

# Bryan T. Grenfell: *Curriculum Vitae*

## Current employment

**Kathryn Briger & Sarah Fenton Professor of Ecology and Public Affairs**, Department of Ecology and Evolutionary Biology, and Woodrow Wilson School of Public and International Affairs, Princeton University, USA 2009 - present

## Former employment

**Alumni Professor of Biology**, Pennsylvania State University, USA 2004 - 2009

**Professor of Population Biology**, Zoology Department, University of Cambridge, UK (BBSRC Professorial Fellowship: 2003-04) 2002 - 2004

**Reader**, Zoology Department, University of Cambridge, UK 1998 - 2002

**Lecturer**, Zoology Department, University of Cambridge, UK 1990 - 1998

**Lecturer**, Department of Animal & Plant Sciences, University of Sheffield, UK 1986 - 1990

**Research Fellow**, Department of Pure & Applied Biology, Imperial College, London, UK 1981 - 1986

**Research Assistant**, Department of Biology, University of York, UK 1977 - 1981

## Academic preparation

**D. Phil.** (York) 1980

**M.Sc.** Biological Computation (York) 1977

**B.Sc.** (Hons) Zoology (Imperial College, London), ARCS (2i) 1976

## Advisory roles and external appointments

Oxford University Clinical Research Unit, Wellcome Trust MOP, Vietnam: **Chair, Scientific Advisory Board** 2013 - present

Emerging Pathogens Institute, University of Florida: **Scientific Advisory Board** 2012 - present

Edinburgh Centre for Immunity, Infection and Evolution: **Scientific Advisory Board** 2012 - present

RAPIDD (Research and Policy in Infectious Disease Dynamics) Program of the US NIH and DHS: **Co-director** 2008 - present

WHO (World Health Organization), **External Advisor** on the dynamics and control of infectious diseases 2005 - 2012

NCEAS (National Center for Ecological Synthesis and Analysis) NSF: **Scientific Advisory Board** 2005 - 2008

Koshland Museum of the National Academy of Sciences, Infectious Disease Exhibit: **Scientific Steering Committee** 2005 - 2007

National Center for Statistical Ecology (UK): **Advisory Board** 2005 - 2006

Cambridge Infectious Disease Consortium (UK): **Scientific Advisory Board** 2004 - present

Fogarty International Center, NIH, Bethesda MD: **Senior visiting scientist** 2002 - present

Girton College, Cambridge (UK): **Fellow** 2002 - 2004

Independent Scientific Group on Bovine Tuberculosis (UK): **Vaccination Subgroup** 2001 - 2003

Programme on Epidemic Models at the Isaac Newton Institute for Mathematical Sciences, Cambridge (UK): **Co-organiser of program** 1993

## Awards

<b>Fellowship</b> of the American Association for the Advancement of Science	2011
<b>Honorary Doctorate</b> , University of Sheffield, UK	2008
<b>Membership</b> of the American Academy of Arts and Sciences	2006
<b>Fellowship</b> of the Royal Society of London (FRS)	2004
<b>Order of the British Empire</b> (Services to epidemiology and the control of infectious diseases)	2002
The <b>Scientific Medal</b> of the Zoological Society of London (national award for outstanding scientist aged under 40)	1995
The <b>T.H. Huxley Medal</b> of Imperial College	1991

## Current funding

National Institutes of Health  
Bill and Melinda Gates Foundation  
US Department of Homeland Security

## Grant committees

Wellcome Trust	Graduate Program Committee	2008 - present
	MOP Thailand and Vietnam, site visit panel	2008
	Infection and Immunity Panel	1992 - 1997
	Biomathematics Panel	1991 - 1996
UK Natural Environment Research Council	Terrestrial Life Sciences Grants Committee	1996 - 1999
	Special Topic on Wildlife Diseases Committee	1991 - 1992

## Learned society membership and offices

American Association for the Advancement of Science	Fellow	Elected 2011
American Academy of Arts and Sciences	Member	Elected 2006
Royal Society of London	Fellow	Elected 2004
British Ecological Society	Member	1983 - present
British Society for Parasitology	Member	1981 - present
	Council Member	1992 - 1994

## Journal editorial responsibilities

<i>PLoS Biology</i>	Editorial Board	2003 - present
<i>Trends in Microbiology</i>	Editorial Board	2000 - present
<i>Journal of Theoretical Biology</i>	Editorial Advisory Board	2000 - 2003
<i>American Naturalist</i>	Associate Editor	1997 - 2000
<i>Journal of Animal Ecology</i>	Editorial Board	1993 - 2001

## Conference organization

RAPIDD Disease Ecology Workshops	Princeton, Penn State and other Universities (12 meetings organized since 2008)	2008 - present
Bill and Melinda Gates Foundation Infectious Disease modeling Symposium	BMGF Main Office, Seattle	June 2013
Mathematical modeling of infectious disease: dynamics and control	Institute for Mathematical Sciences, National University of Singapore	August 2005
Chaos and Forecasting	Royal Society Discussion Meeting	March 1994
Ecology of Infectious Diseases in Natural Populations	The Isaac Newton Institute for Mathematical Sciences, Cambridge, UK	April 1993

## Recent invited talks (typically ~3 per year)

Plenary Lecture	British Society for Parasitology Spring Meeting	April 2014
Francis Black Lecture	Yale School of Public Health	Feb. 2014
Invited lecture	Fondation Mérieux Evolutionary vaccinology symposium	Nov. 2013
Plenary Lecture	Bill and Melinda Gates Foundation convening symposium	June 2013
Plenary lecture	Edinburgh Centre for Immunity, Infection and Evolution, Annual Retreat	June 2013
Invited lecture	Emerging Pathogens Institute, University of Florida	Feb. 2013

## Research group members

### *Postdoctoral scholars and research assistants*

	<b>Funding</b>	<b>Topic</b>	
M. Mina	Princeton	Dynamics of bacterial superinfections	2014 - present
A. Luis	DHS	Age-serological profiles: estimation and modeling	2013 - present
Q. Caudron	DHS	Spatiotemporal aspects of measles spread in small populations	2013 - present
T. Van Boeckel	Princeton	Mapping global trends in antibiotic use in humans and livestock; HFMD dynamics	2013 - present
H. Robbins	Princeton	Epidemiology of HIV	2013 - present
N. Basta	NIH	Epidemiology of meningococcal disease	2012 - present
S. Funk	Gates Foundation	Dynamics of vaccine refusal	2011 - 2013
J. Zelner	NIH/RAPIDD	Epidemiology and transmission dynamics of tuberculosis and diarrheal disease	2010 - present
T. Bogich	NIH	Epidemiology of enteroviruses	2010 - 2014
S. Ballesteros	Gates Foundation	Statistical inference of epidemics	2010 - 2013
N. Arinaminpathy	NIH	Evolutionary epidemiology of influenza	2010 - 2013
N. Bharti	Gates Foundation	Socio-geography of measles	2010 - 2013
R. Kouyos	Swiss Science Foundation	Immunodynamics of measles	2010 - 2012
P. Klepac	Gates Foundation, UNESCO/L'Oreal	Economic epidemiology of vaccination	2009 - 2012

J. Metcalf	Gates Foundation	Control and management of infectious disease	2008 - 2010
S. Bansal	NIH/RAPIDD	Network dynamics of disease	2007 - 2012
V. Pitzer	NIH/RAPIDD	Rotavirus dynamics and control	2007 - 2012
K. Pepin	NIH	Viral evolution	2007 - 2010
M. Ferrari	Gates Foundation	Measles dynamics	2006 - 2009
J. Lloyd Smith	Penn State	Population biology of emerging infections	2006 - 2009
K. Koelle	Penn State	Influenza dynamics	2006 - 2007
I. Volkov	NSF	Population biology of viral infections	2005 - 2008
J. Gog	Royal Society	Population biology of influenza	2003 - 2005
D. Smith	EU	Population biology of influenza	2003 - 2005
A. Fenton	NERC	Parasite population dynamics	2003 - 2005
N. Savill	Wellcome Trust	Foot and Mouth Disease	2003 - 2005
S.C. Cornell	BBSRC/Wellcome	Dynamics of macroparasites	2000 - 2004
A. Park	Animal Health Trust	Epidemiology of equine influenza	2000 - 2004
J. Kappey	Wellcome Trust	Spatio-temporal dynamics of childhood disease	1999 - 2003
Y.C. Xia	Wellcome Trust	Spatio-temporal dynamics of childhood disease	1999 - 2003
K. Glass	Wellcome Trust	Stochastic dynamics in epidemiology	1999 - 2002
J. Read	BBSRC	Evolutionary dynamics of disease	1999 - 2002
B. Leung	NSERC	Wildlife disease epidemiology	1999 - 2001
J. Swinton	NERC	Metapopulation dynamics of wildlife diseases	1998 - 2001
P. Rohani	NERC / Royal Society	Dynamics of disease metapopulations	1996 - 2002
B. F. Finkenstädt	Wellcome Trust	Time series analysis in epidemiology	1996 - 1999
D.J. Earn	Wellcome Trust	Population biology of whooping cough	1996 - 1999
M.J. Keeling	Wellcome Trust / Royal Society	Spatio-temporal dynamics of infectious diseases	1995 - 2002
K.A.J. White	Wellcome Trust	Seasonal dynamics of macroparasites	1994 - 1997
E. Michael	Wellcome Trust	Epidemiology of lymphatic filariasis	1993 - 1999
K. Wilson	NERC	Population dynamics of Soay sheep	1993 - 1996

### *Research students*

	<b>Funding</b>	<b>Topic</b>	
S. Morris	Princeton/EEB	Epidemiological impact of partial immunity	2013 - present
R. Birger	Princeton/EEB	Dynamics and control of HIV and HCV	2010 - present
A. Dorelien	Princeton/WWS/EEB	Demography and infectious disease	2009 - 2013
C. Stack	NIH	Viral phylodynamics	2007 - 2010
N. Bharti	Penn State	Measles in developing countries	2005 - 2009
T. Howat	MRC	Viral dynamics	2003 - 2006
A. Conlan	Wellcome Trust	Disease persistence, invasion and demography	2002 - 2006
C. Russell	Gates Cambridge Trust	Geographical spread of microparasites	2002 - 2006
N. Mantilla	Mexican Govt.	Historical dynamics of childhood infections	2000 - 2004
K. Eames	BBSRC	Network structure and the dynamics of infection	2001 - 2004
J. Gog	Trinity College	Strain structure and infectious disease dynamics	1999 - 2003

R. Hamilton	BBSRC	Within-host dynamics of acute viral infections	1998 - 2003
C. Green	BBSRC	Hierarchical spatial dynamics of infectious diseases	1998 - 2002
S.P. Brown	BBSRC	Evolutionary ecology of macroparasite immunity	1996 - 2000
M.E. Chambers	NERC	Spatial dynamics of filariasis in Papua New Guinea	1995 - 1999
T. Braisher	MRC	Molecular ecology of ruminants' nematode parasites	1994 - 1998
H.E. Boyd	NERC	Dynamics of parasitism in St Kilda sheep	1994 - 1998
N. Alexander	self-funded	Modelling heterogeneity in the dynamics of lymphatic filariasis	1994 - 1998
D.J. Shaw	BBSRC	Population biology of macroparasites	1990 - 1994
B.M. Bolker	Mellon Foundation	Nonlinear dynamics of measles	1990 - 1993
G. Garnett	NERC	Dynamics and control of Varicella-Zoster	1987 - 1990

## Publications <sup>1</sup>

1. Geoghegan J.L., Tan L.V., Kühnert D., Halpin R.A., Lin X., Simenauer A., Akopov A., Das S.R., Stockwell T.B., Shrivastava S., Ngoc N.M., Uyen L.T., Tuyen N.T., Thanh T.T., Hang V.T., Qui P.T., Hung N.T., Khanh T.H., Thinh L.Q., Nhan L.N., Van H.M., Viet D.C., Tuan H.M., Viet H.L., Hien T.T., Chau N.V., Thwaites G., **Grenfell B.T.**, Stadler T, Wentworth DE, Holmes EC, Van Doorn HR. 2015. Phylodynamics of Enterovirus A71-Associated Hand, Foot and Mouth Disease in Viet Nam. *J Virol.* . JVI.00706-15
2. Birger R.B., Kouyos R.D., Cohen T., Griffiths E.C., Huijben S., Mina M., Volkova V., **Grenfell B.T.**, Metcalf C.J. 2015. The potential impact of coinfection on antimicrobial chemotherapy and drug resistance. pii: S0966-842X(15) 106-7.
3. Faust C., Zelner J., Brasseur P., Vaillant M., Badiane M., Cisse M., **Grenfell B.T.**, Olliaro P. 2015. Assessing Drivers of Full Adoption of Test and Treat Policy for Malaria in Senegal. *Am J Trop Med Hyg.* pii: 14-0595.
4. Mina M.J., Metcalf C.J., de Swart R.L., Osterhaus A.D., **Grenfell B.T.** 2015 Vaccines. Long-term measles-induced immunomodulation increases overall childhood infectious disease mortality. *Science.* May 8; **348**(6235):694-9.
5. Metcalf C.J., Andreasen V., Bjornstad O.N., Eames K., Edmunds W.J., Funk S., Hollingworth T.D., Lessler J., Viboud C., **Grenfell B.T.** 2015. Seven challenges in modelling vaccine preventable diseases. *Epidemics.* Mar;10:11-5.
6. Van Boeckel T.P., Brower C., Gilbert M., **Grenfell B.T.**, Levin S.A., Robinson T.P., Teillant A., Laxminarayan R. 2015. Global trends in antimicrobial use in food animals. *Proc Natl Acad Sci USA.* May 5;112(18):5649-54.
7. Takahashi S., Metcalf C.J., Ferrari M.J., Moss W.J., Truelove S.A., Tatem A.J., **Grenfell B.T.**, Lessler J. 2015. Reduced vaccination and the risk of measles and other childhood infections post-Ebola. *Science.* Mar 13;347(6227):1240-2
8. Perkins T.A., Metcalf C.J., **Grenfell B.T.**, Tatem A.J. 2015. Estimating drivers of autochthonous transmission of chikungunya virus in its invasion of the americas. *PLoS Curr.* Feb 10;7.
9. Morris S.E., Pitzer V.E., Viboud C., Metcalf C.J., Bjornstad O.N., **Grenfell B.T.** 2015. Demographic buffering: titrating the effects of birt rate and imperfect immunity on epidemic dynamics. *J R Soc Interface.* Mar 6;12(104):20141245. doi: 10.1098/rsif.2014.1245.

<sup>1</sup> <http://scholar.google.com/citations?user=FEBziZ0AAAAJ&hl=en>

10. Pitzer V.E., Viboud C., Alonso W.J., Wilcox T., Metcalf C.J., Steiner C.A., Haynes A.K., **Grenfell B.T.** 2015 . Environmental drivers of the spatiotemporal dynamics of respiratory syncytial virus in the United States. *Jan 8;11(1):e1004591.*
11. Pitzer, V. E., C. C. Bowles, S. Baker, G. Kang, V. Balaji, J. J. Farrar, and B. T. **Grenfell.** 2014. Predicting the impact of vaccination on the transmission dynamics of typhoid in South Asia: a mathematical modeling study. *PLoS Negl Trop Dis 8:e2642.*
12. Birger, R. B., T. B. Hallett, A. Sinha, B. T. **Grenfell,** and S. L. Hodder. 2014. Modeling the impact of interventions along the HIV continuum of care in Newark, New Jersey. *Clin Infect Dis 58:274-284.*
13. Zelner, J. L., M. B. Murray, M. C. Becerra, J. Galea, L. Lecca, R. Calderon, R. Yataco, C. Contreras, Z. Zhang, B. T. **Grenfell,** and T. Cohen. 2014. Bacillus calmette-guerin and isoniazid preventive therapy protect contacts of patients with tuberculosis. *Am J Respir Crit Care Med 189:853-859.*
14. Xiao, H., H. Y. Tian, L. D. Gao, H. N. Liu, L. S. Duan, N. Basta, B. Cazelles, X. J. Li, X. L. Lin, H. W. Wu, B. Y. Chen, H. S. Yang, B. Xu, and B. **Grenfell.** 2014. Animal reservoir, natural and socioeconomic variations and the transmission of hemorrhagic fever with renal syndrome in Chenzhou, China, 2006-2010. *PLoS Negl Trop Dis 8:e2615.*
15. Ferrari, M. J., B. T. **Grenfell,** and P. M. Strebel. 2013. Think globally, act locally: the role of local demographics and vaccination coverage in the dynamic response of measles infection to control. *Philos Trans R Soc Lond B Biol Sci 368:20120141.*
16. Metcalf, C. J., K. Hampson, A. J. Tatem, B. T. **Grenfell,** and O. N. Bjornstad. 2013. Persistence in epidemic metapopulations: quantifying the rescue effects for measles, mumps, rubella and whooping cough. *PLoS One 8:e74696.*
17. Zelner, J. L., B. A. Lopman, A. J. Hall, S. Ballesteros, and B. T. **Grenfell.** 2013. Linking time-varying symptomatology and intensity of infectiousness to patterns of norovirus transmission. *PLoS One 8:e68413.*
18. Stack, J. C., P. R. Murcia, B. T. **Grenfell,** J. L. Wood, and E. C. Holmes. 2013. Inferring the inter-host transmission of influenza A virus using patterns of intra-host genetic variation. *Proc Biol Sci 280:20122173.*
19. Metcalf, C. J., C. Cohen, J. Lessler, J. M. McAnerney, G. M. Ntshoe, A. Puren, P. Klepac, A. Tatem, B. T. **Grenfell,** and O. N. Bjornstad. 2013. Implications of spatially heterogeneous vaccination coverage for the risk of congenital rubella syndrome in South Africa. *J R Soc Interface 10:20120756.*
20. Dorelien, A. M., S. Ballesteros, and B. T. **Grenfell.** 2013. Impact of birth seasonality on dynamics of acute immunizing infections in Sub-Saharan Africa. *PLoS One 8:e75806.*
21. Kouyos, R., E. Klein, and B. **Grenfell.** 2013. Hospital-community interactions foster coexistence between methicillin-resistant strains of Staphylococcus aureus. *PLoS Pathog 9:e1003134.*
22. Murcia, P. R., G. J. Baillie, J. C. Stack, C. Jervis, D. Elton, J. A. Mumford, J. Daly, P. Kellam, B. T. **Grenfell,** E. C. Holmes, and J. L. Wood. 2013. Evolution of equine influenza virus in vaccinated horses. *J Virol 87:4768-4771.*
23. Pepin, K. M., S. Riley, and B. T. **Grenfell.** 2013. Effects of influenza antivirals on individual and population immunity over many epidemic waves. *Epidemiol Infect 141:366-376.*
24. Rozhnova, G., C. J. Metcalf, and B. T. **Grenfell.** 2013. Characterizing the dynamics of rubella relative to measles: the role of stochasticity. *J R Soc Interface 10:20130643.*
25. Azman, A. S., F. J. Luquero, A. Rodrigues, P. P. Palma, R. F. Grais, C. N. Banga, B. T. **Grenfell,** and J. Lessler. 2012. Urban cholera transmission hotspots and their implications for reactive vaccination: evidence from Bissau city, Guinea bissau. *PLoS Negl Trop Dis 6:e1901.*
26. Lopman, B. A., V. E. Pitzer, R. Sarkar, B. Gladstone, M. Patel, J. Glasser, M. Gambhir, C. Atchison, B. T. **Grenfell,** W. J. Edmunds, G. Kang, and U. D. Parashar. 2012. Understanding reduced rotavirus vaccine efficacy in low socio-economic settings. *PLoS One 7:e41720.*
27. Metcalf, C. J., J. Lessler, P. Klepac, A. Morice, B. T. **Grenfell,** and O. N. Bjornstad. 2012. Structured models of infectious disease: inference with discrete data. *Theor Popul Biol 82:275-282.*

28. Bharti, N., H. Broutin, R. F. Grais, M. J. Ferrari, A. Djibo, A. J. Tatem, and B. T. **Grenfell**. 2012. Spatial dynamics of meningococcal meningitis in Niger: observed patterns in comparison with measles. *Epidemiol Infect* **140**:1356-1365.
29. Arinaminpathy, N., J. S. Lavine, and B. T. **Grenfell**. 2012. Self-boosting vaccines and their implications for herd immunity. *Proc Natl Acad Sci U S A* **109**:20154-20159.
30. Cutts, F. T., C. J. Metcalf, J. Lessler, and B. T. **Grenfell**. 2012. Rubella vaccination: must not be business as usual. *Lancet* **380(9838)**:217-218.
31. Saenz, R. A., S. C. Essen, S. M. Brookes, M. Iqbal, J. L. Wood, B. T. **Grenfell**, J. W. McCauley, I. H. Brown, and J. R. Gog. 2012. Quantifying transmission of highly pathogenic and low pathogenicity H7N1 avian influenza in turkeys. *PLoS One* **7**:e45059.
32. Lin, W. H., R. D. Kouyos, R. J. Adams, B. T. **Grenfell**, and D. E. Griffin. 2012. Prolonged persistence of measles virus RNA is characteristic of primary infection dynamics. *Proc Natl Acad Sci U S A* **109**:14989-14994.
33. Klepac, P., O. N. Bjornstad, C. J. Metcalf, and B. T. **Grenfell**. 2012. Optimizing reactive responses to outbreaks of immunizing infections: balancing case management and vaccination. *PLoS One* **7**:e41428.
34. Lessler, J., C. J. Metcalf, and B. T. **Grenfell**. 2012. Measurement of vaccine-derived immunity: how do we use all the data? *Expert Rev Vaccines* **11**:747-749.
35. Reperant, L. A., T. Kuiken, B. T. **Grenfell**, A. D. Osterhaus, and A. P. Dobson. 2012. Linking influenza virus tissue tropism to population-level reproductive fitness. *PLoS One* **7**:e43115.
36. Stack, J. C., S. Bansal, V. S. Kumar, and B. **Grenfell**. 2012. Inferring population-level contact heterogeneity from common epidemic data. *J R Soc Interface*
37. Arinaminpathy, N., O. Ratmann, K. Koelle, S. L. Epstein, G. E. Price, C. Viboud, M. A. Miller, and B. T. **Grenfell**. 2012. Impact of cross-protective vaccines on epidemiological and evolutionary dynamics of influenza. *P Natl Acad Sci Usa* **109**:3173-3177.
38. Metcalf, C. J., J. Lessler, P. Klepac, F. Cutts, and B. T. **Grenfell**. 2012. Impact of birth rate, seasonality and transmission rate on minimum levels of coverage needed for rubella vaccination. *Epidemiol Infect* **140**:2290-2301.
39. Murcia, P. R., J. Hughes, P. Battista, L. Lloyd, G. J. Baillie, R. H. Ramirez-Gonzalez, D. Ormond, K. Oliver, D. Elton, J. A. Mumford, M. Caccamo, P. Kellam, B. T. **Grenfell**, E. C. Holmes, and J. L. N. Wood. 2012. Evolution of an Eurasian Avian-like Influenza Virus in Naive and Vaccinated Pigs. *Plos Pathog* **8**:ARTN e1002730.
40. Pitzer, V. E., K. E. Atkins, B. F. de Blasio, T. Van Effelterre, C. J. Atchison, J. P. Harris, E. Shim, A. P. Galvani, W. J. Edmunds, C. Viboud, M. M. Patel, B. T. **Grenfell**, U. D. Parashar, and B. A. Lopman. 2012. Direct and indirect effects of rotavirus vaccination: comparing predictions from transmission dynamic models. *PLoS One* **7**:e42320.
41. Metcalf, C. J., O. N. Bjornstad, M. J. Ferrari, P. Klepac, N. Bharti, H. Lopez-Gatell, and B. T. **Grenfell**. 2011. The epidemiology of rubella in Mexico: seasonality, stochasticity and regional variation. *Epidemiol Infect* **1**-10.
42. Metcalf, C. J., O. N. Bjornstad, M. J. Ferrari, P. Klepac, N. Bharti, H. Lopez-Gatell, and B. T. **Grenfell**. 2011. The epidemiology of rubella in Mexico: seasonality, stochasticity and regional variation. *Epidemiol Infect* **139**:1029-1038.
43. Klepac, P., R. Laxminarayan, and B. T. **Grenfell**. 2011. Synthesizing epidemiological and economic optima for control of immunizing infections. *P Natl Acad Sci Usa* **108**:14366-14370.
44. Metcalf, C. J., C. V. Munayco, G. Chowell, B. T. **Grenfell**, and O. N. Bjornstad. 2011. Rubella metapopulation dynamics and importance of spatial coupling to the risk of congenital rubella syndrome in Peru. *J R Soc Interface* **8**:369-376.
45. Metcalf, C. J., A. L. Graham, S. Huijben, V. C. Barclay, G. H. Long, B. T. **Grenfell**, A. F. Read, and O. N. Bjornstad. 2011. Partitioning Regulatory Mechanisms of Within-Host Malaria Dynamics Using the Effective Propagation Number. *Science* **333**:984-988.

46. Metcalf, C. J., P. Klepac, M. Ferrari, R. F. Grais, A. Djibo, and B. T. **Grenfell**. 2011. Modelling the first dose of measles vaccination: the role of maternal immunity, demographic factors, and delivery systems. *Epidemiol Infect* **139**:265-274.
47. Pitzer, V. E., M. M. Patel, B. A. Lopman, C. Viboud, U. D. Parashar, and B. T. **Grenfell**. 2011. Modeling rotavirus strain dynamics in developed countries to understand the potential impact of vaccination on genotype distributions. *P Natl Acad Sci Usa* **108**:19353-19358.
48. Lessler, J., C. J. E. Metcalf, R. F. Grais, F. J. Luquero, D. A. T. Cummings, and B. T. **Grenfell**. 2011. Measuring the Performance of Vaccination Programs Using Cross-Sectional Surveys: A Likelihood Framework and Retrospective Analysis. *Plos Med* **8**:ARTN e1001110.
49. Pitzer, V. E., C. Viboud, B. A. Lopman, M. M. Patel, U. D. Parashar, and B. T. **Grenfell**. 2011. Influence of birth rates and transmission rates on the global seasonality of rotavirus incidence. *J R Soc Interface* **8**:1584-1593.
50. Bharti, N., A. J. Tatem, M. J. Ferrari, R. F. Grais, A. Djibo, and B. T. **Grenfell**. 2011. Explaining Seasonal Fluctuations of Measles in Niger Using Nighttime Lights Imagery. *Science* **334**:1424-1427.
51. **Grenfell**, B. T. 2011. Boosting understanding of pertussis outbreaks. *P Natl Acad Sci Usa* **108**:7279-7280.
52. Bansal, S., B. Pourbohloul, N. Hupert, B. T. **Grenfell**, and L. A. Meyers. 2010. The Shifting Demographic Landscape of Pandemic Influenza. *Plos One* **5**:ARTN e9360.
53. Volkov, I., K. M. Pepin, J. O. Lloyd-Smith, J. R. Banavar, and B. T. **Grenfell**. 2010. Synthesizing within-host and population-level selective pressures on viral populations: the impact of adaptive immunity on viral immune escape. *J R Soc Interface* **7**:1311-1318.
54. Ferrari, M. J., A. Djibo, R. F. Grais, N. Bharti, B. T. **Grenfell**, and O. N. Bjornstad. 2010. Rural-urban gradient in seasonal forcing of measles transmission in Niger. *P Roy Soc B-biol Sci* **277**:2775-2782.
55. Metcalf, C. J., C. V. Munayco, G. Chowell, B. T. **Grenfell**, and O. N. Bjornstad. 2010. Rubella metapopulation dynamics and importance of spatial coupling to the risk of congenital rubella syndrome in Peru. *J R Soc Interface*
56. Conlan, A. J. K., P. Rohani, A. L. Lloyd, M. Keeling, and B. T. **Grenfell**. 2010. Resolving the impact of waiting time distributions on the persistence of measles. *J R Soc Interface* **7**:623-640.
57. Stack, J. C., J. D. Welch, M. J. Ferrari, B. U. Shapiro, and B. T. **Grenfell**. 2010. Protocols for sampling viral sequences to study epidemic dynamics. *J R Soc Interface* **7**:1119-1127.
58. Pepin, K. M., I. Volkov, J. R. Banavar, C. O. Wilke, and B. T. **Grenfell**. 2010. Phenotypic differences in viral immune escape explained by linking within-host dynamics to host-population immunity. *J Theor Biol* **265**:501-510.
59. Bharti, N., A. Djibo, M. J. Ferrari, R. F. Grais, A. J. Tatem, C. A. McCabe, O. N. Bjornstad, and B. T. **Grenfell**. 2010. Measles hotspots and epidemiological connectivity. *Epidemiol Infect* **138**:1308-1316.
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