Peter S. Kim

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University of Sydney NSW 2006, Australia   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**, Cambridge University, Cambridge, UK
        Martingales, stochastic calculus, financial mathematics, actuarial statistics, and
        operational research

2001   **B.Sc. in Mathematics with a minor in physics**,
        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

2014-present   **Senior Lecturer**
                School of Mathematics and Statistics, University of Sydney,
                Sydney, Australia

2011-2013   **Lecturer**
                School of Mathematics and Statistics, University of Sydney,
                Sydney, Australia

2008-2011   **Research Assistant Professor**
                Department of Mathematics, University of Utah, Salt Lake City, USA

2007-2008   **Chateaubriand Postdoctoral Fellow**
                Ecole Supérieure d'Electricité and Paris VI, Paris, France

Fellowships & grants

2016-2019   Australian Research Council Discovery Project ($400,665 AU – PI)
                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)
2012-2015   Australian Research Council Discovery Early Career Research Award
            ($375,000 AU – sole PI)
                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

Mar 2016-present   Matthew Chan (Postdoc, University of Sydney)

Aug 2015-present   Adrianne Jenner (PhD, University of Sydney)
Mar 2015-present   Sara Loo (PhD, University of Sydney)
Jul 2012-Feb 2016   Matthew Chan (PhD, University of Sydney)
Jul 2015-present   James Reoch (PhD, University 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)

2016   Hak Joon Kim (Honours, University of Sydney)
2016   Adarsh Kumbhari (Honours, University of Sydney)
2015-2016   Pantea Pooladvand (Honours, University of Sydney)
2014-2015   Adrianne 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)

2013 Mar-Jun   Jian Cao (Winton Charitable Foundation Internship in Mathematical Biology for 3rd year undergraduate exchange student, University of Sydney)
2011-2012 summer   Edward Kim (3rd year Vacation Scholar, University of Sydney, on stochastic modelling of biological systems)

Undergraduate Research

Sem 2 2015   **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"

Sem 1 2015 **Talented Student Program** (with 3rd-year mentor Edward Burrowes)
Supervised 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)   University of Sydney
- Partial differential equation models in math biology   University of Sydney
  (honours course – 4th yr)
- Special studies program on epidemic modelling (1st yr)   University of Sydney
- Introduction to partial differential equations (2nd yr)   University of Sydney
- Mathematical biology (1st-3rd year graduate)   University of Utah
- Second-year graduate journal club   University of Utah
- Single variable calculus   University of Utah
- College algebra for business   University of Utah
- Single variable calculus   Stanford University
- Linear algebra and calculus of several variables   Stanford University
- Ordinary Differential Equations   MIT

Recent conferences & presentations

Organizer: Australian Mathematical Sciences Institute (AMSI) Bioinfo Summer, Mathematical Biology Day (with J. Yang, M. Myerscough, and N. Armstrong), University of Sydney, Sydney, Australia, Dec 7-11, 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 5-9, 2015.

Sydney International Workshop on "Mathematical Models of Tumour-Immune System Dynamics" (with A. Eladdadi & D. Mallet), University of Sydney, Sydney, Australia, Jan 7-10, 2013.

Mathematical Biology Workshop on Building an Interdisciplinary Career (with D. Toth & M. Zajac), Univ. of Utah, Salt Lake City, USA, May 2009.

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".

Dec 2015   Bioinfo Summer, Mathematical Biology Day, University of Sydney, Australia
Gave plenary talk on "Modelling dynamics of anti-cancer virotherapy and immunotherapy".
Co-organised special session on Mathematical Biology and invited four speakers: Edward Green (University of Adelaide), Adelle Coster (UNSW), Mark Tanaka (UNSW), David Khoury (UNSW)

Aug 2015   Banff International Research Station - Casa Matemática Oaxaca, Mexico.
Invited to workshop on "Viral Dynamics and Cancer: Modeling Oncogenic and Oncolytic Viruses".

Jun 2015   Mathematical Methods in Systems Biology, University College, Dublin, Ireland
Invited to present talk on "Viral Dynamics and Cancer: Modeling Oncogenic and Oncolytic Viruses".

Jun 2015   International Conference on Micro and Macro System in Life Science, Banach Center, Bedlewo, Poland.
Invited to present talk on "Viral Dynamics and Cancer: Modeling Oncogenic and Oncolytic Viruses".

May 2015   SIAM Conference on Applications of Dynamical Systems, Snowbird, USA.
Co-organised, with J. Wares, a minisymposium on "Mathematical models of cancer development and treatment" and presented a talk on "Modelling dynamics of anti-cancer virotherapy and immunotherapy".

Feb 2015   Banff International Research Station, Banff, Canada.
Invited to workshop on "Partial Differential Equations in Cancer Modeling".
Talk on "A maturity-structured model for leukemia stem cell differentiation".

Publications

1. F. FRASCOLI, E. FLOOD, P.S. KIM (2016) "A model of the effects of cancer cell motility and cellular adhesion properties on tumor-immune dynamics", *Mathematical Medicine and Biology*, doi: 10.1093/imammb/dqw004.

2. 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*)

3. 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

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

10. 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.

11. 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.

12. 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.

13. 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.

14. 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.

15. 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.

16. 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.

17. 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.

18. 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

19. 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.

20. 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.

21. 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.

22. 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.

23. 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.

24. 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.

25. 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.

26. 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.

27. 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.

28. 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.

29. 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.)

30. 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.

31. 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.

32. 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.)

33. 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.

34. 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.

35. 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.

36. 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.

37. 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.

38. 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.

39. 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.

40. 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.

41. 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.)

42. P.S. KIM, L. STEMKOSKI, AND C. YUEN (2001), "Polynomial knots of degree five," *MIT Undergraduate Journal of Mathematics* 3: pp. 125-135.

43. L. PACHTER AND P.S. KIM (1998), "Forcing matchings on square grids", *Discrete Mathematics*, 190(1-3): pp. 287-294.