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Supplementary Information for

Alternating lysis and lysogeny is a winning strategy in bacteriophages due to Parrondo's Paradox

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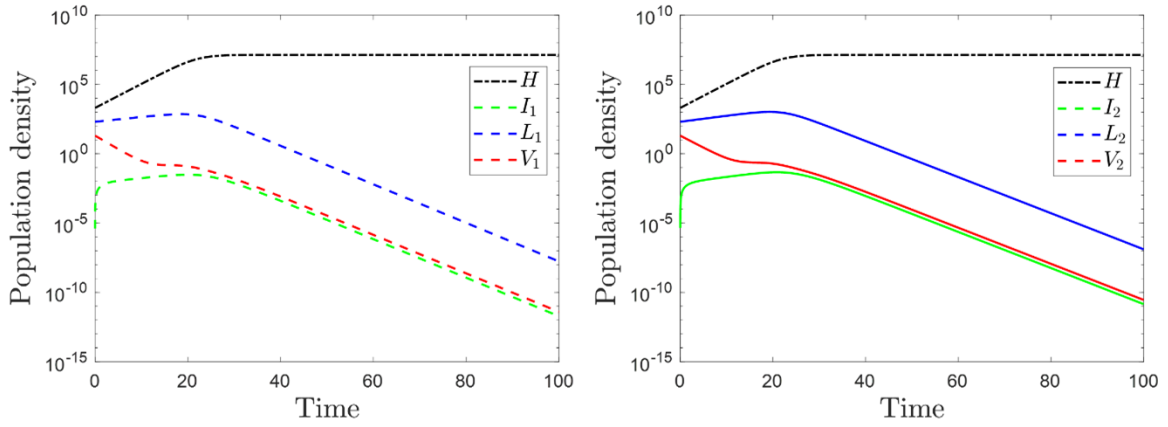
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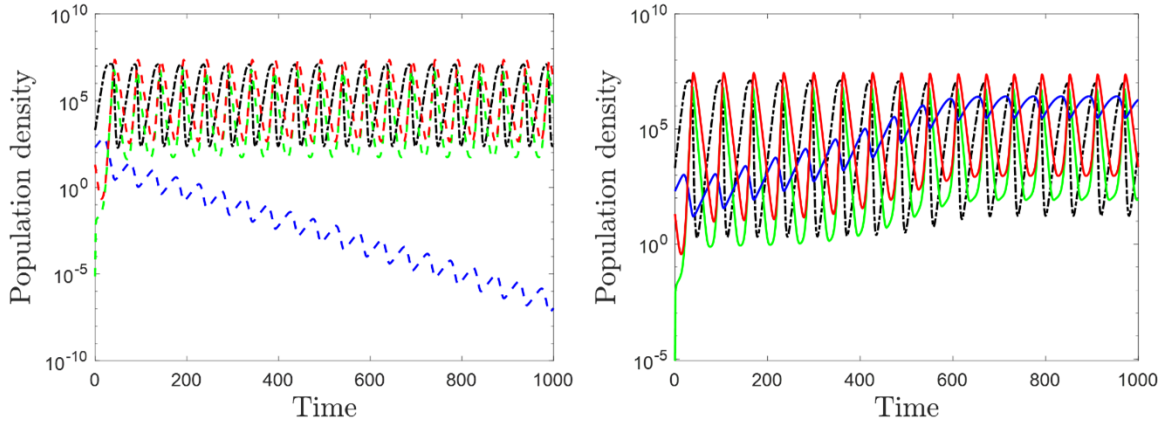
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(A) Losing Result I



(B) Losing Result II

Fig. S1. Compartment densities in the presence of each phage alone, in two losing results.

(A) Population density of compartments when there is only one type of phage to infect the host, with $(\alpha_i, \beta_i) = (0, 0)$ for $i = 1, 2$ ("losing result I").

(B) Identical but with $(\alpha_i, \beta_i) = (1, 0)$ for $i = 1, 2$ ("losing result II").

Initial density of compartments of P_2 is set to zero when P_1 is present alone, and vice versa for P_2 present alone. Parameter values are listed in SI Appendix - Table S1 unless stated otherwise.

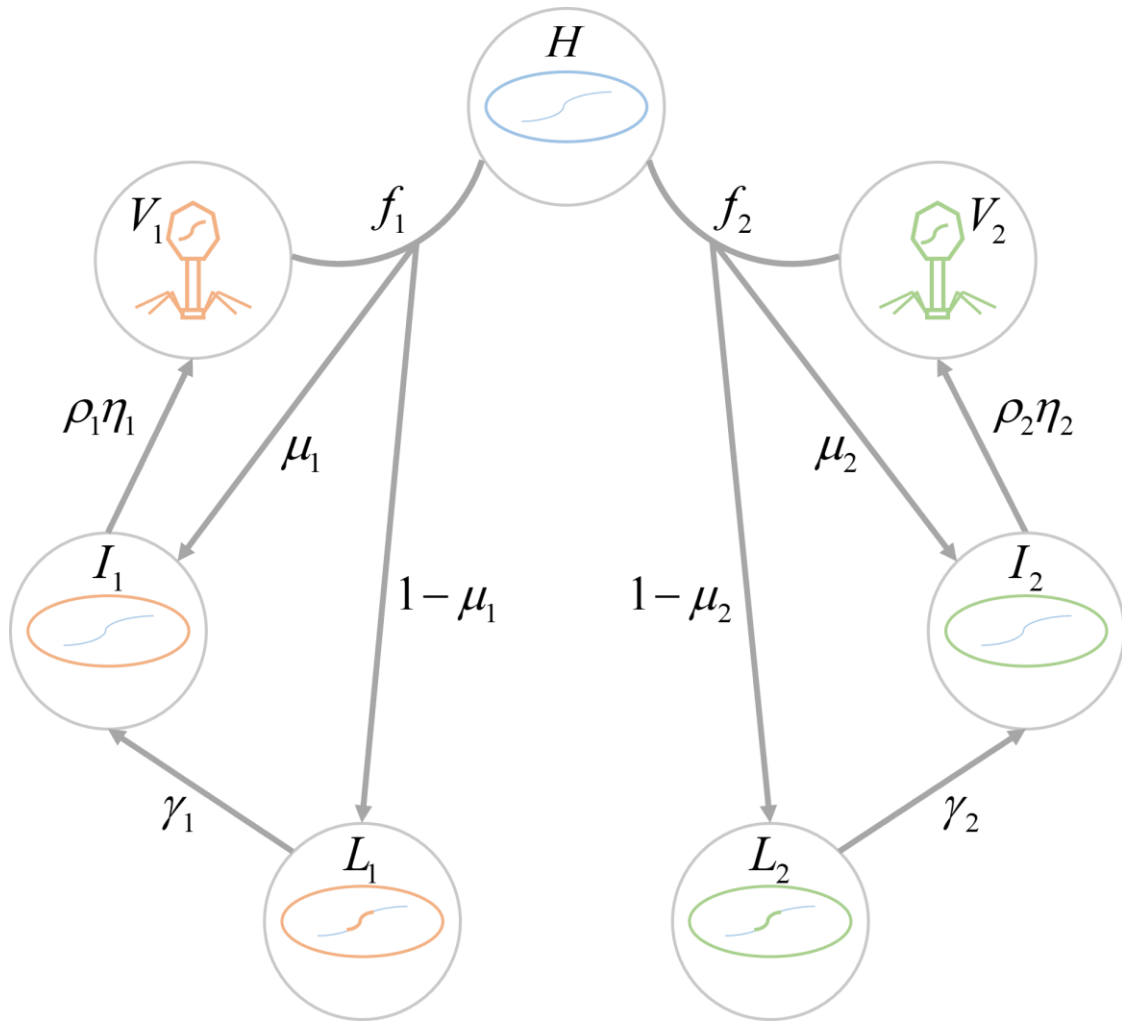


Fig. S2. Framework of the model showing the relationships between the various compartments.

Table S1. Initial values, units, and descriptions of parameters.

Parameter	Description	Values		Units	Reference
H	Number of host cells	2000		ml^{-1}	(1)
V_1	Number of the first virus particles	20		ml^{-1}	(1)
V_2	Number of the second virus particles	20		ml^{-1}	(1)
L_1	Number of the first virus lysogens	200		ml^{-1}	(1)
L_2	Number of the second virus lysogens	200		ml^{-1}	(1)
I_1	Number of lytically-infected cells by V_1	0		ml^{-1}	(1)
I_2	Number of lytically-infected cells by V_2	0		ml^{-1}	(1)
r	Growth rate	0.6		h^{-1}	(2)
K	Environment carrying capacity	2×10^7		ml^{-1}	(1)
d_h	Mortality rate of the host cells	0.2		h^{-1}	(3)
		P_1	P_2		
f	Infection rate	1×10^{-7}	1.1×10^{-7}	ml / h	(4)
ρ	Burst size	200	210	Dimensionless	(1)
γ	Induction rate	2.4×10^{-5}	2.4×10^{-5}	h^{-1}	(2)
η	Portion of infected cells to replicate	0.015	0.015	h^{-1}	(5)
d	Mortality rate of V	0.45	0.4	h^{-1}	(3)
d'	Mortality rate of I and L	0.52	0.5	h^{-1}	(6)
$\mu(h)$	Probability to lyse	Function	Function	Dimensionless	
θ	Switching threshold	0.5	6	ml^{-1}	
χ	Switching interval	0.5	2	ml^{-1}	
α	Lower bound	0	0	Dimensionless	
β	Range	1	1	Dimensionless	

SI References

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