DARREN MICHAEL GREEN

MA Cantab. PhD Lond. DIC

EDUCATION

Imperial College, University of London 1996-2000.	PhD thesis: *Coevolutionary dynamics in a parasitoid-host system.* The evolution of defence and virulence in a system involving the fruit fly, *Drosophila melanogaster*, and its Hymenopteran parasitoids *Leptopilina boulardi* and *Asobara tabida*. The thesis included both experimental and modelling chapters considering the physiology, population dynamics, and genetics of the coevolutionary process.
Clare College, University of Cambridge. 1993-1996.	BA (MA) Natural Sciences (Zoology) 3rd year options: Behavioural ecology, insect biology, developmental biology, the biology of cell interactions. 2nd year options: Animal biology, plant biology, molecular cell biology.

EMPLOYMENT

University of Stirling
2007-

Lecturer in Aquatic Health Modelling, Institute of Aquaculture. My research involves a variety of numerical approaches to tackling problems of aquatic animal health, be it vertebrate or invertebrate from the individual level through to country-wide population levels. Approaches involve both statistical analysis and more simulation-oriented methods. Current projects include:

- Epidemiology of pancreas disease in Atlantic salmon. This is currently the major cause of disease and mortality within the Scottish industry.
- The impact of escaped farmed salmon on wild salmon populations in Scotland.
- Contact networks in aquaculture and their implications for disease transmission. A concern is what features of contact networks should be targets for disease surveillance and are potential targets for disease control.
- A parallel project examines the evolution of parasite dispersal strategies for different host contact structures and host-parasite dispersal in metapopulation models.
- Continued collaboration on projects involving the epidemiology of diseases of large livestock (cattle, sheep) in the UK. Current projects include the epidemiology of bovine tuberculosis and bluetongue virus in cattle.

Teaching responsibilities include contributions to the MSc courses run within the Institute of Aquaculture, including project supervision and lecturing; and supervision of PhD students (three currently). For undergraduates, contributions to semesters 1, 2, 6, and 8 and module coordinate for semester 1 module.

University of Oxford
2004- 2007

Post-doctoral research assistant, Department of Zoology.
Research centred on the modelling and epidemiology of disease. The approaches include network models of disease spread, deterministic differential-equation-based models, and individual-based microsimulation.

Research centred on the four main project areas shown below, primarily concerning the epidemiology of diseases of large livestock in the UK. These involve the design and programming of complex mechanistic models, and handling of very large datasets (tens of millions of records). This work was funded through a two-year project funded by the DEFRA.

- Spread of foot-and-mouth disease (FMD) through the livestock-trading network of Great Britain. Here, disease dynamics and control were explicitly modelled by considering the network of contacts between locations in a stochastic, farm-based, spatially explicit model.

- The distribution of bovine TB and the relative importance of cattle movements and livestock reservoirs of disease. A likelihood-based approach was used to parameterise a deterministic, farm-based model of TB spread in Great Britain.
- The distribution of atypical scrapie cases in the UK sheep flock. Little is known of the epidemiology of this recently identified disease.

In 2005, I was the named researcher on a project funded by DEFRA to consider error biases in the UK cattle movements database (CTS).

In 2004-5, research was focussed on foot-and-mouth disease. We considered to what extent the nature of the contact network can be recovered from epidemic data alone, and its effects on the efficacy of disease control.

Edinburgh University 2000-2004	Post-doctoral research associate, School of GeoSciences. Work as part of a DEFRA research programme. Research was centred on the production of a simulation model of animal growth response to nutrition and the environment. The research animal used was the domestic pig. This work involved the handling and statistical analysis of large data sets, review of literature, the creation of model algorithms, and the structuring of the model as a whole. The model was then tested against growth trial data from dissection and monitoring of live animals through imaging by video camera (visual image analysis, VIA). The work involved strong collaborations with both the Silsoe Research Institute (design of model interface to control system; innovation in the use of the VIA system and analysis of VIA data), and with the University of Bristol (carcase trial data).

EXPERIENCE AND SKILLS

Education	At Stirling, I am involved to varying degrees in the supervision of four PhD students, and recently taught half of the *Epidemiology and Health Control* unit for the Aquaculture MSc, with seminars, lectures, and computer laboratory practical sessions. Recent lecture to Part II students at Cambridge as a guest lecturer. At Oxford University (OU), I acted as the day-to-day project supervisor for a biology MSc student examining the risk of an epidemic of bovine brucellosis in Great Britain. Tutoring of undergraduates (college teaching) in quantitative methods and modelling in environmental biology, supervision of third year extended essays. At Edinburgh University (EU), I organised and demonstrated on a set of practical sessions for final year students for using statistics in Minitab, and demonstrated on the final year field courses for Animal Biology. At Imperial College, tutoring of undergraduates on subjects including elementary maths, plant biochemistry, population genetics, and microscope technique.
Administration	Examined final year undergraduate theses at EU and have acted as internal examiner for three PhD students. Frequent refereeing of papers.

PUBLICATIONS

Abstracts and full text at http://www.pinkmongoose.co.uk/Publications. My h-index is 14.

REFEREED JOURNAL PAPERS

In press

Taylor, M., Simon, P.L., Green, D.M., House, T. & Kiss, I.Z. (2011). From Markovian to pairwise epidemic models and the performance of moment closure approximations. *J. of Mathematical Biology*, in press.

Published

Green, D.M., Werkman, M. & Munro, L.A.(2011). The potential for targeted surveillance of live fish movements in Scotland. *Journal of Fish Diseases*, 35: 29-37.

Werkman, M., Green, D.M., Munro, L.A., Murray, A.G. & Turnbull, J.F. (2011). Seasonality and heterogeneity of live fish movements in Scottish fish farms. *Diseases of Aquatic Organisms*, 96: 69-82.

Green, D.M., Werkman, M., Munro, L.A., Kao, R.R., Kiss, I.Z., & Danon, L. (2011). Network community trends in fish and livestock trading networks. *Prev. Vet. Med., 99: 225-228.*

Soares, S., Green, D.M., Turnbull, J.F., Crumlish, M. & Murray, A. (2011). A baseline method for benchmarking mortality losses in Atlantic salmon (*Salmo salar*) production. *Aquaculture, 314: 7-12.*

Turnbull, J.F., Berrill, I., Green, D.M., Kaye, R., Morris, D., Murray, A., del-Pozo, J. & Shinn, A. (2011). Applied aquatic animal epidemiology in the UK. *Aquaculture Research, 42S1: 21-27.*

Werkman, M., Green, D.M., Murray, A.G. & Turnbull, J.F. (2011). The effectiveness of fallowing strategies in disease control in salmon aquaculture. *Prev. Vet. Med., 98: 64-73.*

Green, D.M. (2010). A strategic model for epidemic control in aquaculture. *Prev. Vet. Med., 94: 119-127.*

Green, D.M. & Kiss, I.Z. (2010). Large-scale properties of clustered networks: Implications for disease dynamics. *Journal of Biological Dynamics* 4: 431-445.

Sturm, A., Bron, J., Green, D.M., & Bury, N. (2010). Mapping of AF1 transactivation domains in duplicated rainbow trout glucocorticoid receptors. *J. Mol. Endocrinology, 45: 391-404.*

del-Pozo, J., Crumlish, M., Ferguson, H.W., Green, D.M. & Turnbull, J.F. (2010). A prospective longitudinal study of "Candidatus arthromitus"-associated rainbow trout gastroenteritis in the UK. *Prev. Vet. Med., 94: 289-300.*

Farkas, J.Z., Green, D.M. & Hinow, P. (2010). Semigroup analysis of structured parasite populations. *Mathematical Modelling of Natural Phenomena, 5: 94-114.*

Green, D.M., Gregory, A., & Munro, L.A. (2009). Small- and large-scale network structure of live fish movements in Scotland. *Prev. Vet. Med., 91:261-269.*

Green, D.M. (2009). Coevolution of dispersal in a parasitoid-host system. *Population Ecology, 51:253-260*

Kiss, I.Z. & Green, D.M. (2008). Comment on "Properties of Highly Clustered Networks". *Physical Review E, 78: 048101.*

Green, D.M., Kiss, I.Z., Mitchell, A.P., & Kao, R.R. (2008). Estimates for Local and movement-based transmission of bovine tuberculosis in British Cattle. *Proc R Soc B, 275: 1001-1005.*

Kiss, I.Z., Green, D.M., & Kao, R.R. (2008). The effect of network mixing patterns on epidemic dynamics and the efficacy of disease contact tracing. *Journal of the Royal Society Interface, 5: 791-799.*

Green, D.M. & Kao, R.R. (2007). Data quality of the Cattle Tracing System (CTS) in Great Britain. *The Veterinary Record, 161: 439–443.*

Green, D.M., del Rio Vilas, V.J., Birch, C.P.D., Johnson, J., Kiss, I.Z. McCarthy, N.D. & Kao, R.R. (2007). Demographic risk factors for classical and atypical scrapie in Great Britain. *Journal of General Virology, 88: 3486-3492.*

Kao, R.R, Green, D.M., Johnson, J. & Kiss, I.Z. (2007). Disease Dynamics over very different timescales: FMD and scrapie on the Network of Livestock Movements in the UK. *Journal of the Royal Society Interface, 4: 907–9.*

Parsons, D.J., Green, D.M., Schofield, C.P. & Whittemore, C.T. (2007). Real-time control of pig growth through an integrated management system. *Biosystems Engineering, 96: 257-266.*

Green, D.M., Kiss, I.Z., & Kao, R.R. (2006). Parasite strain coexistence in a heterogeneous host population. *Oikos, 115: 495-503.*

Green, D.M., Kiss, I.Z., & Kao, R.R. (2006). Modelling the initial spread of foot-and-mouth disease through animal movements. *Proceedings of the Royal Society of London B, 273: 2729-2735.*

Green, D.M., Kiss, I.Z. & Kao, R.R. (2006). Parameterisation of Individual-Based Models: Comparisons with Deterministic Mean-Field Models. *Journal of Theoretical Biology, 239: 289-297.*

Kao, R.R., Danon, L., Green, D.M., & Kiss, I.Z. (2006). Pathogen dynamics on a well characterised network. *Proceedings of the Royal Society of London B 273: 1999–2007.*

Kiss, I.Z., Green, D.M., & Kao, R.R. (2006). The effect of network heterogeneity and multiple routes of transmission on final epidemic size. *Mathematical Biosciences, 203: 124 - 136.*

Kiss, I.Z., Green, D.M., & Kao, R.R. (2006). The network of sheep movements within Great Britain: network properties and their implications for infectious disease spread. *Journal of the Royal Society Interface,* 3: 669-677.

Kiss, I.Z., Green, D.M. & Kao, R.R. (2006). Infectious disease control using contact tracing in random and scale-free networks. *Journal of the Royal Society Interface 3: 55-62.*

Kiss, I.Z., Green, D.M. & Kao, R.R. (2005). Disease contact tracing in random and clustered networks. *Proceedings of the Royal Society of London B, 272, 1407–1414 doi:10.1098/rspb.2005.3092*

Green, D. M. & Whittemore, C. T. (2005). Calibration and sensitivity analysis of a model of the growing pig for weight gain and composition. *Agricultural Systems 84(3):279-295.*

Doeschl-Wilson, A.B., Green, D.M., Fisher, A.V., Carroll, S., Schofield, C.P & Whittemore, C.T. (2005). The relationship between body dimensions of living pigs and their carcass composition. *Meat Science 70:229-240.*

Doeschl, A.B., Green, D.M., Whittemore, C.T., Schofield, C.P., Fisher, A.V. & Knap, P.W. (2004). The relationship between the body shape of living pigs and their carcass morphology and composition. *Animal Science 79:73-83.*

White, R. P., Schofield, C. P., Green, D. M., Parsons, D. J. & Whittemore, C. T. (2004). The effectiveness of a Visual Image Analysis (VIA) system for monitoring the performance of growing/finishing pigs. *Animal Science 78:409-418.*

Green, D.M. & Whittemore, C.T. (2003). Architecture of a harmonised model of the growing pig for the determination of dietary net energy and protein requirements and of excretions into the environment (IMS Pig). *Animal Science 77: 113-130.*

Green, D.M., Brotherstone, S., Schofield, C.P. & Whittemore, C.T. (2003). Food intake and live growth performance of pigs measured automatically and continuously from 25 to 115 kg live weight. *Journal of the Science of Food and Agriculture 83: 1150-1155.*

Whittemore, C. T., Green, D. M., Wood, J. D., Fisher, A. V. & Schofield, C. P. (2003). Physical and chemical composition of the carcass of three different types of pigs grown from 25 to 115 kg live weight. *Animal Science 77: 235-245.*

Fisher, A.V., Green, D.M., Whittemore, C.T., Wood, J.D. & Schofield, C.P. (2003). Growth of carcass components and its relations with conformation in pigs of three types. *Meat Science, 65: 639-650.*

Whittemore, C.T., & Green, D.M. (2002). The description of the rate of protein and lipid growth in pigs in relation to live weight. *Journal of Agricultural Science. 138: 415-423.*

Schofield, C.P., Whittemore, C.T., Green, D.M. & Pascual, M.D. (2002). The determination of beginning and end of period live weights in growing pigs. *J. of the Science of Food and Agriculture. 82: 1672-1675.*

Whittemore, C.T., Green, D.M. & Knap, P.W. (2001). Technical review of the energy and protein requirements of growing pigs: food intake. *Animal Science 73: 3-17.*

Whittemore, C.T., Green, D.M. & Knap, P.W. (2001). Technical review of the energy and protein requirements of growing pigs: energy. *Animal Science 73: 199-215.*

Whittemore, C.T., Green, D.M. & Knap, P.W. (2001). Technical review of the energy and protein requirements of growing pigs: protein. *Animal Science 73: 363-374.*

Green, D.M., Kraaijeveld, A.R. & Godfray, H.C.J. (2000). Evolutionary interactions between *Drosophila melanogaster* and its parasitoid *Asobara tabida. Heredity 85: 450-458.*

Green, D.M. (1997). A New Record and a New Species of *Dohrniphora* (Diptera: Phoridae) from Malaysia. *Malayan Nature Journal 50: 159-165.*

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Wright, A.J., Green, D.M., & Kao, R.R. (2007). Analysing the risk of a bovine brucellosis epidemic in Great Britain using the Cattle Tracing Scheme: Have we just been lucky so far?. *Proceedings of the British Society of Animal Science 2007 p. 195.*

Doeschl-Wilson, A.B., Green, D.M., Fisher, A.V., Carroll, S., Schofield, C.P. & Whittemore, C.T. (2005). The relationship between body dimensions of living pigs and their carcass composition. *Proceedings of the British Society of Animal Science 2005 p. 80.*

Green, D.M. & Whittemore, C.T. (2004). Calibration and sensitivity analysis of a harmonised model of the growing pig. *Journal of Agricultural Science 142: 243-250 (all abstracts).*

Green, D.M., Parsons, D.J., Schofield, C.P. & Whittemore, C.T. (2004). Real-time control of pig growth through an integrated management system (IMS). *Proceedings of the British Society of Animal Science 2004 p. 21.*

Parsons, D.J., Schofield, C.P., Green, D.M., Whittemore, C.T., Carroll, S., Kay, R. (2004). Real-time control of pig growth through an integrated management system (IMS). *Institute of Agricultural Engineers 2004, Leuven, Belgium, 09/04.*

White, R.P., Parsons, D.J., Schofield, C.P., Green, D.M. & Whittemore, C.T. (2003). Use of visual image analysis for the management of pig growth in size and shape. *Proceedings of the British Society of Animal Science 2003 p. 101.*

Döschl, A.B., Whittemore, C.T., Green, D.M., Fisher, A.V. & Schofield, C.P. (2003). Use of visual image analysis for the description of pig growth in size and shape. *Proceedings of the British Society of Animal Science 2003 p. 21.*

Green, D.M. & Whittemore, C.T. (2002). Description and validation of a harmonised model of the growing pig for the optimisation of the utilisation and excretion of nutrients. *Proceedings of the British Society of Animal Science 2002 p. 26.*

Whittemore, C.T., Green, D.M., & Schofield, C.P. (2001). Nutrition management of growing pigs. *In: Integrated management systems for livestock (Eds. Wathes, C.M., Frost, A.R., Gordon, F. & Wood, J.D.) BSAS Occasional Publication No. 28. BSAS, Edinburgh. 89-95.*

BOOK CHAPTERS & THESIS

Green, D.M. & Parsons, D.J. (2006). The place of models in the new technologies of production systems. In: *Mechanistic Modelling in Pig and Poultry Production* (Eds. Fisher, C., Gous, R. & Morris, T). *CABI Publishing, Wallingford, UK.*

Green, D., Wellock, I. & Whittemore, C. (2006). Simulation modelling. *In: Whittemore's Science and Practice of Pig Production (3rd edition; Eds Kyriazakis, I. & Whittemore, C.T.). Blackwell Publishing, Oxford, UK.*

Whittemore, C.T. & Green, D.M. (2001). Growth of the young weaned pig. *In: The Weaner Pig (Eds. Varley, M. & Wiseman, J.). CABI Publishing, Wallingford, UK.*

Green, D. M. (2000). Coevolutionary dynamics in a parasitoid-host system. *PhD thesis, Univ. of London.*

EXPERIENCE AND SKILLS

IT	Advanced programming in C++ .NET and Borland Turbo Pascal (Delphi). Experience of web authoring and design using HTML, CSS, Perl, PHP, and JavaScript. Use of maths and statistics packages e.g. Minitab, SPSS, R, and Matlab. Reported scientific findings by written paper, conference presentation, poster and web. Good knowledge of LaTeX.
Invited seminars (external)	• University of Stirling, Department of Mathematics and Computer Science. Sept. 2010. • University of Sussex, Department of Mathematics. May 2010. • University of Glasgow, Institute of Comparative Medicine. July 2009. • University of Saskatchewan, Dept. of Veterinary Medicine. May 2009. • Royal Statistical Society, Aberdeen. March 2009. • University of York, Department of Biology. December 2008. • University of Stirling, Department of Mathematics and Computer Science. February 2008. • Fisheries Research Services. January 2008. • Health Protection Agency. April 2007. • The 3rd International Symposium on Transmission Models for Infectious Diseases. Kyoto, Japan. January 2007. • Recent Advances in Pig and Poultry Modelling, Ithala Game Reserve, KwaZulu-Natal, South Africa, April 2005 • ZODIAC, University of Wageningen. September 2002 • Nutreco, Boxmeer, The Netherlands. September 2002
Media coverage	Research into foot-and-mouth disease was featured on *Farming Today* on 2nd Aug 2006. Research into bovine tuberculosis was featured on Farming Today, the Daily Telegraph website, BBC Spotlight, and local newspapers in February 2008.
Interests and achievements	Player of the piano, viola, violin, and church organ. I sing bass, or tenor when in short supply. Running (including half marathons), gym, swimming, gardening, painting. linguam latinam disco.

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