

Peter S. Kim

School of Mathematics and Statistics
University of Sydney NSW 2006, Australia

Phone: +61 2 9351 2970
Email: pkim@maths.usyd.edu.au

Education

- 2007 **Ph.D. in Applied Mathematics**, Stanford University, Stanford, USA
“Mathematical models of the activation and regulation of the immune system”, Advisor: Prof. Doron Levy
- 2002 **Part III of the Mathematical Tripos**, University of Cambridge, UK
Martingales, stochastic calculus, financial mathematics, actuarial statistics, and operational research
- 2001 **B.Sc. in Mathematics** with a minors in physics and literature,
Massachusetts Institute of Technology, Cambridge, USA

Research interests

Mathematical biology: immune, cancer, and virus dynamics; ordinary, delay, partial differential equations, and agent-based models

Professional experience

- 2017-present **Associate Professor**
School of Mathematics and Statistics, University of Sydney, Australia
- 2011-2016 **Lecturer** (2011-2013) / **Senior Lecturer** (2014-2016)
School of Mathematics and Statistics, University of Sydney, Australia
- 2008-2011 **Research Assistant Professor**
Dept. of Mathematics, University of Utah, Salt Lake City, USA
- 2007-2008 **Chateaubriand Postdoctoral Fellow**
Ecole Supérieure d'Electricité and Paris VI, Paris, France

Fellowships and grants

- 2017-2018 University of Sydney and Yonsei University Joint Research Funding.
\$20,000 AU – co-CI with Prof. Jeehyun Lee (Yonsei University, Seoul, S. Korea).
- 2016-2019 Australian Research Council Discovery Project
\$396,338 AU – sole CI. (According to the ARC report, the DP success rate for Mathematics, Physics, Chemistry and Earth Sciences was 17.7%.)
- 2015 University of Sydney Bridging Support Grant, \$30,000 AU.
- 2012-2014 Australian Research Discovery Early Career Research Award
\$375,000 AU – sole CI. (According to the ARC report, the DECRA success rate for Engineering, Mathematics, and Informatics was 11.3% in 2012.)
- 2007-2008 Chateaubriand Postdoctoral Fellowship
- 2001-2004 National Science Foundation Graduate Research Fellowship
- 2001-2002 Cambridge Overseas Trust for postgraduate studies

Other funding

- Jan 2013 Sydney International Workshop on Tumour-Immune System Dynamics (with A. Eladdadi and D. Mallet).
- National Science Foundation (Co-PI with A. Eladdadi): \$30,000 US,
 - Australian Mathematical Sciences Institute (PI with A. Eladdadi and D. Mallet): \$7,000 AU,
 - Society for Mathematical Biology (PI with A. Eladdadi): \$2,000 US.

Supervision

- Jun 2016-present Danya Rose (Postdoc, University of Sydney)
July 2017-present, Matthew Chan (Postdoc, University of Sydney)
Mar-Sep 2016
- Jan 2017-present Collin Zheng (PhD, University of Sydney)
Jan 2017-present Adarsh Kumbhari (PhD, University of Sydney)
Jan 2017-present Pantea Pooladvand (PhD, University of Sydney)
Aug 2015-present Adrienne Jenner (PhD, University of Sydney)
Mar 2015-present Sara Loo (PhD, University of Sydney)
Jul 2016-May 2017 Anthony Cheung (PhD, University of Sydney)
Jul 2012-Feb 2016 Matthew Chan (PhD, University of Sydney)
Jul 2015-Aug 2016 James Reoch (PhD, Univ. of Adelaide, external supervisor)
Feb 2012-2016 David Khoury (PhD, UNSW, associate supervisor)
- 2016 Collin Zheng (Masters, University of Sydney)
2015 Jared Field (Masters, University of Sydney)
- 2017 Yuhuang Wu (Honours, University of Sydney)
2017 Ruben Robertson (Honours, University of Sydney)
2016 Hak Joon Kim (Honours, University of Sydney)
2016 Adarsh Kumbhari (Honours, University of Sydney)
2015-2016 Pantea Pooladvand (Honours, University of Sydney)
Aug 2014-Jul 2015 Adrienne Jenner (Honours, University of Sydney)
2014 Jared Field (Honours, University of Sydney)
2014 Sara Loo (Honours, University of Wollongong, co-supervisor, A/Prof Annette Worthy was the primary supervisor)
2013 Andrea Cooper (Honours, University of Sydney)
2012 James Reoch (Honours, University of Sydney)
- 2016 sem 2 Vaishnavi Calisa (Talented Student Program 2nd year project)
2015 sem 2 Vaishnavi Calisa and Benjamin Xie (Talented Student Program 1st year project)
- 2015 sem 1 Noah Johnston, Mona Khosh, Kelsey McKinnon, Justin Phu, and Stephanie Sun (Talented Student Program 1st year project, with 3rd-yr mentor Edward Burrowes)
- 2013 sem 1 Jian Cao (Winton Charitable Foundation Internship in Mathematical Biology for 3rd year exchange student)
- 2011-2012 summer Edward Kim (3rd year Vacation Scholar on stochastic modelling of biological systems)

Undergraduate research

- 2016 sem 2 **Talented Student Program**
Supervised 2nd-yr student Vaishnavi Calisa on a project on the “Mapping evolutionary fitness landscapes for sexually reproducing species”.
- 2015 sem 2 **Talented Student Program**
Supervised 1st-yr students Benjamin Xie and Vaishnavi Calisa on a project on the “Effect of introduced parasite on extinction risk of Darwin’s finches”.
- 2015 sem 1 **Talented Student Program**
Supervised (with 3rd-year mentor Edward Burrowes) five 1st-year students (Justin Phu, Kelsey McKinnon, Noah Johnston, Stephanie Sun, Mona Khosh) on a project on “Excited by light: Modelling the motion of phototactic bacteria” as part of the thematic year on “Light”.
- Jun 2010 **Summer Research Experience for Undergraduates (REU)**
University of Utah, Salt Lake City, USA
Co-organized (with F. Adler, D. Toth, and V. Camacho) a 3-week summer internship for 17 undergraduates on mathematical and computational modeling of ants, epidemics, and the immune system.
- 2010-2011 **Research Experience for Undergraduates (REU)**
University of Utah, Salt Lake City, USA
Supervised an undergraduate biology student on a research project on the mathematical modeling of immune surveillance of cancer.

Teaching experience

- Linear algebra (1st yr) Univ. of Sydney
- Partial differential equation models in math biology (honours course – 4th yr) Univ. of Sydney
- Special studies program on epidemic modelling (1st yr) Univ. of Sydney
- Introduction to partial differential equations (2nd yr) Univ. of Sydney
- Mathematical biology (1st-3rd year graduate) Univ. of Utah
- Second-year graduate journal club Univ. of Utah
- Single variable calculus Univ. of Utah
- College algebra for business Univ. of Utah
- Single variable calculus Stanford Univ.
- Linear algebra and calculus of several variables Stanford Univ.
- Ordinary Differential Equations MIT

Selected conferences and presentations

- Editor** Guest editor (with A. Eladdadi and D. Mallet) of Springer Book on “Mathematical Models of Tumor-Immune System Dynamics”, Nov 2014.
- Organiser**
- July 8-12, 2018 Society for Mathematical Biology (SMB) Annual Meeting, University of Sydney, Sydney, Australia.
Treasurer and member of local organising committee (with M. Myerscough (conference director), A. Coster, J. Murray, and A. Francis).
- Dec 7-11, 2015 Australian Mathematical Sciences Institute (AMSI) Bioinfo Summer, Mathematical Biology Day (with J. Yang, M. Myerscough, and N. Armstrong), University of Sydney, Sydney, Australia.
- Jan 5-9, 2015 American Institute of Mathematics (AIM) workshop on “Mathematical Modeling of Tumor-Immune Dynamics: Linking Agent-Based Models and Partial Differential Equation Approaches” (with A. Eladdadi, D. Mallet, and C.-O. Yun), San Jose, USA.
- Jan 7-10, 2013 Sydney International Workshop on “Mathematical Models of Tumour-Immune System Dynamics” (with A. Eladdadi & D. Mallet), University of Sydney, Sydney, Australia.
- May 2009 Mathematical Biology Workshop on Building an Interdisciplinary Career (with D. Toth & M. Zajac), Univ. of Utah, Salt Lake City, USA.
- Feb 2017 Australia and New Zealand Industrial and Applied Mathematics Annual Meeting, Canberra, Australia
Talk on “Evolution of human longevity, menopause, and sex conflict with grandmothering”.
- Jul 2016 11th American Institute of Mathematical Sciences (AIMS) International Conference on Dynamical Systems, Differential Equations and Applications, Orlando, USA
- Invited to present talk on “Cancer-immune dynamics of oncolytic virotherapy and dendritic cell vaccines” at minisymposium on “Mathematical models of cell motility and cancer progression in microenvironment: Design, experiments, mathematical framework, and hypothesis test”.
 - Invited to present talk on “Modelling evolution of post-menopausal human longevity: the Grandmother Hypothesis” at minisymposium on “Randomness meets life”.
- Feb 2016 Australia and New Zealand Industrial and Applied Mathematics Annual Meeting, Canberra, Australia
Talk on “Cancer-immune dynamics of oncolytic virotherapy and dendritic cell vaccines”.

Publications

1. M.H. CHAN, K. HAWKES, AND P.S. KIM (2017), “Modelling the evolution of traits in a two-sex population, with an application to grandmothering”, accepted by *Bulletin of Mathematical Biology*.
2. S.L. LOO, K. HAWKES, AND P.S. KIM (2017), “Evolution of male strategies with sex-ratio dependent payoffs: connecting pair bonds with grandmothering”, accepted by *Philosophical Transactions of the Royal Society B: Biological Sciences*.
3. S.L. LOO, M.H. CHAN, K. HAWKES, AND P.S. KIM (2017), “Further mathematical modelling of mating sex ratios and male strategies with special relevance to human life history”, *Bulletin of Mathematical Biology*, DOI 10.1007/s11538-017-0313-2.
4. F. FRASCOLI, E. FLOOD, AND P.S. KIM (2017) “A model of the effects of cancer cell motility and cellular adhesion properties on tumour-immune dynamics”, *Mathematical Medicine and Biology*, 34(2): 215–240.
5. J.L. GEVERTZ, P.S. KIM, AND J.R. WARES (2017), “Mentoring undergraduate interdisciplinary mathematics research students: Junior faculty experiences”, *PRIMUS Problems, Resources, and Issues in Mathematics Undergraduate Studies*, 27(3): 352–369. (Authors in alphabetical order.)
6. W.L. SWEATMAN, G. MERCER, J. BOLAND, N. CUSIMANO, A. GREENWOOD, K. HARLEY, P. VAN HEIJSTER, P. KIM, J. MAISANO, M. NELSON, AND G. PETTET (2016), "Seaweed cultivation and the remediation of by-products from ethanol production: a glorious green growth" in T. Farrell and A.J. Roberts (eds.) "Proceedings of the 2014 Mathematics and Statistics in Industry Study Group, MISG-2014", *ANZIAM Journal*, 56: pp. M1-M29. (Authors in alphabetical order.)
7. A. ORTIZ, D. CARNATHAN, J. YU, K. SHEEHAN, P. KIM, A. REYNALDI, T. VANDERFORD, N. KLATT, J. BRENCHLEY, M. DAVENPORT, AND G. SILVESTRI (2016), “Analysis of the in vivo Turnover of CD4+ T-cell Subsets in Chronically SIV-Infected Sooty Mangabeys”, *PLoS One*, 11(5): e0156352.
8. J.A.H. KOOP*, P.S. KIM*, S.A. KNUTIE, F. ADLER, AND D.H. CLAYTON (2016), “An introduced parasitic fly may lead to local extinction of Darwin’s finch populations”, *Journal of Applied Ecology*, 53(2): pp. 511–518. (* Both authors contributed comparably.)

(Press coverage: *BBC News*, *Smithsonian*, *The Telegraph*, *London*, *Discovery News*, *Christian Science Monitor*, *Huffington Post*, *Newsy* (video), *Mental Floss*, *Phys.Org*, *International Business Times*, *Dispatch Tribunal*, *Laboratory Equipment*, *I4U News*, *States Chronicle*, *Council Chronicle*, *FTC Publications*)
9. M.H. CHAN, K. HAWKES, P.S. KIM (2016), “Evolution of longevity, age at last birth and sexual conflict with grandmothering”, *Journal of Theoretical Biology*, 393: pp. 145–157
10. J.E. COXWORTH, P.S. KIM, J.S. MCQUEEN, AND K. HAWKES (2015), “Grandmothering life histories and human pair bonding”, *Proceedings of the National Academy of Sciences, USA*, 112(38): pp. 11806–11811.

11. M.H. CHAN, R. SHINE, G.P. BROWN, P.S. KIM (2015), “Mathematical modelling of spatial sorting and evolution in a host-parasite system”, *Journal of Theoretical Biology*, 380: pp. 530–41.
12. J.R. WARES, J. J. CRIVELLI, C.-O. YUN, I.-K. CHOI, J.L. GEVERTZ, AND P.S. KIM (2015), “Treatment strategies for combining immunostimulatory oncolytic virus therapeutics with dendritic cell injections”, *Mathematical Biosciences and Engineering*, 12(6): pp. 1237–1256.
13. P.S. KIM, J. J. CRIVELLI, I.-K. CHOI, C.-O. YUN, AND J.R. WARES (2015), “Quantitative impact of immunomodulation versus oncolysis with cytokine-expressing virus therapeutics”, *Mathematical Biosciences and Engineering*, 12(4): pp. 841–858.
14. A. K. COOPER AND P.S. KIM (2014), “A cellular automata and a partial differential equation model of tumour-immune dynamics and chemotaxis”, in A. Eladdadi, P. Kim, and D. Mallet, (eds.), *Mathematical Models of Tumor-Immune System Dynamics*, Springer Proceedings in Mathematics & Statistics, vol. 107, Springer, New York, NY: pp. 21-46.
15. J.R. WARES, J. J. CRIVELLI, AND P. S. KIM (2014), “Differential equation techniques for modeling a cycle-specific oncolytic virotherapeutic”, in A. Eladdadi, P. Kim, and D. Mallet, (eds.), *Mathematical Models of Tumor-Immune System Dynamics*, Springer Proceedings in Mathematics & Statistics, vol. 107, Springer, New York, NY: pp. 253-275.
16. M.H.T. CHAN AND P.S. KIM (2014), “Modelling the impact of marine reserves on a population with depensatory dynamics”, *Bulletin of Mathematical Biology*, 76(9): pp. 2122–2143.
17. F. FRASCOLI, P.S. KIM, B.D. HUGHES, AND K.A. LANDMAN (2014), “A dynamical model of tumour immunotherapy”, *Mathematical Biosciences*, 253: pp. 50–62.
18. P.S. KIM, J.S. MCQUEEN, J.E. COXWORTH, K. HAWKES (2014), “Grandmothering drives the evolution of longevity in a probabilistic model”, *Journal of Theoretical Biology*, 353: pp. 84–94.
19. M.H.T. CHAN AND P.S. KIM (2014), “An age-structured approach to modelling behavioural variation maintained by life-history trade-offs”, *PLoS One*, 9(1): e84774.
20. D. KHOURY, D. CROMER, S. BEST, K. JAMES, P. KIM, C. ENGWERDA, A. HAQUE, AND M. DAVENPORT (2014), “Effect of mature, blood-stage Plasmodium parasite sequestration on pathogen biomass in mathematical and in vivo models of malaria”, *Infection and Immunity*, 82(1): pp. 212-220.
21. M.H.T. CHAN AND P.S. KIM (2013), “Modelling a *Wolbachia* invasion using a slow-fast dispersal reaction-diffusion approach”, *Bulletin of Mathematical Biology*, 75(9): pp. 1501-1523.
22. F.R. ADLER AND P.S. KIM (2013), “Models of contrasting strategies of rhinovirus immune manipulation”, *Journal of Theoretical Biology*, 327(1): pp. 1-10.
23. P.S. KIM, P.P. LEE, AND D. LEVY (2013), “Basic principles in modeling adaptive regulation and immunodominance”, in A. Friedman, E. Kashdan, U. Ledzewicz,

and H. Schättler, (eds.), *Mathematical Models and Methods in Biomedicine, Lecture Notes on Mathematical Modelling in the Life Sciences*, Springer, New York, NY: pp. 33-57.

24. P.S. KIM, J.E. COXWORTH, AND K. HAWKES (2012), “Increased longevity evolves from grandmothering”, *Proceedings of the Royal Society B: Biological Sciences*, 279 (1749): pp. 4880-4884
25. P.S. KIM AND P.P. LEE (2012), “Modeling protective immunity via preventative cancer vaccines using a hybrid agent-based and delay differential equation approach”, *PLoS Computational Biology*, 8(10): e1002742.
26. J.J. CRIVELLI, J. FOLDES, P.S. KIM, AND J. WARES (2012), “A mathematical model for cell cycle specific cancer virotherapy”, *Journal of Biological Dynamics*, 6(S1): pp. 104–120.
27. P.S. KIM (2011). “Modeling leukemia stem cell differentiation: Bridging agent-based and partial differential equation models”, *Proc. Russia-Korea Workshop on advanced computer and information technologies*, Yekaterinburg, Russia, 29 May – 1 June 2011: pp. 28-51.
28. M.M. PEET, P.S. KIM, AND P.P. LEE (2011), “Biological circuit models of the immune regulatory response: a decentralized control system”, *Proc. 50th IEEE Conference on Decision and Control and European Control Conference*, Orlando, Florida, USA, December 12-15, 2011: pp. 3020-3025.
29. F. MAZENC, P.S. KIM, AND S.-I. NICULESCU (2011), “Stability of an imatinib and immune model with delays”, *Institute of Mathematics and its Applications Journal of Mathematical Control and Information*, 28: pp. 447–462.
30. K. HAWKES, P.S. KIM, B. KENNEDY, R. BOHLENDER, AND J. HAWKS (2011), “A reappraisal of grandmothering and natural selection”, *Proceedings of the Royal Society B: Biological Sciences*, 278(1714): pp. 1936-1938.
31. P.S. KIM, P.P. LEE, AND D. LEVY (2011), “A theory of immunodominance and adaptive regulation”, *Bulletin of Mathematical Biology*, 73(7): pp. 1645-1665.
32. D. PAQUIN, P.S. KIM, P.P. LEE, AND D. LEVY (2011), “Strategic treatment interruptions during imatinib treatment of chronic myelogenous leukemia”, *Bulletin of Mathematical Biology*, 73(5): pp. 1082-1100.
33. P.S. KIM AND P.P. LEE (2011), “T cell state transitions produce an emergent change detector”, *Journal of Theoretical Biology*, 275(1): pp. 59-69.
34. P.S. KIM, P.P. LEE, AND D. LEVY (2010), “Emergent group dynamics governed by regulatory cells produce a robust primary T cell response”, *Bulletin of Mathematical Biology*, 72(3): pp. 611-644.
35. M. DOUMIC-JAUFFRET*, P.S. KIM*, AND B. PERTHAME (2010), “Stability analysis of simplified yet complete model for chronic myelogenous leukemia”, *Bulletin of Mathematical Biology*, 72(7): pp. 1732-1759. (* Both authors contributed comparably.)
36. S.-I. NICULESCU, P.S. KIM, K. GU, P.P. LEE, AND D. LEVY (2010), “Stability crossing boundaries of delay systems modeling immune dynamics in leukemia”, *Discrete and Continuous Dynamical Systems – Series B*, 13(1): pp. 129-156.

37. P.S. KIM, D. LEVY, AND P.P. LEE (2009), "Modeling and simulation of the immune system as a self-regulating network", in Michael L. Johnson and Ludwig Brand, (eds), *Methods in Enzymology*, vol. 467, Academic Press, Burlington, MA: pp. 79-109.
38. M.M. PEET*, P.S. KIM*, S.-I. NICULESCU, AND D. LEVY (2009), "New computational tools for modeling chronic myelogenous leukemia", *Mathematical Modelling of Natural Phenomena*, 4(2): pp. 119-139. (* Both authors contributed comparably.)
39. F. MAZENC, P.S. KIM, AND S.-I. NICULESCU (2008), "Stability of a Gleevec and immune model with delays", *Proc 47th IEEE Conference on Decision and Control*, Cancun, Mexico.
40. P.S. KIM, P.P. LEE, AND D. LEVY (2008), "A PDE model for imatinib-treated chronic myelogenous leukemia", *Bulletin of Mathematical Biology*, 70(7): pp.1994-2016.
41. P.S. KIM, P.P. LEE, AND D. LEVY (2008), "Dynamics and potential impact of the immune response to chronic myelogenous leukemia", *PLoS Computational Biology*, 4(6): e1000095.
42. P.S. KIM, P.P. LEE, AND D. LEVY (2008), "Modeling imatinib-treated chronic myelogenous leukemia: reducing the complexity of agent-based models", *Bulletin of Mathematical Biology*, 70(3): pp. 728-744.
43. S.-I. NICULESCU, P.S. KIM, P.P. LEE, AND D. LEVY (2007), "On stability of a combined Gleevec and immune model in chronic leukemia: Exploiting delay system structure", *Proc. 7th IFAC Symposium on Nonlinear Control Systems (NOLCOS 2007)*, Pretoria, South Africa.
44. P.S. KIM, P.P. LEE, AND D. LEVY (2007), Mini-transplants for chronic myelogenous leukemia: a modeling perspective, in Queinnec et al. (eds.) "Biology and Control Theory: Current Challenges", *Lecture Notes in Control and Information Sciences*, 357, Springer, Berlin: pp. 3-20.
45. P.S. KIM, P.P. LEE, AND D. LEVY (2007), "Modeling regulation mechanisms in the immune system", *Journal of Theoretical Biology*, 246(1): pp. 33-69.
46. S.-I. NICULESCU, P.S. KIM, K. GU, AND D. LEVY (2006), "On the stability crossing boundaries of some delay systems modeling immune dynamics in leukemia", *Proc 17th International Symposium on Mathematical Theory of Networks and Systems*, Kyoto, Japan.
47. R. DECONDE*, P.S. KIM*, D. LEVY, AND P.P. LEE (2005), "Post-transplantation dynamics of the immune response to chronic myelogenous leukemia", *Journal of Theoretical Biology*, 236(1): pp. 39-59. (* Both authors contributed comparably.)
48. P.S. KIM, L. STEMKOSKI, AND C. YUEN (2001), "Polynomial knots of degree five," *MIT Undergraduate Journal of Mathematics* 3: pp. 125-135.
49. L. PACHTER AND P.S. KIM (1998), "Forcing matchings on square grids", *Discrete Mathematics*, 190(1-3): pp. 287-294.