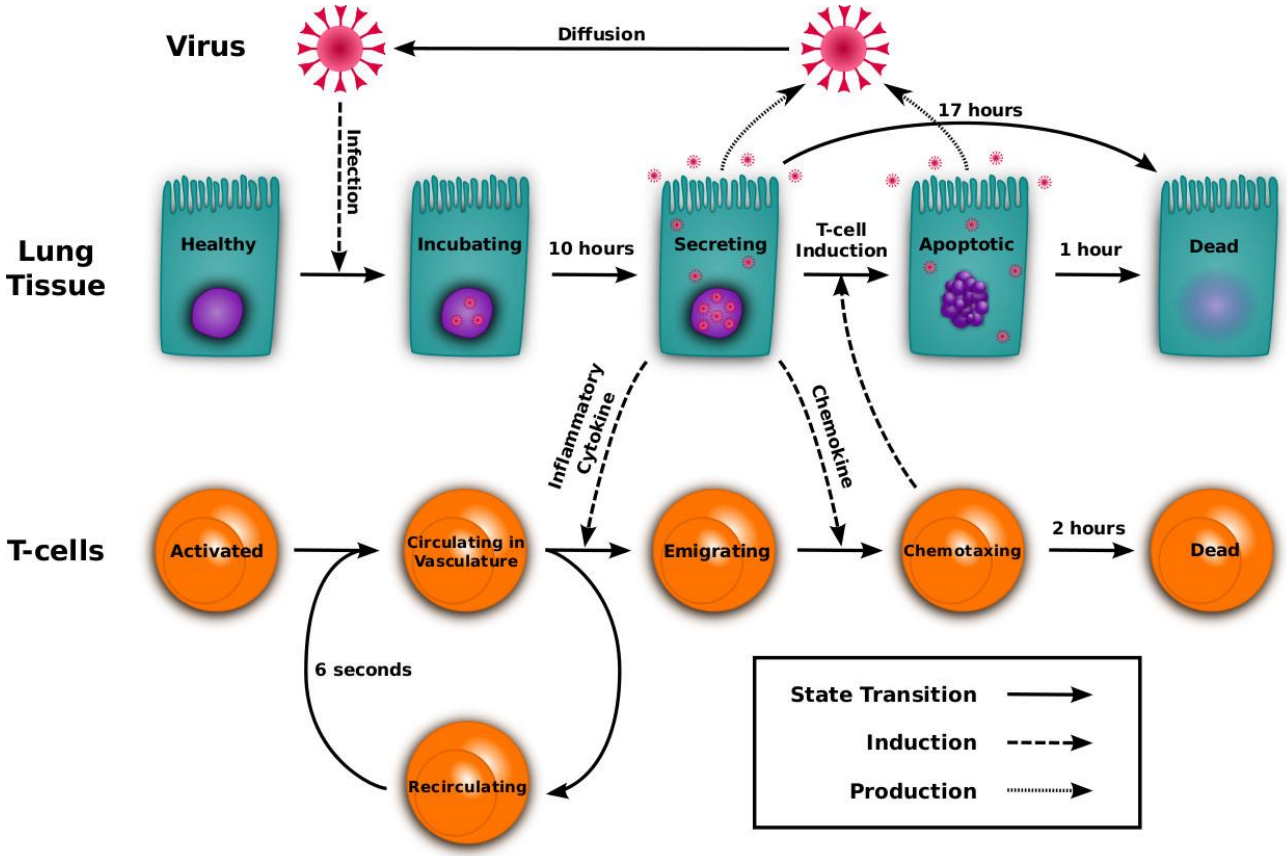
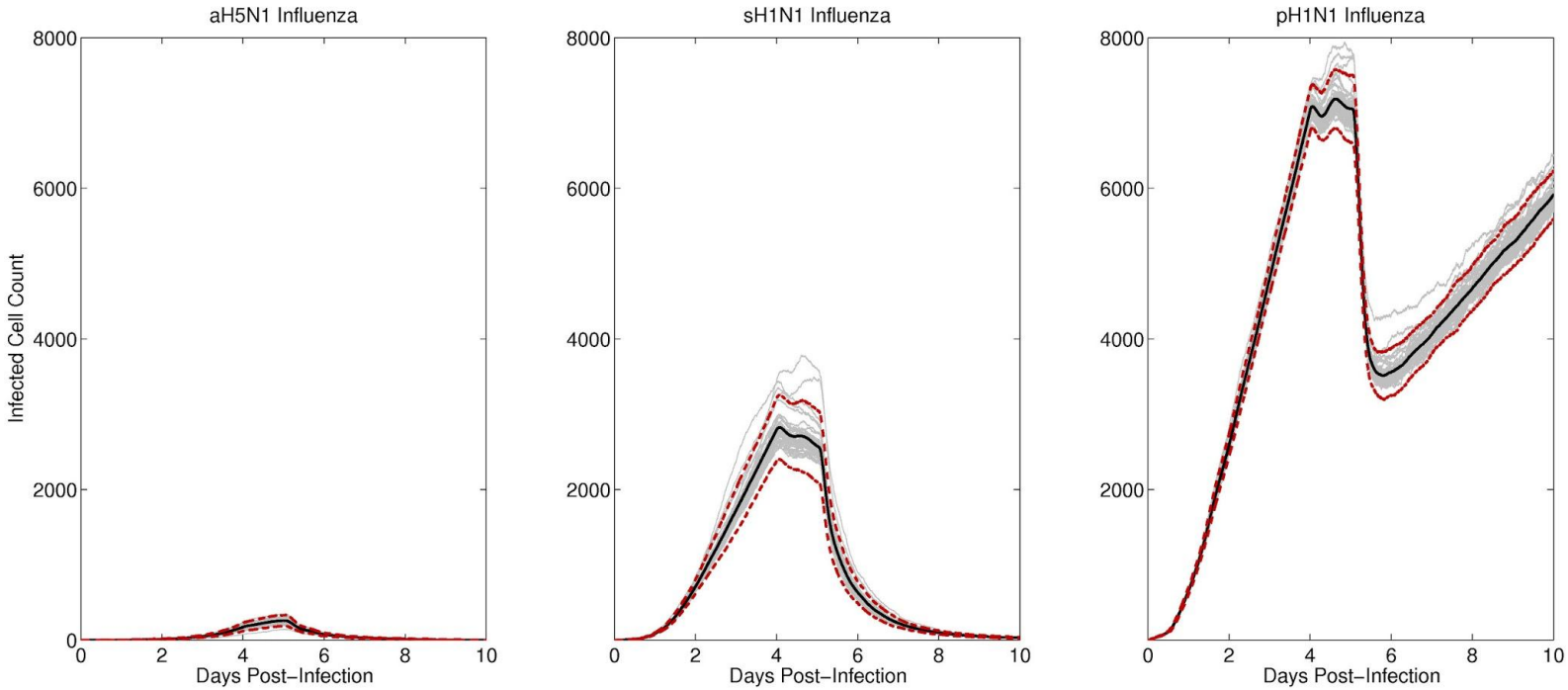
The System


Lymph Node
Lymph Recirculation
Venous Recirculation
T-cell
Lung Vascular Network
14 Bifurcations
Infected Region
Lung Tissue

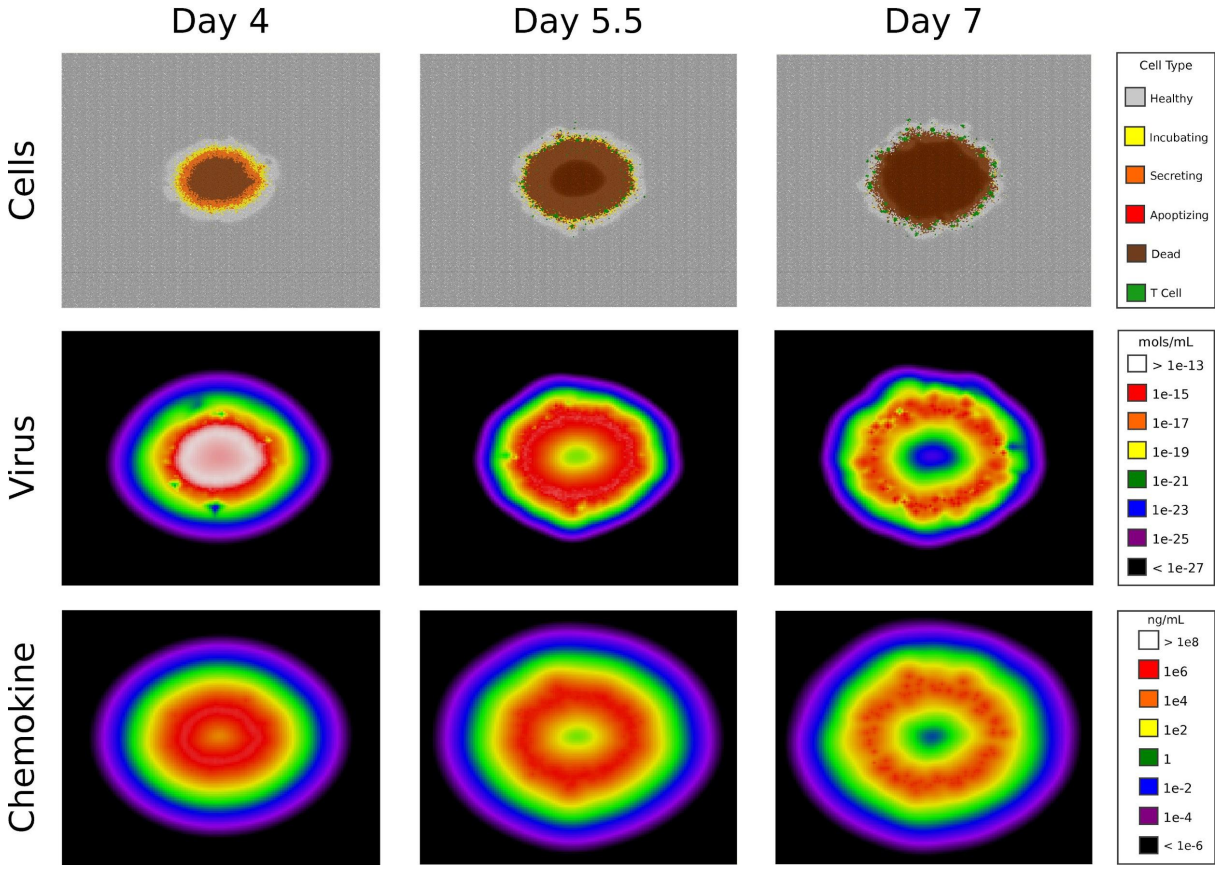
The Model


Virus
Diffusion
Infection
17 hours
Lung Tissue
Healthy
Incubating
10 hours
Secreting
T-cell Induction
Apoptotic
1 hour
Dead
Inflammatory Cytokine
Chemokine
T-cells
Activated
Circulating in Vasculature
Emigrating
Chemotaxing
2 hours
Dead
6 seconds
Recirculating
State Transition
Induction
Production

Initial Results



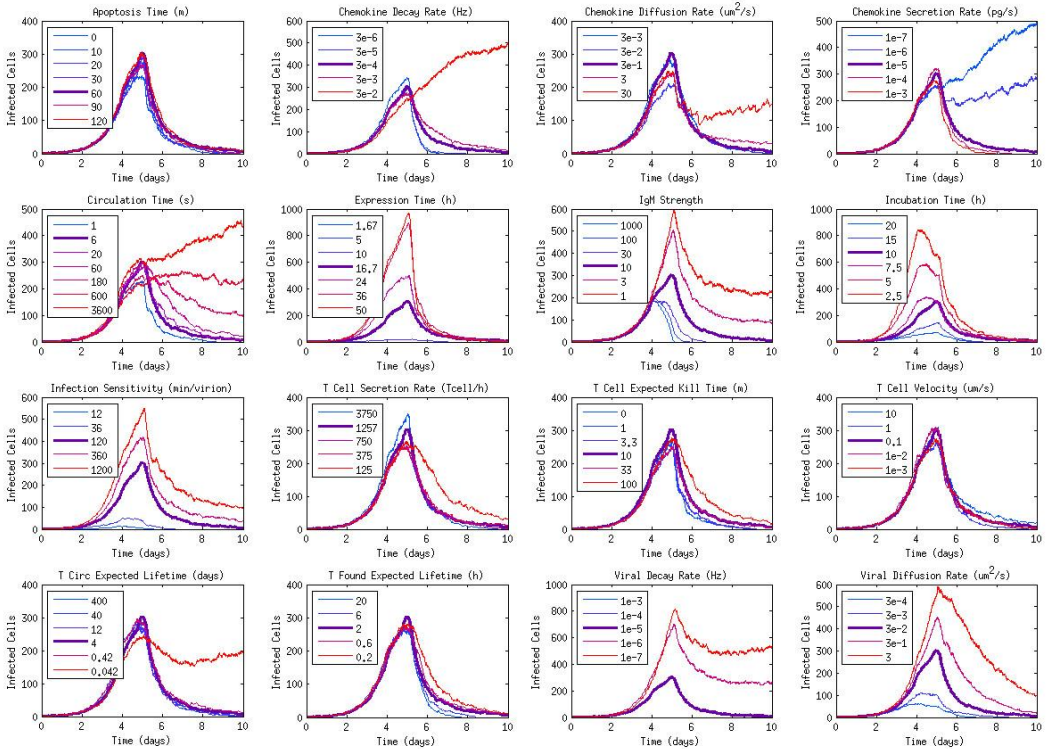
Spatial Effects



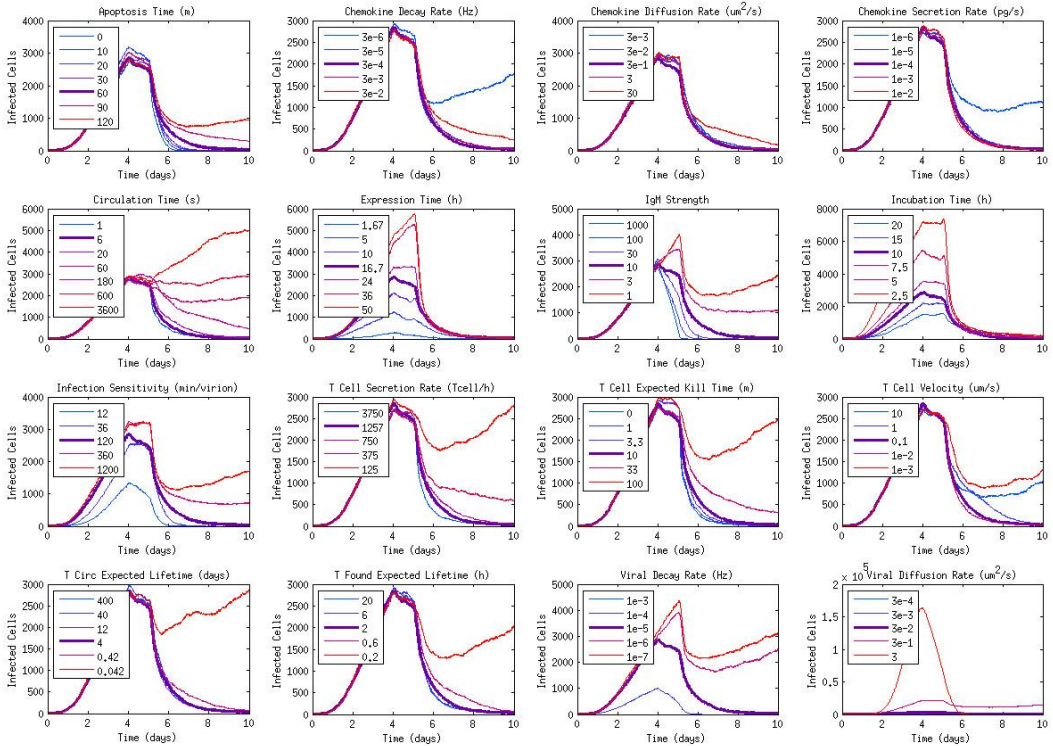
Sensitivity Analysis

Category	Parameter	Avian H5N1	Seasonal H1N1	Pandemic H1N1
Stable	Apoptosis Time	stable	stable	stable
	Chemokine Decay Rate	mostly stable	mostly stable	stable
	Chemokine Diffusion Rate	mostly stable	stable	stable
	Chemokine Secretion Rate	mostly stable	stable	stable
	Circulation Time	mostly stable	mostly stable	mostly stable
	T Cell Kill Rate	stable	mostly stable	mostly stable
	T Cell Velocity	stable	mostly stable	mostly stable
	Circulating Decay Rate	stable	mostly stable	mostly stable
	Found Decay Rate	stable	mostly stable	mostly stable
Peak Change	Expression Time	peak change	peak change	peak change
	Incubation Time	peak change	peak change	peak change
Sensitive	IgM Strength	sensitive	sensitive	sensitive
	Infection Sensitivity	sensitive	sensitive	sensitive
	Viral Decay Rate	sensitive	sensitive	sensitive
	Viral Diffusion Rate	sensitive	sensitive	sensitive
	T Cell Secretion Rate	mostly stable	sensitive	sensitive

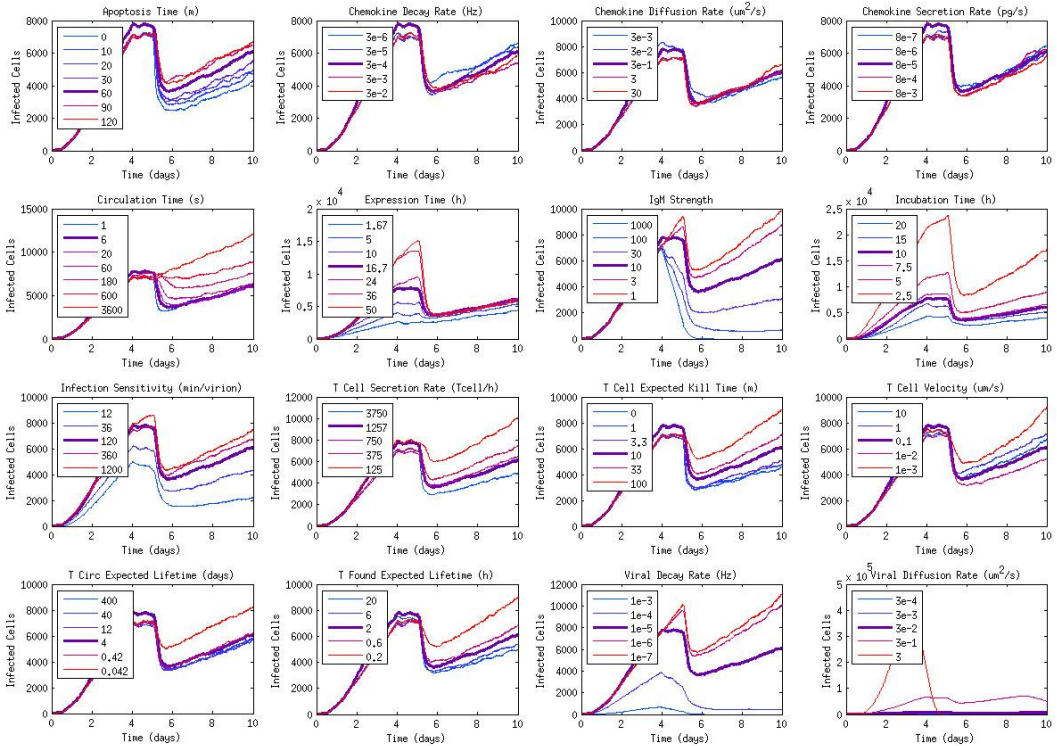
Sensitivity (Avian)



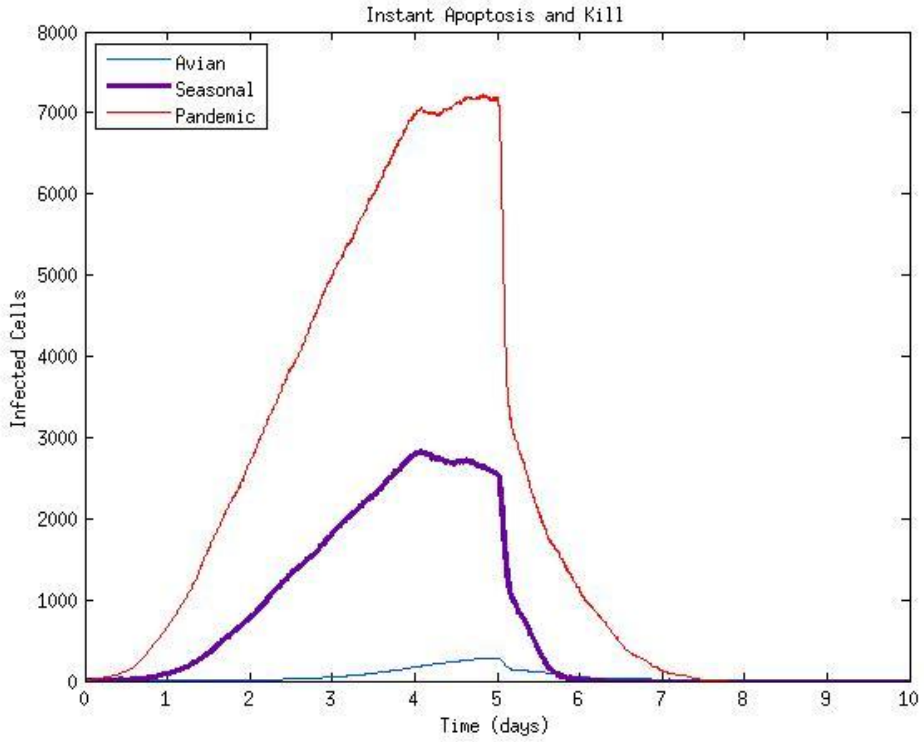
Sensitivity (Seasonal)



Sensitivity (Pandemic)



Instant Kill



Equation!

$Ro = p * t$

Avian p = 5.4e-5 PFU/s
Seasonal p = 3.8e-4 PFU/s
Pandemic p = 5.1e-3 PFU/s

<u>For Ro = 1:</u>
Avian t = 5h : 3m : 27s
Seasonal t = 43m : 52s
Pandemic t = 3m : 16s

t includes:
arrival, induction, and apoptosis

induction = 10m
apoptosis = 1h

minimum time: 1h : 10m Uh Oh!