Dr Mark Norman Read

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A. General

Current Status

Department:	School of Chemical and Biomolecular Engineering and the Charles Perkins Centre, The University of Sydney
Position:	Research Fellow specialising in Computational Biology

British Citizen, Permanent Resident of Australia

Employment History and Education

Date	Qualification/Position	Host institution
Commencing Sept 2019	Lecturer in Digital Health	School of Computer Science University of Sydney
Sept 2018 - Aug 2019	Research Fellow	School of Chemical and Biomolecular Engineering and the Charles Perkins Centre, University of Sydney
Sept 2013 - Sept 2018	Research Fellow	School of Live and Environmental Sciences and the Charles Perkins Centre, University of Sydney
April 2011 - August 2013	Research Associate	Electronic Engineering, University of York, UK
Oct 2007 - Feb 2012	Ph.D. in Computer Science	Computer Science, University of York, UK Funded through departmental scholarship
Oct 2002 - Oct 2007	MEng in Computer Science & Systems Engineering 1^{st} Class Honours	Computer Science, University of York, UK
June 2004 - June 2005	Industrial trainee	IBM Hursley, UK

B. Research and Scholarship

B1. Research Synopsis

I strive to advance biological research through computational, mathematical and statistic methods, chiefly the immune system and the gut microbial communities. More recently I have ventured into applying machine learning techniques to predict clinical outcomes and interpret high-throughput data sets. I cultivate close collaborations with clinicians and experimentalists in carrying out these research programs; such interdisciplinary teams are essential to tackling the principle challenges in the life sciences, and it's also a tremendously exciting space in which to work. Lastly, though a secondary theme in recent years, I study how principles of biological organisation and function can be exploited in engineered systems, such as algorithms and control systems in robotics.

B2. Publications

Working across a range of disciplines, I adhere to the authorship conventions the target discipline. In biology, last authorship positions and corresponding author status are highly coveted: they denote seniority in conceiving, convening and managing the project. These attributes carry little significance in computer science, where relative contribution is indicated by authorship order. In statistics and mathematics, authors are sometimes listed alphabetically.

Books

B1 *S Stepney, FAC Polack, K Alden, P Andrews, J Bown, A Droop, RB Greaves, MN Read, A Sampson, J Timmis, A Winfield.* (2018). **Engineering Simulations as Scientific Instruments: A Pattern Language.** Springer.

Book Chapters (* corresponding author)

CH1 *M Read *, P Andrews and J Timmis.* (2011). An introduction to artificial immune systems. **The Handbook of Natural Computing**, edited by G Rozenberg, T Back and J Kok. Springer, pages 1575-1597.

Refereed Journal Articles (* corresponding author)

J17 *CAM Fois, TYL Le, A Schindeler, S Naficy, DD McClure, MN Read, P Valtchev, A Khademhosseini, F Dehghani.* (2019). Models of the Gut for Analyzing the Impact of Food and Drugs. **Advanced Healthcare Materials** 8(21):1900968.

J16 *GH Putri, MN Read*, I Koprinska, D Singh, U Röhm, TM Ashhurst, NJC King.* (2019). ChronoClust: density-based clustering and cluster tracking in high-dimensional time-series data. **Knowledge Based Systems** 174:9-26.

J15 *MN Read*, K Alden, J Timmis, PS Andrews.* (2018). Strategies for Calibrating Models of Biology. **Briefings in Bioinformatics** :bby092.

J14 *I Moran, A Nguyen, W Khoo, D Butt, K Bourne, C Young, J Hermes, M Biro, G Gracie, C Ma, C Munier, F Luciani, J Zaunders, A Parker, A Kelleher, S Tangye, P Croucher, R Brink, MN Read and T Phan.* (2018). Memory B cells are reactivated in subcapsular proliferative foci of lymph nodes. **Nature Communications** 9:3372.

J13 *MN Read *, AJ Holmes.* (2017). Towards an integrative understanding of diet-host-gut microbiome interactions. **Frontiers in Immunology** 8:538.

J12 *AJ Holmes, YV Chew, F Colakoglu, JB Cliff, E Klaassens, MN Read, SM Solon-Biet, AC McMahon, VC Cogger, K Ruohonen, D Raubenheimer, DG Le Couteur, SJ Simpson.* (2017). Diet-microbiome interactions in health are controlled by intestinal nitrogen source constraints. **Cell Metabolism** 25:1-12.

J11 *MN Read *, K Alden, L Rose and J Timmis.* (2016). Automated multi-objective calibration of biological agent-based simulations. **Journal of the Royal Society Interface** 13(122):20160543.

J10 *MN Read *, J Bailey, J Timmis and T Chtanova.* (2016). Leukocyte motility models assessed through simulation and multi-objective optimization-based model selection. **PLoS Computational Biology** 12(9):e1005082.

J9 *J Hywood, M Read, G Rice.* (2016). Statistical analysis of spatially homogeneous dynamic agent-based processes using functional time series analysis. **Spatial Statistics** 17:199-219.

J8 *J Cosgrove, JA Butler, K Alden, M Read, V Kumar, J Timmis and M Coles.* (2015). Agent-based modelling in systems pharmacology. **CPT: Pharmacometrics & Systems Pharmacology** 4(11):615–629.

J7 *K Alden, M Read, P Andrews, J Timmis and M Coles.* (2014). Applying spartan to understanding parameter uncertainty in simulations. **The R Journal** 6(2):1-10.

J6 *M Read *, PS Andrews, J Timmis and V Kumar.* (2014). Modelling biological behaviours using the unified modelling language: an immunological case study and critique. **Journal of the Royal Society Interface** 11(9):20140704.

J5 *M Read *, P Andrews, J Timmis, R Williams, R Greaves, H Sheng, M Coles, V Kumar.* (2013). Determining disease intervention strategies using spatially resolved simulations. **PLoS ONE** 8(11):e80506.

J4 *K Alden, M Read, J Timmis, P Andrews, H Veiga-Fernandes and M Coles.* (2013). Spartan: a comprehensive tool for understanding uncertainty in simulations of biological systems. **PLoS Computational Biology** 9(2):e1002916.

J3 *R Greaves, M Read, J Timmis, P Andrews, J Butler, B Gerckens and V Kumar.* (2013). In silico investigation of novel biological pathways: the role of CD200 in regulation of T cell priming in experimental autoimmune encephalomyelitis. **Biosystems** 112(2):107-121.

J2 *R Williams, R Greaves, M Read, J Timmis, P Andrews and V Kumar.* (2013). In silico investigation into dendritic cell regulation of CD8Treg mediated killing of Th1 cells within murine experimental autoimmune encephalomyelitis. **BMC Bioinformatics** 14(Suppl 6):S9.

J1 *M Read *, P Andrews, J Timmis and V Kumar.* (2011). Techniques for grounding agent-based simulations in the real domain: a case study in experimental autoimmune encephalomyelitis. **Mathematical and Computer Modelling of Dynamical Systems** 17(4):296-302.

Refereed Conference Papers (* corresponding author)

Typical in computer science and engineering is the publication of full-length papers in conference proceedings. All the conferences in which I publish employ a peer review process, typically using at least 3 reviewers, and often a round of revisions prior to decisions regarding acceptance for publication.

C9 *GH Putri, MN Read, I Koprinska, TM Ashhurst and NJC King.* (2019). Dimensionality reduction for clustering and cluster tracking of cytometry data. **International Conference on Artificial Neural Networks** 624-640.

C8 *B Naylor, M Read, A Turner, J Timmis and A Tyrrell.* (2014). The Relay Chain: A scalable dynamic communication link between an exploratory underwater shoal and a surface vehicle. **Artificial Life (ALife)**, pages 290-297.

C7 *M Read *, C Möeslinger, T Dipper, D Kengyel, J Hilder, R Thenius, A Tyrrell, J Timmis and T Schmickl.* (2013). Profiling underwater swarm robotic shoaling performance using simulation. **Towards Autonomous Robotic Systems (TAROS)**, pages 404-416.

C6 *D Sutantyo, P Levi, C Möslinger and M Read* (2013). Collective-adaptive Levy flight for underwater multi-robot exploration. **IEEE Conference on Mechatronics and Automation**, pages 456-462.

C5 *RB Greaves, M Read, J Timmis, PS Andrews, V Kumar.* (2012). Extending an established simulation: exploration of the possible effects using a case study in experimental autoimmune encephalomyelitis. **International Conference on Information Processing in Cells and Tissues (IPCAT)**, LNCS 7223, pages 150-161.

C4 *T Schmickl, R Thenius, C Möslinger, J Timmis, A Tyrrell, M Read, J Hilder, J Halloy, C Stefanini, L Manfredi, A Campo, T. Dipper, D Sutantyo, S Kernbach.* (2011). CoCoRo – The self-aware underwater swarm. **IEEE International Conferences on Self-Adaptive and Self-Organizing Systems (SASO)**, pages 120-126.

C3 *F Polack, P Andrews, T Ghetiu, M Read, S Stepney, J Timmis and A Sampson.* (2010). Reflections on the simulation of complex systems for science. **IEEE International Conference on Engineering Complex Computer Systems (ICECCS)**, pages 276-285.

C2 *M Read *, J Timmis, P Andrews and V Kumar.* (2009). A domain model of Experimental Autoimmune Encephalomyelitis. **2nd Workshop on Complex Systems Modelling and Simulation**, pages 9-44.

C1 *M Read *, J Timmis and P Andrews.* (2008). Empirical investigation of an artificial cytokine network. **International Conference on Artificial Immune Systems (ICARIS)**, LNCS 5132, pages 340-351.

Refereed Conference Abstracts (* corresponding author)

The following represent peer-reviewed abstracts (1-2 pages) published in conference proceedings. In-person presentations to conference attendees facilitate rapid dissemination before pursuing publication in a journal; this is common in engineering and computer science.

A7 *M Read *, J Timmis and T Chtanova.* (2015). Simulation-based analysis of in situ cellular motility. **European Conference on Artificial Life (ECAL)**, page 637.

A6 *M Read *, AJ Holmes, M Hartill-Law, S Solon-Biet, D Raubenheimer and SJ Simpson.* (2015). Simulating the influence of diet on the intestinal microbiome composition. **European Conference on Artificial Life (ECAL)**, page 638.

A5 *M Read *, M Tripp, H Leonova, L Rose and J Timmis.* (2013). Automated calibration of agent-based immunological simulation. **International Conference on Artificial Immune Systems track at European Conference on Artificial Life (ECAL)**, MIT Press, pages 874-875.

A4 *E Hart, M Read, C McEwan, J Greensmith and U Aickelin.* (2013). On the role of the AIS practitioner. **Artificial Immune Systems track at European Conference on Artificial Life (ECAL)**, MIT Press, pages 891-892.

A3 *M Read, J Butler, B Ole-Gerckens, J Timmis and V Kumar.* (2012). CD200 regulation can promote recovery from autoimmunity in Experimental Autoimmune Encephalomyelitis. Presented at **International Conference on Artificial Immune Systems (ICARIS)**.

A2 *R Williams, M Read, J Timmis, P Andrews and V Kumar.* (2011). In silico investigation into CD8Treg mediated recovery in murine Experimental Autoimmune Encephalomyelitis. **International Conference on Artificial Immune Systems (ICARIS)**, LNCS 6825, pages 52-54.

A1 *M Read *, J Timmis, P Andrews and V Kumar.* (2009). Using UML to model EAE and its regulatory network (extended abstract). **International Conference on Artificial Immune Systems (ICARIS)**, LNCS 5666, pages 4-6.

Other

D3 *K Alden and M Read* (2013). Scientific software needs quality control. **Nature** 502:448. This is an editor-reviewed correspondence.

D2 *M Read.* (2012). Statistical and Modelling Techniques to Build Confidence in the Investigation of Immunology through Agent-Based Simulation. **PhD thesis**, Department of Computer Science, University of York.

D1 *M Read.* (2007). Explicable Boolean Functions. **Masters degree dissertation**, Department of Computer Science, University of York.

B3. Research Funding

- *M Read, A Kumar, E Shanahan, AWS Luk, YC Koay, T Nguyen, AP Wang, S Yoo.* Enabling personalised dietary recommendations to improve cardiometabolic health. **Cardiovascular Initiative Catalyst Award: Cariovascular Precision Medicine**, $10K, 2019

- *M Read, G Rangan.* Understanding Polycystic Kidney Disease through Data-Driven Approaches. **Westmead Industrial Placement Scholarship**: $18.5K, 2019
- *M Read, C Chow, A Kumar.* Advancing cardiovascular disease management through machine learning. **Westmead Industrial Placement Scholarship**: $18.5K, 2019
- *M Read, S Dervish, I Koprinska, T Ashhurst, G Haryono.* Understanding the immune response to disease though temporal cluster tracking **Westmead Summer Scholarship**: $10K, 2019
- *M Danta, S Ghaly, D Samocha-Bonet, C Bourke, M Read, L Macia, G Wark.* Metabolic monitoring of the microbiome in gastrointestinal disease study. **St Vincent's Clinic Foundation Research Grant**: $40K, 2018.
- *M Biro, M Read.* Search strategy optimisation by theory, functional analysis and simulation. **Australian Research Council Discovery Project**: $388K, 2018-2021. DP180102458.
- *T Ashurst, M Read, N King, U Roehm, I Koprinska, R Scalzo.* Mapping dynamic immunity: Next generation computational approaches to track the evolution of immune responses in West Nile virus and Zika virus encephalitis. **Marie Bashir Institute**: $10K, 2017.
- *C Clark, S Garcia, M Read.* Large dairy herds: Creating value from data. **Dairy Australia/Research and Development Grants**: $158K, 2015-2017.
- *M Read.* Royal Academy of Engineering International Travel Grant: £500, 2009.

B4. Prizes

- 2017 Award for Reduction in the Use of Animals in Research, The University of Sydney.
- Best computational immunology paper prize at the International Conference on Artificial Immune Systems (ICARIS) 2011, for output A2 (above). Voted for by conference attendees
- My PhD thesis was awarded 2nd prize in the University of York Computer Science Department's "Best PhD Thesis Award 2011"
- My Masters degree dissertation was awarded the 2007 Science Engineering and Technology (SET) national prize in Information Technology
- My Masters degree dissertation was awarded "Best Project" prize by the University of York's Computer Science department in 2007

B5. Supervision of Research Students

Current

- Givanna Haryono (2017-ongoing), PhD. "Revealing the development of the immune response through dynamic clustering." Associate supervisor.
- Juan Ortiz, PhD (2019-ongoing). "Modelling the gut: An in silico/in vitro approach to understanding the gut microbiome dynamics." Primary supervisor.
- Yifan Shi, Masters dissertation.

Completed

- Davis Edwards (2019), Capstone. "How do we rationally control gut microbial systems? Insights from computational modelling." Primary supervisor.

- Raymond Huang (2019), Honours. "Computational simulation of microbial monoculture growth dynamics; a prerequisite for rational microbiome-targeting interventions". Primary supervisor.
- Juan Ortiz (2018), Summer Scholar. "What drives microbial symbiosis? Exploring gut microbiome dynamics for improved design of dietary interventions." Primary supervisor.
- Takua Kojima (2018), Summer Scholar. "Using machine learning to predict gut microbiome-modulation of clinical outcomes in melanoma." Primary supervisor.
- Juan Ortiz (2018), Masters capstone project. "The role of gut microbial symbiosis on community resilience and hysteresis." Primary supervisor.
- Huw Evans (2018), undergraduate Talented Student Project. "Novel functional groupings of microbes that yield more accurate predictions of clinical outcomes." Primary supervisor.
- Avneet Kaur (2018), Honours. "Swarming in-silico: a case study on neutrophils" Primary supervisor.
- Joshua Won (2016-17), Honours. "Partial differential equation modelling of gut microbial dynamics." Associate supervisor.
- Mika Herath (2017), Honours. "Developing a model for studying hematopoietic stem cell recirculation: A multidisciplinary approach." Associate supervisor.
- Charlotte Haunton (2017), undergraduate Talented Student Project. "Microbes, maladies and machine learning: an overview of the emerging field of microbiome-based machine learning." Primary supervisor.
- Jonathan Du (2017), undergraduate Talented Student Project. "Classification of breathing patterns using machine learning techniques." Associate supervisor.
- Tao Tang (2016-17), summer scholarship holder. "Analysing the immune response through dynamic, dimensionality-reducing, time-series clustering." Primary supervisor.
- Rui Geng (2016-17), summer scholarship holder. "Visualising the high dimensional temporal development of the immune response." Primary supervisor.
- Samuel Freire (2016-17), initially a visiting international student, a CPC Summer Scholarship holder thereafter. "Characterising the stem cell dynamics underlying clonal haematopoiesis through simulation." Primary supervisor.
- Deeksha Singh (2016), Honours. "Incremental clustering of high dimensional, high throughput cytometry data to analyse immune response to West Nile Virus." Primary Supervisor, attained a mark of 87 (high distinction).
- Cecilia Li (2016), undergraduate Talented Student project, thereafter a summer scholarship holder. "Classification of breathing patterns using machine learning techniques" Associate supervisor.
- Jonathan Chung (2016), undergraduate Talented Student project. "Predicting weight loss using machine learning" Associate supervisor.
- Aolei Yu, Yu-wen Hsu, Jennifer Ellen Myrna Supple, Alysia Conditsis, Charley Jin and Charlotte Haunton (2016). A group project on "Computer simulation of how diets work to drive a healthy gut." Part of the University of Sydney's Talented Students Program (TSP). Primary supervisor.
- Roya Huang (2016), an international placement student. "Modelling the gut microbiome response to diet." Primary supervisor.
- Rong Zhang (2016), a summer scholarship student. "Predicting asthma and chronic obstructive pulmonary disease from patient data using machine learning." Associate supervisor.
- Cameron Andrews (2016), a summer scholarship student. "Dynamic time-series clustering of the developing immune response to West Nile Virus." Associate supervisor.
- Madison Hartill-Law (2015), Honours. "A computational approach to investigating the interaction between diet and the microbiome." Associate supervisor, attained a mark of 84 (distinction).

- Chris Saunders (2013), PhD student rotation project. "Using an established EAE simulator for novel in-silico experimentation: The effect of antigen-coated microparticles in reducing EAE autoimmunity." Associate supervisor.
- Magnus Tripp (2013), Master of Engineering student. "Automated calibration of agent-based simulation for an autoimmune disease." Associate supervisor.
- Sophie Alexander (2013), Master of Engineering student. "Simulating underwater swarm robotic systems." Associate supervisor.
- Hannah Leonova (2012), MRes in Computational Biology. "Automated calibration of agent-based simulation for an autoimmune disease." Associate supervisor.
- Bjorn Ole-Gerckens (2012), undergraduate project. "Investigating the effect that 2D versus 3D spatial representations have on simulation dynamics." Associate supervisor.
- Bjorn Ole-Gerckens, James Butler and Steve Goode: three students from Leeds university are engaged in placements with Jon Timmis. Their work concerned CD200 modelling in EAE. Associate supervisor.
- Richard Greaves (2011), Master of Research in Computer Science. "Computational modelling of Treg networks in Experimental Autoimmune Encephalomyelitis" Associate supervisor.
- Richard Williams (2010), Master of Research in Computational Biology (Distinction). "In silico experimentation using simulation of experimental autoimmune encephalomyelitis (EAE)." Associate supervisor.

B6. Reviewing and Programme Committee Duties

In 2019 I peer reviewed for the Australian Research Council.

- Peer reviewed journal manuscripts for:
  - Applied Soft Computing
  - Artificial Intelligence
  - BMC Bioinformatics
  - Computers in Biology and Medicine
  - Engineering Applications of Artificial Intelligence
  - Frontiers in Microbiology
  - IEEE Transactions on Evolutionary Computation
  - The International Society for Microbial Ecology (ISME) Journal
  - Natural Computing
  - PLoS Computational Biology
  - Robotica
  - Robotics and Autonomous Systems
  - Science of Computer Programming
  - Swarm Intelligence
  - Water Research
- Organising committee member of:
  - Workshop Chair for the 2013 Confidence in Computer Simulation workshop, part of the Summer Computer Simulation Conference (SCSC)
  - Workshop Chair for the 2012 CoSMoS project workshop
  - Publicity Chair of the 2011 ICST Conference on Bio-Inspired Models of Network, Information, and Computing Systems (BIONETICS)

- Programme committee member of:
  - Genetic and Evolutionary Computation Conference (GECCO) 2015, 2016, 2018, 2019
  - IEEE Congress on Evolutionary Computation (CEC): 2018, 2019
  - Complex Systems Modelling and Simulation Workshop (CoSMoS) 2014, 2015
  - Artificial Immune Systems (AIS) track at Genetic and Evolutionary Computation Conference (GECCO) 2014
  - Summer Computer Simulation Conference (SCSC) 2013
  - International Conference on Artificial Immune Systems (ICARIS) 2012
  - The Complex Systems Modelling and Simulation Infrastructure (CoSMoS) 2010 workshop
  - International Conference on Engineering Complex Computer Systems (ICECCS) 2010.
  - International Conference on Artificial Immune Systems (ICARIS) 2009

B7. Visiting Research Posts

My doctoral research was conducted in conjunction with Dr. Vipin Kumar, an immunologist who headed the Laboratory of Autoimmunity at the Torrey Pines Institute for Molecular Studies (TPIMS) San Diego. I undertook six week-long trips to TPIMS between 2008 and 2012.

B8. Invited Talks, Research Seminar, and Summer School Participation

"Microbes and the Mind." University of Sydney School of Psychology, November 2019.

"Delivering pre/probiotic health benefits by moving beyodn the 'One Size Fits All' paradigm." St George and Sutherland Clinical School Research in Progress Meetings, Sydney, 2019

"Delivering pre/probiotic health benefits and getting them to market by moving beyond the 'One Size Fits All' paradigm." Food Engineering and Personalised Food, Sydney, 2019

"Untangling biological complexity through modelling. Leukocyte motility and search for targets, and gut microbial responses to diet." The Garvan Institute of Medical Research, Sydney 2018.

"Host- vs diet-derived nutrient balance, and carbon vs nitrogen limitation, determines the effect of dietary intervention on the microbiome." Society for Mathematical Biology, Sydney 2018.

"Diagnostics and prognostics through machine learning; a tutorial and case study in gut microbiome-based weight-loss prediction." Australian Society for Microbiology, Brisbane 2018.

"Host- vs diet-derived nutrient balance, and carbon vs nitrogen limitation, determines the effect of dietary intervention on the microbiome." Cold Spring Harbour Asia conference on Microbiota, Metagenomics and Health, 2017.

"Determining immune cell search strategies: Studying motility through agent-based modelling and muti-objective optimization." QUT School of Mathematical Sciences, 2017.

"Computational modelling and simulation techniques to investigate the gut bacterial ecosystems response to diet." Invited talk at Theo Murphy Australian Frontiers of Science conference on the Microbiome, Adelaide, Australia, 2016.

"From an animal's nutrient environment to the microbial environment." Invited talk at Modelling the impact of the nutritional environment on host-microbiome interactions, the Cold Spring Harbour Asia Satellite Workshop, Suzhou, China, 2016.

"Simulating the influence of diet on the intestinal microbiome composition." Invited talk at Australian Society for Microbiology conference, Canberra, Australia, 2015.

"Modelling the diet's influence on gut bacterial communities." Invited talk at the joint University of Sydney and Shanghai Jiao Tong University Research Alliance workshop, 2015.

Delivered an invited talk on the analysis and simulation of complex biological data to a hand-selected group of farmers from New South Wales, Australia, who are seeking data-driven ways to optimise their farming practices. Talk took place in December 2014.

"In Situ Imaging & Mechanistic Simulation of Cellular Swarming." Invited talk at the Computer Graphics in Biomedical and Biological Imaging Data workshop, co-located with Computer Graphics International (CGI), Sydney, Australia, 2014.

"Modelling the gut microbiota response to host diet." Invited talk at the Australia and New Zealand Obesity Society conference, Sydney, 2015.

"Capturing the immune system: from the wet-lab to the robot." Invited guest lecture at the Awareness Summer School, Lucca, Italy, 2013. Further to this, I organized a case study for students to work on. The case study entailed deriving, in simulation, an algorithm run on underwater swarm robotic platforms that would organize the swarm into a dynamic chain that connected two (possibly moving) points in space.

"Determining disease intervention strategies using spatially resolved simulations." Invited talk at the BSI Mathematical and Computational Modelling in Immunology conference, Cambridge, UK, 2013.

I was invited to participate in the AWARENESS (EU funded coordination action) "slides factory" in 2012, a meeting of representatives from projects examining self-awareness in autonomic systems who collectively wrote a popular science seminar and an academic course on the subject.

I have presented my research to a variety of research groups and departments within the University of York, to researchers at the Torrey Pines Institute for Molecular Studies in San Diego, and at the Cheltenham Science Festival 2010.

In 2011 I participated in an invitation-only Schloss Dagstul seminar series on Artificial Immune Systems (AIS), and lead a group examining how to derive AIS algorithms from established immunological simulations.

"Building confidence in immunological simulation." Invited talk at the International Conference on Artificial Immune Systems, Cambridge, UK. 2011.

C. Service and the Promotion of Learning

In March 2015 I joined the NSW EMCR (Early and Mid Career Researcher) Network organising committee, and served as the Vice President. This network runs roughly 4 events a year, which aim to build professional networks between EMCRs and the private sector. Specifically, this is to make EMCRs aware of professional opportunities and careers where their training as researchers would be valued, and to provide the NSW private sector with exposure to a wide range highly skilled researchers. I stood down in 2017.

I was a founding member and inaugural Chair (2014-2016) of the Early Career Researcher Initiative committee, at the University of Sydney's Charles Perkins Centre (CPC), an interdisciplinary research institute of 900 researchers. The committee organises activities supporting EMCR professional development, social integration and career progression. It also advocates on their behalf to the CPC's executive committee.

I have served as an independent assessor for the following higher degree by research students:

- Bial Akil; Masters, 2019, University of Sydney Faculty of Engineering & IT. "A comparative study of

Hadoop MapReduce, Apache Spark & Apache Flink for data science."

- Thomas Geddes; Honours, University of Sydney Faculty of Science.

I have contributed to student learning in a wide variety of courses taught at the University of Sydney's (USYD), and the Department of Computer Science at the University of York (UY).

Course coordination:

- HTIN5004: Integrated Approaches to Chronic Disease (2016, 2017; USYD). I helped design this course.

Lecturing experience (lecture title and details of unit given):

- "ICT-enabled diagnostics, prognostics and clinical decision support" (2019; USyd). 1h guest lecture for Enterprise Healthcare Information Systems.
- "Computational Modelling in Biological Research" (2016 - 2019; USyd, post-graduate unit). 1h lecture as part of Integrated Approaches to Chronic Disease.
- "Bioinformatics for Cytometry" (2017; USyd, medical unit). Guest lecture on cutting edge technologies for analysing high-dimensional cytometry data. Given to students of USyd's Medical Program, Cardiovascular Sciences stream.
- "Simulating the Gut Microbial Response to Diet" (2016; USyd, post-graduate unit). A 3 hour session delivered as part of The Nature of Systems (HTIN5001).
- "Workshop on Writing Academic Papers" (2015; USyd). I co-organised and co-wrote this course, and delivered lectures on the presentation of data and selecting a journal to publish in.
- "Providing an Integrative Perspective of Biological Systems using Computer Simulations" (2014; USyd, undergraduate unit). A 1h guest lecture to 3rd year Veterinary Science students, studying Animal Biotechnology.
- I developed and delivered 4 hours of material for the Swarm Intelligence master's unit (2012; UY, post-graduate). Titles:
  - "Group Behaviour"
  - "Simulation of Swarm Robotic Systems"
  - "Statistics and Sensitivity Analysis"
  - "Communication-less Boids" (a flocking algorithm)
- As part of UY's Combating Infectious Disease: Computational Approaches in Translational Science Ph.D. training program, I developed and delivered the following, in both 2011 and 2012.
  - "The Experimental Autoimmune Encephalomyelitis Simulator"
  - "Performing *in silico* Experiments"
  - "Calibration & Sensitivity Analysis"
- "Simulation in Swarm Robotics" (2011; UY, post-graduate). A 1h lecture I prepared and delivered for the Swarm Intelligence unit.

I served on a panel to select the receipient for the 2018 'Reduction in the Use of Animals in Research' award by the University of Sydney.

D. Public Engagement

Ran a workshop on machine learning for teachers of science at a University of Sydney event in 2018.

In 2016 I worked with a journalist in the University of Sydney's Alumni magazine who wrote an article on the gut microbiome that featured my research.

In March 2015 I delivered a public lecture on the interactions between host diet and gut microbial communities in influencing host health. The talk took place in Ultimo library, Sydney, and is part of the 'Inspiring Science' scheme which seeks to give the public exposure to the work of early stage academic researchers.

In 2009 I joined the EPSRC funded New Outlooks In Science and Engineering[1] (NOISE) public engagement initiative. Through NOISE, I have demonstrated principles of science and engineering to the general public at the 2009 Manchester Science Festival. I sat on a panel of 3 computer scientists at the 2010 Cheltenham Science Festival and engaged the audience in a discussion concerning the future of computers, and how they have aided modern day life. Through NOISE I have attended workshops in media training and public engagement.

E. Academic References

Associate Professor Andrew Holmes
Faculty of Science, The University of Sydney, Australia
andrew.holmes@sydney.edu.au
A/Prof Holmes is close a collaborator on my microbiome-related work, and was my line manager for 5 years at the Charl

Associate Professor Irena Koprinska
Faculty of Science, The University of Sydney, Australia
irena.koprinska@sydney.edu.au
A/Prof Koprinska is a close collaborator on my machine learning-related projects.

Dr. Maté Biro
School of Medical Sciences and EMBL Australia, The University of New South Wales, Australia
Dr. Biro is a close collaborator on immune motility and search strategies.

Professor Jon Timmis
Department of Electronics, The University of York, United Kingdom
jon.timmis@york.ac.uk
Prof Timmis was my Ph.D. supervisor, and, thereafter, line manager during my first post-doctoral position.

[1] *http://www.noisemakers.org.uk/*