Supporting Material for Spatiotemporal Evolution of Erythema Migrans, the Hallmark Rash of Lyme Disease

Dhruv K. Vig and Charles W. Wolgemuth

Supplemental Figure

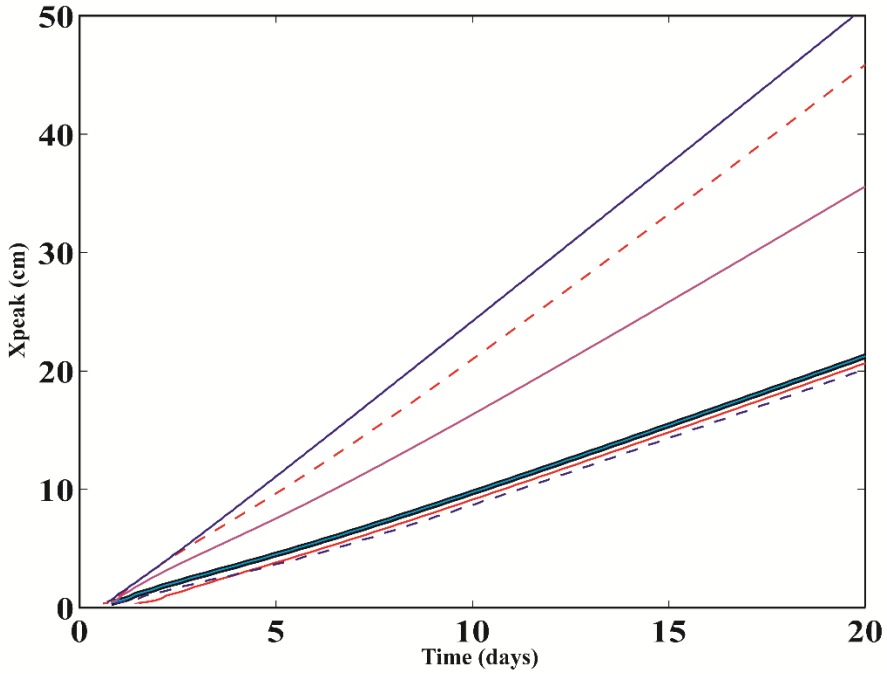

Figure S1. The effect of the parameters on the spreading velocity. A spreading velocity of 1 cm/day (black) was compared with changes in the model's parameters. Simulations were performed under the following various conditions: a bacterial replication rate, r ~4 days^{-1} (blue), bacterial diffusion coefficient, D~ 5 cm^2/day (dashed red), the absence of stationary spirochetes, k_{on} ~ 0 days^{-1} (magenta), a chemotaxis constant, χ ~ 0.25 cm^{5}day^{-1} (cyan), a macrophage activation rate, a ~ 1 day^{-1} (red), and a macrophage clearing rate, d~*1* (dashed blue). The spirochete clearing rate due to phagocytosis was found to be equal to changes in the macrophage activation rate.

Supplemental Table of Paramaters

Table S1. List of parameters and their values for the model.

Parameters	Symbol	Value	Reference
Diffusion coefficient	D	$1 cm^2 day^{-1}$	$\nu^2 k_{off}^{-1}$
Spirochete replication rate	r	$2 days^{-1}$	(18)
Phagocytosis rate	c	$5 days^{-1}$	Estimated
Dermal binding constant	k_{on}	$100 days^{-1}$	(4)
Dermal release constant	k_{off}	$50 days^{-1}$	(4)
Chemotaxis constant	χ	$0.05 cm^5 day^{-1}$	Estimated
Macrophage activation	a	$1 day^{-1}$	(8)*
Macrophage clearing	d	$0.05 - 0.3 day^{-1}$	(19)
Spirochete velocity	ν	$1 - 5 \mu m s^{-1}$	(4)

*value estimated based on the data in this reference.

Supporting Movies Legends

Movie S1: Time series showing a radial slice through a developing homogeneous rash. Blue lines denote the density of the spirochetes and the red lines show the density of the macrophages.

Movie S2: Time series showing a radial slice through a developing central erythema. Blue lines denote the density of the spirochetes and the red lines show the density of the macrophages.

Movie S3: Time series showing a radial slice through a developing central clearing rash. Blue lines denote the density of the spirochetes and the red lines show the density of the macrophages.

Movie S4: Time series showing the simulated spatiotemporal evolution of a homogeneous erythema. The red coloring tracks the macrophage density.

Movie S5: Time series showing the simulated spatiotemporal evolution of a central erythema. The red coloring tracks the macrophage density.

Movie S6: Time series showing the simulated spatiotemporal evolution of a central clearing rash. The red coloring tracks the macrophage density.

Movie S7: Simulation of the spatiotemporal clearing of a homogeneous erythema during the time course of a typical 30 day antibiotic treatment.

Movie S8: Simulation of the spatiotemporal clearing of a central erythema during the time course of a typical 30 day antibiotic treatment.

Movie S9: Simulation of the spatiotemporal clearing of a central clearing rash during the time course of a typical 30 day antibiotic treatment.