

**AMSI WINTER SCHOOL 2016**  
**ON BIOLOGICAL &**  
**ENVIRONMENTAL MODELLING**

**The University of Queensland**

4 July to 15 July 2016

**AMSI Winter School 2016** would like to thank the following sponsors for their support:



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**CHOOSE  
MATHS**



# AMSI Winter School 2016

## on Biological and Environmental Modelling

The University of Queensland  
4 July to 15 July 2016

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Prof Markus  
HEGLAND  
AMSI Deputy Director (AMS)

# INTRODUCTION

AMSI Winter School 2016 was held in July at the University of Queensland for the eleventh consecutive year. As one of the Australian Mathematical Sciences Institute's (AMSI) flagship higher-education events, the Winter School enabled participants to expand their skills while broadening and deepening their mathematical knowledge.

The two-week program, designed for graduate students and postdoctoral fellows, also attracted undergraduates and early-career researchers in the mathematical sciences and cognate disciplines, and encouraged attendees to meet and build collaborative networks. This was achieved through the lecture and tutorial/lab program, as well as a variety of program extras from a public lecture through to social events.

The School was opened by AMSI Deputy Director Professor Markus Hegland (Australian National University) at the Science Learning Centre, with warm words of inspiration and motivation welcoming the 45 attendees to the University of Queensland and the advanced program of biological and environmental modelling.

Well-established senior researchers from around Australia and New Zealand, continuing the Winter School's traditional high standard of attracting leaders in their field to the event, delivered four courses over the intensive two-week program, focused on biological modelling in Week One and environmental modelling in Week Two. Attendees appreciated and enjoyed being exposed to fields and topics outside their specialist area, including the opportunity to share their own research through the Participant Talk feature in the program.

Professor Hugh Possingham's Public Lecture "Is Science Any Use for Saving Species and Habitat?", supported by BrisScience, was a particular highlight of the School, discussing the value of collecting and monitoring information for achieving nature-conservation outcomes by asking whether some topics of research are more useful than others, and whether utility should factor into decisions about research funding. This event attracted national media interest, and was fully subscribed over a week before the event was held at the State Library of Queensland's The Edge.

AMSI Winter School 2016 was jointly funded by the Australian Mathematical Sciences Institute and the Australian Government's Department of Education & Training, with support from the University of Queensland, QCIF, ACEMS, the Simulation Group and the BHP Billiton Foundation through the *CHOOSEMATHS* program.

*“With an innovative new structure, AMSI Winter School 2016 was an essential event for post-graduate students and early-career researchers interested in biological and environmental modelling. Dedicating a week to each respective area of research allowed participants to benefit from in-depth collaboration. As Director of AMSI, I wish to acknowledge the efforts of Event Director Dr Phillip Isaac and the University of Queensland organising committee and lecturers in helping coordinate such a successful event.*

*AMSI Winter School 2016 was made possible through the efforts of AMSI staff and the generous support of sponsors and the Department of Education & Training. On behalf of AMSI, I thank all those involved in AMSI Winter School 2016 and invite potential partners to join us in supporting future events.”*

## ***Professor Geoff Prince***

***Director***

***Australian Mathematical Sciences Institute***

*“The interplay between modelling and experiment was often revisited throughout the academic program — emphasising the importance of mathematical models, rather than presenting reproduced existing experimental results, but predicting new and unanticipated results.”*

***Dr Phillip Isaac***

***AMSI Winter School 2016 Event Director***  
***The University of Queensland***

# COURSE PROGRAM

## Our “Second Brain”: Modelling its Development and Disease

Professor Kerry Landman, The University of Melbourne

## The Mathematical Modelling of Chemotaxis as a Mechanism for Structure and Pattern in Cell Populations

Professor Graeme Pettet, Queensland University of Technology

## The Dynamics of Calcium: The Interaction of Modelling and Experiments

Professor James Sneyd, The University of Auckland

## Introduction to the Mathematics of Environmental Decision Science

Professor Hugh Possingham, The University of Queensland

Dr Eve McDonald-Madden, The University of Queensland

# Our “Second Brain”: Modelling its Development and Disease

Professor Kerry Landman, The University of Melbourne



The enteric nervous system is responsible for normal stomach function and peristaltic contraction. Embryonic development of the enteric nervous system involves the colonisation of the stomach wall from one end to the other by a population of proliferating neural crest cells. Failure of these cells to invade the whole stomach results in the relatively common, potentially fatal condition known as Hirschsprung’s disease.

This course explored cell invasion, whereby cells move and undergo cell division, which occurs in tumour growth, wound healing and during embryonic development. A perfect example of this is the development of the enteric nervous system (ENS) in our gastrointestinal tract. The connection between our brain and our stomach leads to the nickname for the enteric nervous system as the “second brain”.

Mathematical modelling, both continuum and discrete, was shown to provide insight into the key biological processes required for complete colonisation, and to the generation of experimentally testable predictions. This gave rise to interesting mathematical problems such as the problem of modelling cell proliferation on a growing domain.

Particular emphasis was given to Fisher’s equation, with some historical perspective provided. Enlightening derivations of relevant discrete master equations and their continuum limits were discussed. Overall, the audience was treated to deep insights of an accomplished applied mathematician that would enable them to further develop essential mathematical-modelling skills.



# The Mathematical Modelling of Chemotaxis as a Mechanism for Structure and Pattern in Cell Populations

Professor Graeme Pettet, Queensland University of Technology



Single-celled organisms and many of the cells found in tissues of higher-order organisms have the capacity to be motile and, in particular, respond to gradients in concentration of locally-distributed molecules. In certain instances, this directed motility known as chemotaxis provides the underlying mechanism for the formation of striking patterns in tissues and populations of single-celled organisms.

In this course, participants explored methods of mathematical modelling and solutions for classic experimental examples of bacterial chemotaxis and for some more recent models of tissue invasion. Attendees were introduced to the characterisation of travelling wave solutions to many of these models. This was shown to provide a foundation for recent developments in dynamical systems theory that was considered further.

The course predominantly formulated continuum models as coupled systems of partial differential equations, using MATLAB or Mathematica as a tool for exploring numerical simulations. This was compared with known special-case solutions and phase-plane methods for exploring the existence of travelling wave solutions and confirming related analytically-derived results.

One model that featured throughout the discussions was the Keller-Segel model. Related geometric, analytic and numeric methods were considered, and the connection to travelling wave solutions examined. The audience spent time in the computer lab during this first week, and were introduced to NetLogo as an online visualisation tool and programmable modelling environment.

# The Dynamics of Calcium: The Interaction of Modelling and Experiments

Professor James Sneyd, The University of Auckland



Modulation of the concentration of free intracellular calcium is one of the most ubiquitous and important intracellular signalling mechanisms, and as a result, the study of how intracellular calcium concentration is controlled has become an important research area in cell physiology and signalling. Furthermore, because of the intricate complexities of the calcium response, which exhibits spikes, oscillations and waves, the study of calcium dynamics is one area where there is a close relationship between experimentalists and modellers.

This course gave an introduction to the physiology of calcium dynamics, and described how to construct models of intracellular calcium oscillations and waves. After the delivery of a more generic introduction to the field, the course covered some case examples in more detail.

These applications showed the potential interactions between experiments and theory, including smooth muscle contraction, water secretion by secretory epithelial cells, and bursting action potentials in neuroendocrine cells. Modelling oscillations of calcium ions ( $\text{Ca}^{2+}$ ) and inositol (1,4,5)-trisphosphate ( $\text{IP}_3$ ) is just one example of many mathematical models that were used to predict new results.

The course also highlighted aspects of the books *Mathematical Physiology I: Cellular Physiology* and *II: Systems Physiology* by James Keener and James Sneyd, including material on biochemical reactions and cellular homeostasis, excitability and, ultimately, calcium dynamics.

# Introduction to the Mathematics of Environmental Decision Science

**Professor Hugh Possingham, The University of Queensland**

**Dr Eve McDonald-Madden, The University of Queensland**

Recent decades have seen a dramatic decline in the plants and animals that supply our food, medicine and clean air — our way of life. Drawing from concepts in mathematics, computer science, economics, social science and ecology, the field of Environmental Decision Science is working at the cutting edge to use theory to inform the management of our natural world.

In this course, the lecturers shared their experience using mathematics in environmental decision science through a sequence of lectures, research examples and problem-solving sessions covering: structuring environmental decision problems, modelling ecological populations, prioritisations and the knapsack problem, resource allocation and stochastic dynamic programming, game theory and conservation actors, and spatial planning to inform protected-area reserve design.

A wide range of related mathematical methods was exhibited throughout the course, from Markov processes to coupled systems of nonlinear differential equations. Emphasis was placed on the construction of models and the interpretation of the mathematical analysis and the prediction of unexpected features.

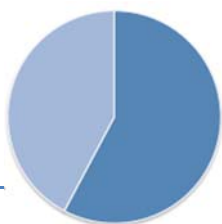
Short guest presentations from University of Queensland researchers were incorporated into the course, demonstrating how the researchers use these theories to inform conservation decisions, as were computer lab sessions, working through carefully-prepared modelling problems and exercises related to topics such as the effect of policy on how people modify their behaviour in the context of wildlife conservation, decision-making in the context of relocation of endangered species of birds to protected reserves, and implementation of solutions to the knapsack problem.



# PARTICIPATION BREAKDOWN

## UNIVERSITY/INSTITUTION

The University of Queensland	10
Queensland University of Technology	7
The University of Melbourne	3
The University of Western Australia	3
James Cook University	3
Deakin University	2
Griffith University	2
RMIT University	2
The University of Adelaide	2
The University of Sydney	2
University of Wollongong	2
Curtin University of Technology	1
Flinders University	1
Monash University	1
The University of New South Wales	1
The Australian National University	1
University of Technology Sydney	1
University of the Sunshine Coast	1
<b>TOTAL</b>	<b>45</b>



## GENDER

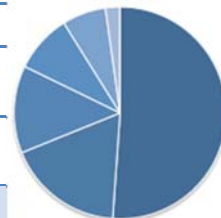
Male	26	58%
Female	19	42%



## ATSI STATUS

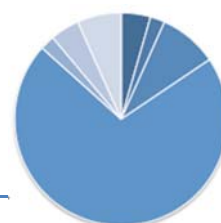
Yes	1	2%
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No



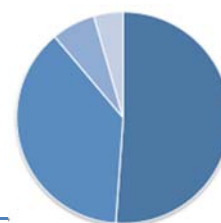
## STATE/TERRITORY

QLD		
VIC	8	18%
NSW	6	13%
QA	4	9%
SA	3	7%
ACT	1	2%
NT	0	0%
TAS	0	0%



## ACADEMIC STATUS

Undergraduate	2	4%
Honours	1	2%
Masters	4	9%
PhD	32	71%
Academic	1	2%
Early-Career Researcher	2	4%
Other	3	7%



## RESIDENCY STATUS

Australian Citizen	23	51%
Permanent Resident	2	4%
Student Visa	17	38%
Other	3	7%

# GRANTS

## AMSI Travel Grants

AMSI Travel Grants are offered to support AMSI Member student travel and accommodation to attend flagship higher-education events. AMSI Winter School 2016 grants were funded by the Australian Mathematical Sciences Institute, the Australian Government's Department of Education & Training and the University of Queensland, and were determined on a competitive basis.

In 2016, AMSI Travel Grants were awarded to 18 students from 12 AMSI Member Universities across Australia:

- Gal Almogy, RMIT University
- Rosemary Aogo, The University of New South Wales
- James Archer, University of Wollongong
- Hasseeb Azzawi, Deakin University
- Magdalena Budzinska, The University of Sydney
- James Cavallo, Monash University
- Jessica Cheok, James Cook University
- Thomas Dolan, The University of Adelaide
- Nicholas Gale, The University of Western Australia
- Vanessa Haller, James Cook University
- Vira Koshkina, RMIT University
- Ben Luo, The University of Western Australia
- Michael McCullough, The University of Western Australia
- Tui Nolan, University of Technology Sydney
- Robert Qiao, Flinders University
- Anna Quaglieri, The University of Melbourne
- Linda Riquelme, The University of Melbourne
- Ishraq Uddin, The University of Sydney

## CHOOSEMATHS Grants

CHOOSEMATHS Grants are designed to offer full or partial support for Australian female mathematical sciences students and early-career researchers to participate in the AMSI higher-education programs and/or assist with caring responsibilities. The BHP Billiton Foundation, as an initiative of the CHOOSEMATHS program, funded these grants to help females build and extend mathematical skills and professional networks.

In 2016, CHOOSEMATHS Grants were awarded to four female students and one early-career researcher, each from a different AMSI Member University:

- Zahra Al Helal, Curtin University of Technology
- Russul Alanni, Deakin University
- Hilary Hunt, The University of Melbourne
- Elisa Jager, University of Wollongong
- Catherine Penington, Queensland University of Technology

# PROGRAM EXTRAS

## Welcome BBQ

The University of Queensland hosted a welcome BBQ at Emmanuel College to meet and greet the attendees ahead of the School's formal opening. This was a nice opportunity for the event coordinators to register and check in with the participants, and distribute the information packs and bags including the program and timetable. The informal setting enabled some professional and social networking as well!

## Women in Maths

This networking event attracted over 70 people attending from the AMSI Winter School cohort and other invited academic guests, including panel speakers:

- Professor Kerry Landman (The University of Melbourne)
- Julia Bruerton (Brisbane Grammar School)
- Ellie Foxcroft (Biarri)

Hosted by the AMSI Winter School in conjunction with the Australian Mathematical Society's (AustMS) Women in Mathematics Special Interest Group (WIMSIG), the event provided an active forum of discussion focused on highlighting the contribution of women in mathematics, raising awareness about issues for women and promoting career pathways.



## Guest Lecture & Queensland Brain Institute Tour

Professor Geoffrey Goodhill presented a guest lecture on the computational neuroscience research being conducted at the Queensland Brain Institute (QBI), after which attendees were invited to tour the QBI research labs. This was the third consecutive year that AMSI Winter School attendees have been privileged to hear a guest lecture from Professor Goodhill and tour the facilities at QBI.

## Participant Talks

AMSI Winter School 2016 attendees were given the opportunity to present a 15-minute presentation on the area of their research or a related field, to assist in building networks and to share their study investigations with peers. Attendees were encouraged to ask questions at the end of each talk, and to build collaborative networks throughout these sessions. A secret vote is held at the end of the final session to determine an overall winner.

*Vira Koshkina (RMIT University) was declared the winner for her presentation, "Stochastic ecological models for predicting species distribution and extinction". An honourable mention and second place was awarded to David Harman (Griffith University) for his presentation, "Applying Generalised Polynomial Chaos to Epidemic Models with Individualised Parameter Distributions".*

## Friday Night Social

An informal social was held on the middle Friday of the Winter School at Saint Lucy's Cafe, one of Brisbane's authentic Italian dining restaurants on campus. This was a very casual event, encouraging attendees, lecturers and the event team to socialise, relax and reflect on their Winter School experience at the end of the first week.

## Public Lecture



Professor Hugh Possingham (The University of Queensland) presented a Public Lecture in conjunction with BrisScience at the Queensland State Library's The Edge, engaging a broad audience by highlighting the theme of the AMSI Winter School program in his talk, "Is Science Any Use for Saving Species and Habitat?".

Director at the Possingham Lab (a threatened-species recovery hub that is using mathematics to formulate and solve problems for saving plants, animals and ecosystems), Professor Possingham discussed critical environmental conservation questions facing our planet and the value of monitoring and collecting information for achieving nature-conservation outcomes, using decision-science tools (optimisation) as the framework for deciding which research is useful.

## Conference Dinner

To celebrate the end of AMSI Winter School 2016, a conference dinner was hosted by the University of Queensland at the Regatta Hotel on the Brisbane River in Toowong. Guest speaker Will Vandenberg (The Simulation Group) spoke of the significance of commercial mathematics and its use in the workforce.

# FEEDBACK ANALYSIS

Sixty-seven per cent of attendees at AMSI Winter School 2016 completed the online survey to provide their feedback and comments on the event. In rating their overall experience at the event on a scale of 1 to 10, where 1 is Poor and 10 is Excellent, the respondents' average rating was 8.6.

Overall, the responses received were extremely positive, with over 94 per cent of the attendees indicating that they "Strongly Agreed" or "Agreed" that the event was well-organised and of a high standard, and that they would recommend the event to others. Attendees maximised the opportunities at the School to network, with 87 per cent stating that they made useful contacts at the School.

To explain their primary motivation or reason for attending AMSI Winter School, 47 per cent of respondents indicated that the program related to their research interest, while 20 per cent of respondents indicated that they wanted to broaden their knowledge.

## OVERALL, THE SCHOOL WAS OF A HIGH STANDARD

Strongly Agree	76%
Agree	17%
Neutral	7%
Disagree	0%
Strongly Disagree	0%



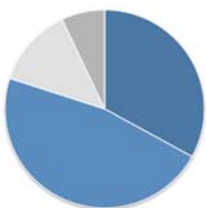
## OVERALL, THE SCHOOL WAS WELL-ORGANISED

Strongly Agree	86%
Agree	7%
Neutral	7%
Disagree	0%
Strongly Disagree	0%



## WOMEN IN MATHS EVENT WAS A REWARDING EXPERIENCE

Strongly Agree	33%
Agree	47%
Neutral	13%
Disagree	7%
Strongly Disagree	0%



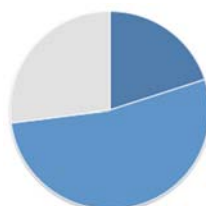
## THE PUBLIC LECTURE WAS INTERESTING AND INFORMATIVE

Strongly Agree	76%
Agree	16%
Neutral	8%
Disagree	0%
Strongly Disagree	0%



## THE SCHOOL STRENGTHENED MY MATHEMATICAL CREDENTIALS

Strongly Agree	20%
Agree	53%
Neutral	27%
Disagree	0%
Strongly Disagree	0%



## I WOULD RECOMMEND THE WINTER SCHOOL TO OTHERS

Strongly Agree	73%
Agree	20%
Neutral	7%
Disagree	0%
Strongly Disagree	0%





# STUDENT PROFILE

## LAND OF GEOMETRY TO ENVIRONMENTAL MODELLING

**Vira Koshkina, RMIT University**



As she read about the adventures of Dot, Pencil, Line and the villainous Eraser in the popular Ukrainian children’s book *Journey in the Land of Geometry*, Vira Koshkina could never have imagined she was already on a path that would lead her to Australia and a career in mathematical ecology.

Fast forward to 2016 and the Mathematical Ecology PhD student is buzzing from her experience at AMSI Winter School.

“As a maths student you spend a lot of time working on your own or within your fixed research group. It was exciting to connect with ambitious researchers from around Australia and explore different areas of mathematics and opportunities for future collaboration,” she says.

Given her area of research, this year’s theme of biological and environmental modelling was perfect for Vira.

“I research species-distribution models, so environmental modelling was very relevant and interesting for me. I love this area, as there is something magical about the fact we can use mathematical formulas to describe something as complex as animal distribution,” she explains.

Species-distribution models take into account factors such as behaviour and interaction to provide detailed geographical mapping of animal location. These are used to inform animal-protection policy and site analysis for companies undertaking activities such as logging or mining, in order to minimise negative long-term impacts and protect flora and fauna.

“If an endangered species is identified on, say, a logging site, the company is required to stop work while protection policies are implemented. Unfortunately, this is not always done in time to avoid habitat damage but through better modelling we are getting closer to minimising these impacts,” says Vira.

While she may be busy mapping species, her future is a different matter. She believes that “doing research in something as fundamental as maths opens all kinds of doors. Whatever I do, I hope it will make people’s lives better.”

Singing the event’s praises, Vira is quick to point out Winter School’s enormous value as a student-networking platform essential to establishing a career in science.

“The friendships and collaborations we made will stay with us for a long time. It was an amazing opportunity to see what else is out there and learn about other approaches you can use in your own work,” she says.

Fresh from discussing the highs and lows of the mathematical world with her peers, Vira is pragmatic about the challenges: “There is a lack of female role models, which contributes to the low number of females maths students. Also, real-world application is still a challenge with such low research-industry engagement.”

# MEDIA RELEASE

## HOW MUCH DO WE NEED TO KNOW TO SAVE SPECIES AND ECOSYSTEMS?

**Brisbane, Queensland — 6 July 2016**

Ecosystems like the Great Barrier Reef and Australia’s 1800 threatened species need urgent action and waiting for more knowledge is not an option, according to AMSI Winter School Public Lecturer Professor Hugh Possingham.

“We are past the point of having time for more research and monitoring in many situations. We need to take our understanding of mathematics, statistics, economics and ecology and crunch the numbers on what we can do now to preserve the most threatened habitats and species,” he says.

Based at The University of Queensland, Professor Possingham is the global leader in mathematical modelling and decision science for nature conservation, an approach that views threatened species, ecosystems and natural habitats in much the same way as we view other assets.

He believes that we need to manage our natural assets like a share portfolio, balancing risk and reward. This means questioning our approach to conservation and making difficult decisions about the balance between research, monitoring and action.

“We need to ask ourselves, why do we keep counting the humpback whales as they pass the coast of Queensland? Why record the impact of coral bleaching when climate change is in the hands of international politicians and importantly, why carry out research on the ecology of endangered species?”

Professor Possingham will explore the challenges facing those in the environmental management hot-seat and ask why conservation is a numbers game when he addresses the 2016 AMSI Winter School Public Lecture from 6.30pm, 11 July at The Edge (State Library of Queensland).

This lecture is one of a number of public events delivered annually as part of AMSI’s flagship training programs. Australian Mathematical Sciences Institute (AMSI) Director Geoff Prince believes that these opportunities play an important role in building community understanding of the value and impact of mathematical research.

“An essential bridge between the mathematical sciences and general community, these popular lectures highlight our role in discovery and innovation that benefits humanity and the planet,” explains Professor Prince.

### **About AMSI Winter School**

Professor Possingham is also a 2016 AMSI Winter School lecturer. A two-week training school hosted by The University of Queensland, Winter School is part of AMSI’s flagship research-training program. These events set the gold standard in preparing postgraduate and early-career researchers for cross-discipline and industry research. Running from 4–15 July, this year’s theme is Biological and Environmental Modelling.

## Great Barrier Reef

## Great Barrier Reef: government must choose which parts to save, says expert

Professor Hugh Possingham says authorities must confront prospect that some parts of reef are doomed and focus on what to preserve



Professor Hugh Possingham says agencies need to think about which parts of the reef can be saved 'rather than trying to save everything'. Photograph: Alison Godfrey/AAP



943 313

Joshua Robertson 

Saturday 9 July 2016 08.15 AEST

Governments must decide which parts of the [Great Barrier Reef](#) they most want to save and confront the prospect that some of it may be doomed, an expert on conservation modelling has warned.

University of [Queensland](#) professor Hugh Possingham said agencies, including the Great Barrier Reef Marine Park Authority, needed to make tough decisions about which parts of the natural wonder are most worth preserving "rather than trying to save everything".

Possingham said the looming "triple whammy" of global warming's impact on the reef - warmer seas, more acidity and more cyclones - meant time was running out and "triage" priorities were needed.

🗨️ **How the Great Barrier Reef got polluted - from farms and fossil fuels to filthy propaganda**

**Graham Readfearn**

 [Read more](#)

"We should be identifying the most resilient places - the ones most likely to be able to deal with all these assaults from outside and focusing our attention on them rather than trying to save everything," he said.

"We need to focus on the bits we can definitely save."

Possingham, a former Rhodes scholar who is described by the Australian Mathematical Sciences Institute as "the global leader in mathematical modelling and decision science for nature conservation", conceded it could be "suicide" for politicians to talk of abandoning some parts of the reef over others.

# DIRECTOR'S REPORT

## DR PHILLIP ISAAC

### The University of Queensland



*Over the years, the Winter School has established itself as a significant event in the Australian calendar for post-graduate students and early-career researchers in the mathematical sciences and cognate disciplines.*

*This year saw the eleventh AMSI Winter School held at The University of Queensland's St Lucia campus in Brisbane. The two-week program offers participants the opportunity to expand their skills and perspective, and also to build collaborative networks with like-minded researchers.*

*The theme this year was Biological and Environmental Modelling. Such a topical selection of courses related to this theme attracted a variety of participants from scientific disciplines such as mathematics, statistics, biology, bioinformatics, ecology, conservation, environmental science, physics, epidemiology and agriculture. Indeed, this year, compared to previous years, there was a relatively large number of students from cognate scientific disciplines.*

*The structure of the Winter School was slightly different to previous years. In the past, lecture courses spanned the full two weeks, with introductory lectures given in Week One and more advanced topics covered in Week Two. This year, however, Week One focused on mathematical models in biology, with three lecture series. Professor Kerry Landman from The University of Melbourne gave an outstanding set of lectures where she considered the mathematical modelling of proliferating cells in the enteric nervous system in the gastrointestinal tract, sometimes referred to as "the second brain", in order to understand diseases such as Hirschsprung's disease. Professor James Sneyd from the University of Auckland discussed the interplay between mathematical modelling and experiments in the context of the dynamics of calcium. Professor Graeme Pettet from Queensland University of Technology presented an engaging series of lectures on aspects of the mathematical modelling of chemotaxis.*

*By contrast, Week Two was exclusively concerned with environmental modelling, particularly relating to the research of the two main presenters, Professor Hugh Possingham and Dr Eve McDonald-Madden, both from The University of Queensland. Over the course of Week Two, as part of their introduction to the mathematics of environmental decision science, the presenters touched upon the issues surrounding the structuring of environmental decision problems, modelling ecological populations, prioritisations and the knapsack problem, resource allocation and stochastic dynamic programming, game theory and spatial planning to inform reserve design.*

*Participant talks were held on the Tuesday of the first week. As a peer-voted competition, these talks were managed in six groups, and a winner was selected from each group. On the Monday morning of the second week, the finalists gave presentations to the entire group and a winner was elected. The quality of the talks was impressive, and the winner was Vira Koshkina from RMIT for her presentation entitled "Stochastic Ecological Models for Predicting Species Distribution and Extinction". An honourable mention was given to David Harman from Griffith University who came a close second for his talk entitled "Applying Generalised Polynomial Chaos to Epidemic Models with Individualised Parameter Distributions".*

*On Thursday of Week One, Professor Geoff Goodhill from UQ's School of Mathematics and Physics and the Queensland Brain Institute (QBI) gave a lecture about his research conducted in the QBI lab, followed immediately by a guided tour of the lab and refreshments on the terrace at QBI. Many of the participants enjoyed this tour, having been given the chance to see the environment in which leading-edge research is produced in the field of computational neuroscience.*

*There were several social highlights of the Winter School. On the Wednesday night of the first week was the Women in Maths networking event. This was a relaxed evening of wine and cheese with a panel discussion. The aim of the evening was to highlight the contribution of women in mathematics, with engaging discussions about career paths. The panel members this year were Professor Kerry Landman from The University of Melbourne, Julia Bruerton from Brisbane Grammar School and Ellie Foxcroft from Biarri.*

*Monday evening of the second week was a public lecture by Professor Hugh Possingham from The University of Queensland. His talk, entitled "Is Science Any Use for Saving Species and Habitat?", was given to a full house at The Edge, State Library of Queensland. This year's Public Lecture was in conjunction with UQ BrisScience, and the UQ Science Faculty provided a light supper afterwards.*

*The Winter School attracted financial support from external sponsors QCIF, ACEMS and The Simulation Group. The BHP Billiton Foundation also provided support by financing the **CHOOSEMATHS** Grants. These grants provide support for Australian female mathematical sciences students and early-career researchers.*

*Thursday night of the second week was the Winter School dinner, held at The Regatta Hotel in Toowong. In attendance was the Queensland general manager of The Simulation Group, Will Vandenberg, who gave a presentation about the activities of The Simulation Group.*

*In summary, the Winter School continues to be a great success on many levels, and has proven, yet again, to be a valuable experience for Australia's next generation of mathematicians and cognate researchers.*

# EVENT COMMITTEES

AMSI wishes to acknowledge the generous donation of time and scientific advice of the following committees, without whose contribution this event would not be a continuing success:

## Standing Committee

- **Committee Chair:** Phillip Isaac, The University of Queensland
- Troy Farrell, Queensland University of Technology
- Gary Froyland, The University of New South Wales
- Joe Grotowski, The University of Queensland
- Marcus Hegland, Australian National University
- Simi Henderson, Australian Mathematical Sciences Institute
- Andree Phillips, The University of Queensland
- Hugh Possingham, The University of Queensland
- Geoff Prince, Australian Mathematical Sciences Institute

## Organising Committee

- **Event Director:** Phillip Isaac, The University of Queensland
- Simi Henderson/Anne Nuguid, Australian Mathematical Sciences Institute
- Joe Grotowski, The University of Queensland
- Catherine Parsons, Australian Mathematical Sciences Institute
- Andree Philips, The University of Queensland





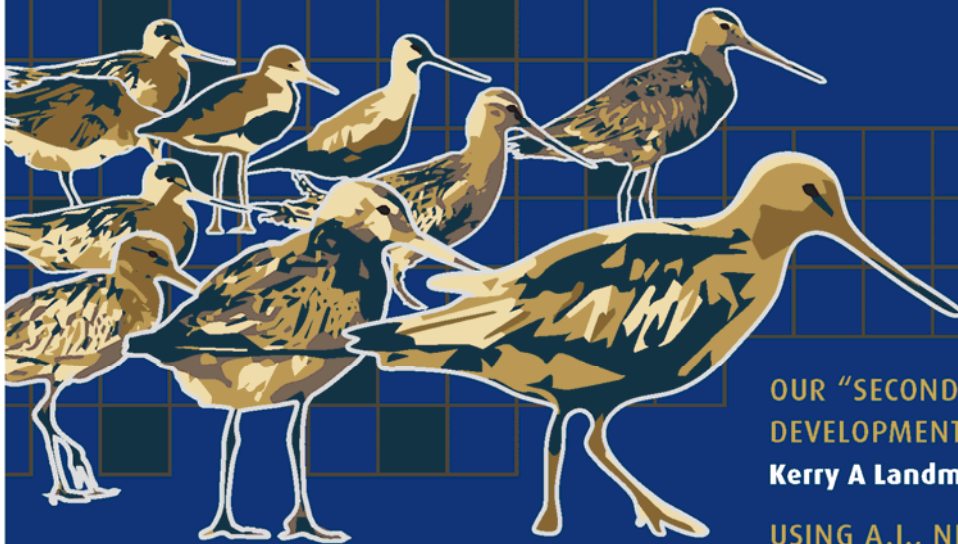
AMSI  
WINTER  
SCHOOL

16

ON BIOLOGICAL &  
**ENVIRONMENTAL**  
MODELLING

4-15 JULY | THE UNIVERSITY OF QUEENSLAND

$$\frac{\partial p}{\partial t} = f(x) + \alpha \frac{\partial^2 p}{\partial x^2}$$



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