A model for endolysins in transients dynamics

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Abstract

test

The model

We propose a predator-prey model to describe the interaction of endolysins and bacteria. This model consists of six parameters and five mechanistic terms (see equation 1 below):

1. Bacterial logistic growth: bacteria duplicate until they reach the carrying capacity.
2. Bacterial predation by endolysins: n endolysins to find a bacterial cell and kill it.
3. Endolysin flow: endolysins are introduced into the system at a certain rate.
4. Endolysin decay by predation: n endolysins leave the system whenever they bump into a bacterial cell.
5. Endolysin decay: endolysins will decay if they do not bump into their target bacteria.

$$\frac{dB}{dt} = \underbrace{r(1-B/K)B}_{\text{logistic growth}} - \underbrace{dBnE}_{\text{endolysin predation}} \tag{1}$$

$$\frac{dE}{dt} = \underbrace{fE}_{endolysin flow} - \underbrace{dBnE}_{\text{endolysin predation}} - \underbrace{mE}_{\text{endolysin decay}} \tag{2}$$

Table 1: 1

Parameter	Units	Description	Values	Source
r	h^{-1}	Maximum growth rate		
K	$cells/ml$	Carrying capacity		
d	ml/h	Infection rate		
n		Number of endolysins to kill a bacteria		
f	h^{-1}	Flow rate of endolysins		
m	h^{-1}	Decay rate of endolysins		