Dr Alex Best

Lecturer in Mathematics & Statistics

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I am an applied mathematician working in the field of mathematical biology. My research focuses on developing and analysing mathematical models of infectious disease dynamics. I teach a variety of courses across mathematics, and I was departmental director for equality, diversity and inclusion from 2018-2022.

Appointments

2016 -	**Lecturer (equiv. Assistant Professor)** School of Mathematics and Statistics, University of Sheffield
2021	**Fulbright-Lloyds Visiting Scholar** Integrative Biology, UC Berkeley
2013 - 2016	**Research Fellow** School of Mathematics and Statistics, University of Sheffield
2012 - 2013	**Associate Research Fellow** Biosciences, University of Exeter
2010 - 2012	**Postdoctoral Research Associate** Department of Animal & Plant Sciences, University of Sheffield

Education

2006 - 2010	**PhD Mathematical Biology** University of Sheffield
2005 - 2006	**MRes Mathematics in the Living Environment (Distinction)** University of York
2002 - 2005	**BSc Mathematics and Philosophy (First Class)** University of Durham

Research Grants & Fellowships

2021	Fulbright-Lloyds Scholarship	$15,000
2019	London Mathematical Society Travel Grant	£1,200
2013	Leverhulme Early Career Fellowship	£87,000

Publications

I have 45 publications (20 first-author) gaining over 1900 citations and 4 in review.

1. Wren, L. and **Best, A.** (2021). How local interactions impact the dynamics of an epidemic. *Bull. Math. Biol.*, 83:124.
2. Singh, P. and **Best, A.** (2021). Simultaneous evolution of host resistance and tolerance to parasitism. *J. Evol. Biol., In Press*
3. Ward, C. and **Best, A.** (2021). How seasonal variations in birth and transmission rates impact population dynamics in an epidemiological model. *Ecol. Complexity*, 47:100949.
4. **Best, A.**, Singh, P., Ward, C., Vitale, C., Oliver, M., Idris, L. and Poulston, A. (2021). The impact of varying class sizes on epidemic spread in a university population. *Roy. Soc. Open Science,* 8:210712.
5. **Best, A.** and Ashby, B. (2021). Evolutionarily stable strategies are well studied in periodically fluctuating populations. *Proc. Nat. Acad. Sci.*, 118:e2102001118
6. Ashby, B. and **Best, A.** (2021). Herd Immunity. *Curr. Biol.*, 31:R1-R5.

7. Ferris, C., Wright, R., Brockhurst, M. and **Best, A.** (2020). The evolution of host resistance and parasite infectivity is highest in seasonal resource environments that oscillate at intermediate amplitudes. *Proc. Roy, Soc. B.* 287:20200787.
8. **Best A.**, Jubrail, J., Boots, M., Dockerell, D. and Marriott, H. (2020). A mathematical model shows that macrophages delay *Staphylococcus aureus* replication, but limitations in microbicidal capacity restrict the extent of bacterial clearance. *J. Theor. Biol.* 497:110256.
9. Ferris, C. and **Best, A.** (2019). The effect of temporal fluctuations on the evolution of host tolerance to parasitism. *Theor. Pop. Biol.* 130:182-190.
10. Vitale, C. and **Best, A.** (2019). The impact of selective predation on host-parasite SIS dynamics. *Bull. Math. Biol.* 81:2510-2528.
11. Vitale, C. and **Best, A.** (2019). The paradox of tolerance: Parasite extinction due to the evolution of host defence. *J. Theor. Biol.* 474:78-87.
12. Ashby, B., Iritani, R. **Best, A.** and Boots, M. (2018). Understanding the role of eco-evolutionary feedbacks in host-parasite coevolution. *J. Theor. Biol.* 464:115-125.
13. **Best, A.** (2018). Host-pathogen coevolution in the presence of predators: fluctuating selection and ecological feedbacks. *Proc. R. Soc. B.,* 285:20180928.
14. Boots, M. and **Best, A.** (2018). The evolution of constitutive vs induced defense to infectious disease. *Proc. R. Soc. B.*, 285:20180658.
15. Ferris, C. and **Best, A.** (2018). The evolution of host defence to parasitism in fluctuating environments. *J. Theor. Biol.*, 440:58-65.
16. **Best, A.,** Ashby, B., White, A., Bowers, R., Buckling, A., Koskella, B and Boots, M. (2017). Host-parasite fluctuating selection in the absence of specificity. *Proc. R. Soc. B.*, 284:20171615.
17. **Best, A.**, White, A. and Boots, M. (2017). The evolution of host defence when parasites impact reproduction. *Evol. Ecol. Res.*, 18.
18. Toor, J. and **Best, A.** (2016). Evolution of host defence against multiple enemy populations. *Am. Nat.*, 187:308-319;
19. Hesse, E., **Best, A.**, Boots, M., Hall, A. and Buckling, A. (2015). Spatial heterogeneity lowers rather than increases diversity by reducing host-parasite specialisation. *J. Evol. Biol.,* 28:1682-1690.
20. **Best A.**, Bowers, R, and White, A. (2015). Evolution, the loss of diversity and the role of trade-offs. *Math. Biosci.,* 264:86-93.
21. Westra, E., van Houte, S., Oyesiku-Blakemore, S., Makin, B., Broniewski, J. **Best, A.**, Bondy-Deonmy, J., Davidson, A., Boots, M. and Buckling, A. (2015). Parasite exposure drives selective evolution of constitutive versus inducible defense. *Curr. Biol.*, 25:1043-1049.
22. Toor, J. and **Best A.** (2015). The evolution of host resistance to disease in the presence of predators. *J. Theor. Biol.*, 365:104-111.
23. Lopez Pascua, L., Hall, A. R., **Best, A.**, Morgan, A. D., Boots, M. and Buckling, A. (2014). Higher resources decrease fluctuating selection during host-parasite coevolution. *Ecol. Lett.,* 17:1380-1388.
24. Boots, M., White, A, **Best, A.** and Bowers, R. (2014). How specificity and epidemiology drive the coevolution of static trait diversity in hosts and parasites. *Evolution*, 68:1594-1606
25. **Best A.**, White, A, and Boots, M. (2014). The coevolutionary implications of host tolerance. *Evolution*. 68:1426-1435
26. **Best A.** and Hoyle, A. (2013). A limited host immune range facilitates the creation and maintenance of diversity in parasite virulence. *Interface Focus*, 3:20130024.
27. **Best A.** (2013). The effects of seasonal forcing on invertebrate-disease interactions with immune priming. *Bull. Math. Biol.,* 75:2241-2256.
28. **Best A.** and Hoyle, A. (2013). The evolution of costly acquired immunity. *Ecol. Evol.*, 3:2223-2232.
29. **Best, A.,** Tidbury, H., White, A. and Boots, M. (2013). The evolutionary dynamics of

within-generation immune priming in invertebrate hosts. *J. Roy. Soc. Interface*, 10:20120887.

30. Donnelly, R., **Best, A.**, White, A. and Boots, M. (2012). Seasonality selects for more acutely virulent parasites when virulence is density dependent. *Proc. Roy. Soc. B*, 280:20122464.
31. Hoyle, A., **Best A.** and Bowers, R. (2012). The evolution of host resistance towards pathogen exclusion: the role of predators. *Evol. Ecol. Res.,* 14:125-146.
32. Morozov, A. and **Best A.** (2012). Predation on infected hosts promotes evolutionary branching of virulence and pathogen biodiversity. *J. Theor. Biol*., 307:29-36
33. Boots, M., White, A., **Best, A**., and Bowers, R. (2012). Diversity in host resistance: the importance of who infects whom. *Ecol. Lett.*, 15:1104-1111.
34. Tidbury, H., **Best, A**. and Boots, M. (2012). The epidemiological consequences of immune priming. *Proc. Roy. Soc. B*, 279:4505-4512.
35. **Best A**., Long, G., White, A. and Boots, M. (2012). The implications of immunopathology for parasite evolution. *Proc. Roy. Soc. B,* 279: 3234:3240.
36. **Best A**., Webb, S., Antonovics, J. and Boots, M. (2012). The implications of local frequency- and density-dependent transmission to infectious disease dynamics and host extinctions. *Theor. Ecol.*, 5:211-217.
37. **Best A**., Webb, S., White, A. and Boots, M. (2011). Host resistance and coevolution in spatially-structured populations. *Proc. Roy. Soc. B*, 278:2216-2222.
38. Vale, P., **Best, A.**, Wilson, A., Boots, M. and Little, T. (2011). Epidemiological, evolutionary and coevolutionary implications of context-dependent parasitism. *Am. Nat.*, 177:510-521.
39. **Best, A**., White, A., Kisdi, E., Antonovics, J., Brockhurst, M. and Boots, M. (2010). The evolution of host-parasite range. *Am. Nat.*, 176:63-71.
40. **Best, A.**, White, A. and Boots, M (2010). Resistance is futile but tolerance can explain why parasites don't always castrate their hosts. *Evolution*, 64:348-357.
41. **Best, A.**, White, A. and Boots, M (2009). The implications of coevolutionary dynamics to host-parasite interactions. *Am. Nat*., 173:779-791.
42. Boots, M., **Best, A.**, Miller, M. and White, A. (2009). The role of ecological feedbacks in the evolution of host defence: what does theory tell us? *Phil. Trans. Roy. Soc. B*, 364:27-36.
43. **Best A.**, White, A. and Boots, M. (2008). The maintenance of host variation in tolerance to pathogens and parasites. *Proc. Natl. Acad. Sci*., 105:20786-20791.
44. Travis, J., Münkemüller, T., Burton, O., **Best, A.**, Dytham, C. and Johst, K. (2007). Deleterious mutations can surf to high densities on the wave front of an expanding population. *Mol. Biol. Evol.*, 24:2334-2343.
45. **Best, A.**, Johst, K., Münkemüller, T. and Travis, J. (2007). Which species will successfully track climate change? The influence of intraspecific competition and density dependent dispersal on range shifting dynamics. *Oikos,* 116:1531-1539.

The following manuscripts are currently undergoing peer-review:

1. **Best, A.** and Ashby, B. How do fluctuating ecological dynamics impact the evolution of hosts and parasites? *Phil. Trans. R. Soc. B*
2. Singh, P. and **Best, A.** Reconciling experiment and theory: a sterility – mortality tolerance trade-off leads to within-population variation in host tolerance. *Evol. Lett.*
3. Vitale, C., Singh, P. and **Best, A.** The evolution of tolerance to parasitism under selective predation. *Evolution.*
4. Pidwill, G., Pyrah, J., Sutton, J., **Best, A.**, Renshaw, S. and Foster, S. Clonal population expansion of Staphylococcus aureus occurs due to escape from a finite number of intraphagocyte niches. *PLoS ONE.*

Supervision of Research Students

PhD	5 completed PhD students, 3 ongoing.
Master's	11 completed MSc/MMath students.
Undergraduate	4 completed UG summer projects & 4 group projects.

Regular Teaching

2018 – current	Mathematics and Statistics in Action	2nd year
2016 – current	Mathematical Modelling of Natural Systems	3rd/4th year
2016 – current	Scientific Programming Practicals	2nd year
2013 – current	Mathematical Biology	3rd year
2013 – current	Core Mathematics Tutorials	1st year
2014 – 2019	Differential Equations Tutorials	2nd year
2013 – 2018	Essential Mathematics for Engineers	1st year

Main Administrative Roles

2022 – current	Staff-student forum convener
2015 – current	Speaker at outreach events
2018 – 2022	Departmental director for equality, diversity & inclusion
2015 – 2020	Mathematical biology seminar series coordinator
2017 – 2020	Admissions team

Refereeing & Editorialships

I review 10-20 manuscripts for journals each year, and 1-2 grant reviews.
I am a Recommender for *PCI Theoretical & Mathematical Biology* – an online pre-print recommendation alternative to traditional journals.

Invited Seminars and Conference Talks

2022	Institute for Evolution and Biodiversity Seminar, WWU Muenster (online)
2021	European Society for Mathematical & Theoretical Biology Colloquium, Online
2020	Ecological Immunology Workshop, Berlin, Germany
	Centre for Mathematical Biology Seminar, University of Bath, UK
2019	Infectious Disease Seminar, UC Berkeley, USA
2018	Cross-Disciplinary Research: Evolution, Evolvability and Change, York Univ., UK
	Gordon Research Conference: Microbial Population Dynamics, Proctor Acad., USA
	European Conference on Mathematical and Theoretical Biology (Lisbon)
2017	Centre for Mathematical Medicine and Biology Seminar, Nottingham University, UK
	Modelling Biological Evolution (Leicester)
2016	European Conference on Mathematical and Theoretical Biology (Nottingham)
2015	Modelling Biological Evolution (Leicester)
2014	European Conference on Mathematical and Theoretical Biology (Gothenburg)
	Society for Mathematical Biology (Osaka)
2013	Centre for Mathematical Biology Seminar, University of Bath, UK
	Mathematical Models in Ecology and Evolution (York)
	Modelling Biological Evolution (Leicester)
2012	Applied Mathematics Seminar, University of Sheffield, UK
2011	Ecology and Environment Seminar, University of Sheffield, UK
	Applied Mathematics Seminar, University of Leicester, UK
	British Ecological Society Annual Meeting (Sheffield)
	European Conference on Mathematical and Theoretical Biology (Krakow)
2010	Krebs Institute Symposium, University of Sheffield, UK
	Computational and Mathematical Population Dynamics (Bordeaux)
2009	Biomathematics Seminar, University of Helsinki, Finland

European Society for Evolutionary Biology (Turin)
Mathematical Models in Ecology and Evolution (Bristol)
2008 European Conference on Mathematical and Theoretical Biology (Edinburgh)