CURRICULUM VITAE

PROFESSOR ALEKS OWCZAREK

Academic Appointments

Current:

Dean
Faculty of Science, The University of Melbourne
1st August, 2019 –

Previous Appointments

Acting Dean
Faculty of Science, The University of Melbourne
1st September, 2018 – 31st July, 2019

Deputy Dean
Faculty of Science, The University of Melbourne
3rd February, 2017 – 31st August, 2018

Head of School
School of Mathematics and Statistics, The University of Melbourne
1st January 2015 – 2nd February, 2017

Head of Department
Department of Mathematics and Statistics, The University of Melbourne
1st January 2011 – 31st December 2014

Deputy Dean
Faculty of Science, The University of Melbourne
1 July 2013 until 5th February, 2014

Associate Dean (Graduate Programs)
Faculty of Science, The University of Melbourne
***Director*, Melbourne Graduate School of Science**, The University of Melbourne
October 2009 – 2nd February, 2017

Acting Head of Department
Department of Mathematics and Statistics, The University of Melbourne
1 July, 2008 until 31 December 2008

***Professor [Continuing]*: Level E**
Department of Mathematics and Statistics, The University of Melbourne
From 1st January, 2010

Deputy Head of Department
Department of Mathematics and Statistics, The University of Melbourne
From 1st January 2006 – 31st December 2010

Associate Professor and Reader
From 1 January 2004 until 31st December, 2009

***Senior Lecturer**:* From December, 2000 until 31 December 2003
(held concurrently with Fellowship – see below)

Continuing position (aka `tenure'): Department of Mathematics and Statistics
Appointment: December, 2000; **Confirmed** on 8 August 2003.

ARC *Senior Research Fellow*, (Level D)
Department of Mathematics and Statistics, The University of Melbourne
From 1 January 2002 until June 29, 2004
Held concurrently with Continuing Position

ARC *Senior Research Fellow*, (Level C)
Department of Mathematics and Statistics, The University of Melbourne
From July 1999 until 31 December 2001
Held concurrently with Continuing Position from December, 2000.

ARC *Australian Research Fellow*, (Level B)
Department of Mathematics, The University of Melbourne
From February 1995 until June 1999

ARC *Australian Postdoctoral Fellow*, (Level A)
Department of Mathematics, The University of Melbourne
From February 1992 until January 1994.

Postdoctoral Fellow
Department of Theoretical Physics, University of Oxford,
From April 1989 until November 1991

Academic Qualifications

Ph.d (Theoretical Physics), *Australian National University*, **(1989**).
Department of Theoretical Physics, Institute of Advanced Studies **(1986-1988).**
Supervisor: Professor R.J. Baxter F.R.S., F.A.A..
Thesis title: *Properties of the Six Vertex and Related Models in Statistical Mechanics.*

B.Sc. Honours (Physics) 1st Class, *University of Queensland*, (**1985**)
University Medal, University of Queensland
Duncan McNaughton Scholarship Holder, University of Queensland (1985)

B.Sc., *University of Queensland*, (**1984**);

Senior Certificate, (*Dux of College***),** *St. Laurence's College*, Brisbane, (**1981**).

Publications

Journal Articles (Fully Referred)

[1] A. L. OWCZAREK and R. J. BAXTER, Generalised Percolation Probabilities for the Self-Dual Potts Model, *J. Phys. A*, **20**: pages 5263-5271 (1987).

[2] A. L. OWCZAREK and R. J. BAXTER, A Class of Interaction-Round-a-Face Models and Its Equivalence with an Ice-Type Model, *J. Stat. Phys.*, **49**: pages 1093-1115 (1987).

[3] A. L. OWCZAREK and R. J. BAXTER, Surface Free Energy of the Critical Six Vertex Model with Free Boundaries, *J. Phys. A*, **22**: pages 1141-1165 (1989).

[4] D. B. ABRAHAM and A. L. OWCZAREK, Correlation Function for the Baxter Model, *Phys. Rev. Lett.*, **64**: pages 2595-2598 (1990).

[5] P. M. BINDER, A. L. OWCZAREK, A. R. VEAL, and J. M. YEOMANS, Collapse Transition in a Simple Polymer Model: Exact Results, *J. Phys. A*, **23**: pages L975-L979 (1990).

[6] J. O. INDEKEU, A. L. OWCZAREK, and M. R. SWIFT, Quasiwetting and Critical Point Leaps, *Phys. Rev. Letts.*, **66**: pages 2174 (1991

[7] M. R. SWIFT, A. L. OWCZAREK, and J. O. INDEKEU, Effect of Confinement on Wetting and Drying between Opposing Boundaries, *Euro. Phys. Letts.*, **14**: pages 475-481 (1991).

[8] A. L. OWCZAREK, P. M. BINDER, and D. Y. K. KO, Cutoff Scalings for One Dimensional Order, *J. Phys. A*, **25**: pages L21-L24 (1992).

[9] P. M. BINDER, D. Y. K. KO, A. L. OWCZAREK, and C. J. TWINING, Ordered Cellular Automata In One-Dimension, *J. Physique. I*, **23**: pages 21-28 (1993).

[10] A. L. OWCZAREK and T. PRELLBERG, Exact Solution of the Discrete (1+1)-Dimensional SOS Model with Field and Surface Interactions, *J. Stat. Phys.*, **70**: pages 1175-1194 (1993).

[11] A. L. OWCZAREK, T. PRELLBERG, and R. BRAK, A New Scaling Form for the Collapsed Polymer Phase, *Phys. Rev. Lett.*, **70**: pages 951-953 (1993).

[12] A. L. OWCZAREK, T. PRELLBERG, and R. BRAK, Reply to Exact Scaling Form for the 2D Polymer Phase, *Phys. Rev. Lett.*, **71**: pages 4275 (1993).

[13] A. L. OWCZAREK, Scaling in the Collapsed Polymer Phase: Exact Results, *J. Phys. A.*, **26**: pages L647-L653 (1993).

[14] T. PRELLBERG, A. L. OWCZAREK, R. BRAK, and A. J. GUTTMANN, Finite Length Scaling of Collapsing Directed Walks, *Phys. Rev. E.*, **48**: pages 2386-2396 (1993).

[15] A. L. OWCZAREK, T. PRELLBERG, and R. BRAK, The Tricritical Behaviour of Self-Interacting Partially Directed Walks, *J. Stat. Phys.*, **72**: pages 737-772 (1993).

[16] R. BRAK, A. L. OWCZAREK, and T. PRELLBERG, A Scaling Theory of Collapse

Transitions, *J. Phys. A.*, **26**: pages 4565-4579 (1993).

[17] A. J. GUTTMANN, T. PRELLBERG, and A. L. OWCZAREK, On the Symmetry Classes of Planar Self-Avoiding Walks, *J. Phys. A.*, **26**: pages 6615-6623 (1993).

[18] D. BENNETT-WOOD, R. BRAK, A. J. GUTTMANN, A. L. OWCZAREK, and T. PRELLBERG, Low Temperature Partition Function Scaling: Series Analysis Results, *J. Phys. A.*, **27**: pages L1-L8 (1994).

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[21] A. L. OWCZAREK and T. PRELLBERG, Interacting Partially Directed Walks: A Model of Polymer Collapse., *Physica A*, **205**: pages 203-213 (1994).

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of Directed Percolation Clusters, *J. Phys. A.*, **30**: pages 6679-6691 (1997).

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[Selected for the *Virtual Journal of Biological Physics* Vol. **12**, 2006]

[67] A. L. OWCZAREK and T. PRELLBERG, Collapse transition of self-avoiding trails on the square lattice, *Physica A*, **373**: pages 433-438 (2006).

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functions for directed polymers confined between attracting walls, *J. Phys. A.: Math. Theor.*, **41**: 035002: (16 pages) (2008).

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This article was highlighted by the journal as one of the most highly rated by the referees.

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[Selected for the *Virtual Journal of Biological Physics*, 2009]

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[110] J. KRAWCZYK, A. L. OWCZAREK AND T. PRELLBERG, A semi-flexible attracting-segment model of three-dimensional polymer collapse, *Physica A*, **431**, 74 - 83 (2015)

[111] R. TABBARA, A. L. OWCZAREK and A. RECHNITZER, An exact solution of three interacting friendly walks in the bulk, *J. Phys. A: Math. Theor.*, **49**, 154004 (16pp), (2016).

[112] A. BEDINI, A. L. OWCZAREK and T. PRELLBERG, The role of three-body interactions in polymer collapse*, J. Phys. A.: Math. Theor.*, **49**, 214001 (16pp), (2016).

[113] A. BEDINI, A. L. OWCZAREK and T. PRELLBERG, Self-attracting polymers in two dimensions with three low-temperature phases*, J. Phys. A.: Math. Theor.*, **50**, 095003 (16pp), (2017).

[114] E. DAGROSA, A. L. OWCZAREK and T. PRELLBERG, Writhe induced phase transition in unknotted self-avoiding polygons, *J. Stat. Mech.: Th. and Exp.,* **50**: 093206 (20pp) (2017).

[115] E. DAGROSA, A. L. OWCZAREK and T. PRELLBERG, Phase Diagram of Twist Storing Lattice Polymers in Variable Solvent Quality, *J. Stat. Mech.: Th. and Exp.,* **50**: 103204 (18pp) (2017).

[116] A. L. OWCZAREK and A. RECHNITZER, Force signature of the unzipping transition for strip confined two-dimensional polymers, *J. Phys. A: Math. Theor*., **50**: 484001 (24pp), (2017). [Artwork from this article appears on the front cover of the journal and the article also appeared in the *Journal of Physics A Highlights of 2017 collection*]

[117] A. NARROS, A. L. OWCZAREK and T. PRELLBERG, Anomalous polymer collapse winding angle distributions, *J. Phys. A: Math. Theor.,* **51:** 114001 (9pp), (2018).

[118] C. BRADLY, A. L. OWCZAREK and T. PRELLBERG Universality of crossover scaling for the adsorption transition of lattice polymers, *Phys. Rev. E*, **97**: 022503 (10pp), (2018).

Conference Articles (Refereed)

[119] T. PRELLBERG and A. L. OWCZAREK, Partially Convex Lattice Vesicles: Methods and Recent Results, in *Proceedings of the Conference `Confronting the Infinite'*, pages 204-214, World Scientific, (1995).

[120] R. BRAK, J. ESSAM, and A. L. OWCZAREK, Equivalence of the Bethe Ansatz and the Gessel-Viennot Theorem for Non-intersecting Paths, in *Proceedings of the 11th Formal Power Series and Algebraic Combinatorics Conference*, pages 108-118, (1999).

[121] T. PRELLBERG and A. L. OWCZAREK, Polymer Collapse in High Dimensions: Monte Carlo Simulation of Lattice Models, pages 147-151, in *Computer Simulation Studies in Condensed Matter Physics XVI*, Springer Verlag, (2004).

[122] A. L. OWCZAREK, A note on the corrections-to-scaling for the number of nearest neighbour contacts in self-avoiding walks, in *Counting Complexity: An International Workshop On Statistical Mechanics And Combinatorics*, volume 42 of *Journal of Physics: Conference Series*, pages 221-224, (2006).

[123] A. L. OWCZAREK and A. RECHNITZER, On the number of anisospiral walks: a challenge in numerical analysis, in *Counting Complexity: An International Workshop On Statistical Mechanics And Combinatorics*, volume 42 of *Journal of Physics: Conference Series*, pages 225-230, (2006).

[124] R. BRAK, J. ESSAM, J. OSBORN, A. L. OWCZAREK, and A. RECHNITZER, Lattice Paths and the Constant Term, in *Counting Complexity: An International Workshop On Statistical Mechanics And Combinatorics*, volume 42 of *Journal of Physics: Conference Series*, pages 47-58, (2006).

[125] A. NARROS, A. L. OWCZAREK and T. PRELLBERG, Winding angle distributions for two- dimensional collapsing polymers, Journal of Physics: Conference Series, 686: 012007 (9 pages) (2016)

Conference Articles (Un-referred)

[126] A. J. GUTTMANN, A. L. OWCZAREK, D. BENNETT-WOOD, and T. PRELLBERG, Recent
Developments in the Study of Walks, Polygons and the Ising Model, *Nuc. Phys. B. (Proc. Suppl.)*, **42**: pages 911-913 (1995).).

Conference Proceedings (Editorship)

[127] R. BRAK, O. FODA, C. GREENHILL, A. J. GUTTMANN, and A. L. OWCZAREK, editors, *Proceedings of the 2002 Formal Power Series and Algebraic Combinatorics Conference*, ISBN 0 7340 22158, (2002)

Chapters in Books

[128] A. L. OWCZAREK and S. WHITTINGTON, *Interacting Lattice Polygons*, chapter 12, Polygons, Polyonimoes and Polyhedra, (ed. A. J. Guttmann) Lecture Notes in Physics, Vol. **775**, Springer, 2009

Ten Career Best Outputs

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[i] A. L. OWCZAREK and R. J. BAXTER, A Class of Interaction-Round-a-Face Models and Its Equivalence with an Ice-Type Model, *J. Stat. Phys.*, **49**: pages 1093-1115 (1987).

A new class of exactly solvable models based on the then nascent idea of finding new representations of the algebraic structure underlying the solution of a particular model was pioneering.

[ii] A. L. OWCZAREK, T. PRELLBERG, and R. BRAK, A New Scaling Form for the Collapsed Polymer Phase, *Phys. Rev. Lett.*, **70**: pages 951-953 (1993).

This paper explained the different scaling nature of low-temperature polymers in solution, which had been overlooked despite many years of theoretical investigation.

* [iii] A. L. OWCZAREK, T. PRELLBERG, and R. BRAK, The Tricritical Behaviour of Self-Interacting Partially Directed Walks, *J. Stat. Phys.*, **72**: pages 737-772 (1993).

This paper gave an exactly solved example of the tricritical nature of polymer collapse, a tenet of established theory.

[iv] T. PRELLBERG and A. L. OWCZAREK, On the Asymptotics of the Finite-Perimeter Partition Function of Two-Dimensional Lattice Vesicles, *Commun. Math. Phys.*, **201**: 4 pages 93-505 (1999).

This paper introduced new rigorous results for self-avoiding polygons which are some of the few that are available.

* [v] A. L. OWCZAREK, J. ESSAM, and R. BRAK, Scaling analysis for the adsorption transition in a watermelon network of N directed non-intersecting walks, *J. Stat. Phys.*, **102**: pages 997-1017 (2001).

An infinite hierarchy of scaling functions was calculated exactly here: scaling functions are rare in statistical mechanics and so this work gives a significant precedent.

* [vi] R. BRAK, A. L. OWCZAREK, A. RECHNITZER, and S. WHITTINGTON, A directed walk model of a long chain polymer in a slit with attractive walls, *J. Phys. A*, **38**: pages 4309-4325, (2005).

The exact solution of this model of the steric stabilisation of colloidal dispersions demonstrated the remarkable physical difference in the subtle mathematical difference of the order of two infinite limits.

* [vii] A. L. OWCZAREK and T. PRELLBERG, and A. RECHNITZER, Finite-size scaling functions for directed polymers confined between attracting walls, *J. Phys. A.: Math. Theor.*, **41**: 035002: (16 pages) (2008).

This article is significant because it calculates exact scaling functions for the crossover between a polymer confined between two walls and one wall.

* [viii] H. LONSDALE, R. BRAK, J. W. ESSAM, A. L. OWCZAREK, and A. RECHNITZER, On directed compact percolation near a damp wall, *J. Phys. A.: Math. Theor.*, **42**: 125001(26pp) (2009).

This exact calculation pushes the boundaries of current techniques. This article was highlighted by the journal as one of the most highly rated by the referees.

* [ix] A. L. OWCZAREK, A. RECHNITZER, and T. WONG, Exact solution of two friendly walks above a sticky wall with single and double interactions, *J. Phys. A.: Math. Theor.,* 45 (2012).

This article utilised a generalisation of the so-called kernel method to solve exactly a two walk interacting model with two types of interaction. While cases with a single interaction had previously been solved this demonstrated how cases of two interactions may also be integrable. Importantly, we proved that the full solution is not a D-finite function.

* [x] R. TABBARA, A. L. OWCZAREK and A. RECHNITZER, An exact solution of three interacting friendly walks in the bulk, *J. Phys. A: Math. Theor.*, **49**, 154004 (16pp), (2016).

This article again utilised a further generalisation of the kernel method to solve exactly a three walk interacting model with two types of interaction.

Research Recognition

The 120 of my 125 refereed journal (118) and conference (7) articles found by a search in the *ISI Web of Science* citation index show an average of over 40 citations per year since I started being cited with a total of 1270 citations. In the past ten years an average of over 65 citations per year have been recorded by this database. (I have additionally 3 other publication and 2 referred articles have now appeared.) In the past 5 years Google Scholar records over 80 citations per year indicating how my output has been seen to be more impactful over time.

The journals in which I publish are the top and established journals in my field and have relatively high impact factors for the field (Impact Factors below 1.0 are not unusual): these are

- *Journal of Physics A: Mathematical and Theoretical (Impact Factor 1.857),*
- *Journal of Statistical Physics (Impact Factor 1.349),*
- *Physical Review E (Impact Factor 2.366),* and the
- *Journal of Statistical Mechanics: Theory and Experiment. (Impact Factor 2.196*).

These journals all known as leading international *statistical mechanics* journals.

While I have also published in *Europhysics Letters (Impact Factor 1.957)* and *Physical Review Letters (Impact Factor 8.462)* are top Physics letter format journals with very high impact factors.

Several of my papers have been chosen to be featured on the front covers of the journals including my recent paper [116]. This paper has also been selected to be part of the *Journal of Physics A Highlights of 2017 collection*. My recent paper [viii] was highlighted by the journal as most highly rated by the referees. I have also had three papers (including [81]) chosen to be included in the *Virtual Journal of Biological Research* after appearing in print in *Physical Review*.

I became a *Fellow* of the Australian Mathematical Society in 2015.

Research Overview

My most significant contributions have been in the area of lattice models in statistical mechanics. I am an authority on the scaling associated with the `critical phenomena and phase transitions' of dilute polymeric systems as modelled by lattice walks. This is a coherent body of work published in leading journals in mathematical physics with a cross-disciplinary vision to chemistry and biology.

I use my results from both computational and analytical approaches to problems to advance scientific insight, especially when it comes to the solvability of lattice walk and polygon models. Among these contributions, which now total ninety from 1987 onwards, has been my early publication [i] on defining a new class of exactly solvable models based on the then nascent idea of trying to find new representations of the algebraic structure (Temperley-Lieb algebra) underlying the solution of a particular model.

In the early 90's I wrote a series of papers with collaborators T. Prellberg and R. Brak on the exact solution of two-dimensional walk and polygon models including [ii,iii] which not only gave an explicit example of the tricritical nature of polymer collapse, a tenet of established theory, but led to a better understanding of scaling in the collapsed phase itself. I have extended this work in a paper that shows via an exact solution how the collapse transition can change nature in the presence of polymer stiffness [9].

Other work using basic kinetic growth on the Manhattan lattice demonstrated the relationship of conformal field theory results to lattice walks via various mappings to exactly solved models. One dramatic result, using the kinetic growth-based PERM algorithm, has led to a revival of a discarded theory of polymer collapse. Other exciting recent results show potentially observable mesoscopic layering behaviour at low temperatures for polymers attached to an attractive wall while others show unexpected polymer phase transitions when using random walk models.

Recent work on polymers with hydrogen bonding [7,8,14] is relevant to biological molecules and show novel phenomena. Also, of interest in biology is the occurrence of knotting and I have worked on the time it takes for knotted polymers to unknot (DNA needs to unknot prior to replication for example) [4]. Another physical problem of wide interest that I have been contributing towards [15,16] is the understanding of the stretching or pulling single polymer molecules: this has been of interest since experimental techniques in the past decade have been able to undertake such delicate studies.

Over the past few years another body of research has taken shape: my contribution to the study of networks of directed walkers. This has led to a deeper understanding of the relationship of the Bethe-Ansatz from statistical mechanics (a method of exact solution) and the Gessel-Viennot Involution from combinatorics and, importantly, by demonstrating the power of the relationship of directed walks to Young Tableaux, where the unexpected use of directed walk theory in the study of random matrices has now been recognised. In [vii] an infinite hierarchy of scaling functions was calculated exactly: scaling functions are rare in statistical mechanics and so this work will prove significant. The exact solution of a walk model of the steric stabilisation of colloidal dispersions has demonstrated the remarkable physical difference in the subtle mathematical difference of the order of two infinite limits [vi]. These works concern solvability of lattice statistical mechanical models.

These studies on directed walks have now moved to using generalisations of the kernel method to find new exact solutions [ix,x] and [107,116]. Here my collaborators and I have been

considering *interacting* versions of lattice path problems which involves counting multiple features of the paths/walks simultaneously. This has opened up a new horizon for problems to be tackled with the kernel method and is an exciting moment for the development of this technique.

Research Grants and Funding

ARC *Australian Postdoctoral Fellowship*, *1992-1994*,
(Sole applicant), F69140349
Lattice Models of Polymers and Membranes,
3 year Fellowship with total funding of approximately $180,000

ARC *Large Grant*, *1995-1996*:
(Chief Investigator with two other Chief Investigators), *Supercomputer studies of lattice models in statistical mechanics*,
2 year grant with $130,000 total funding.

ARC *Australian Research Fellowship*, *1995-1999*:
(Sole applicant), F69540292
Critical phenomena of Polymeric and Related Systems,
5 year fellowship with total funding approximately $285,000

ARC *Small Grant*, *1996:*
(Chief Investigator with two other Chief Investigators),
Directed percolation, $19,828.

ARC *Small Grant*, *1997:*
(Sole Chief Investigator),
Symmetry and universality in self-avoiding walks, $7,000.

ARC *Small Grant*, *1998*:
(Chief Investigator with one other Chief Investigator),
Monte Carlo Studies of random walk models of self-interacting polymers, $17,262.

University of Melbourne Collaborative Research Program: Visiting Scholars Award
1998/1999: $4,000.

ARC *Small Grant*, *1999*:
(Chief Investigator with one other Chief Investigator),
Paths and Exactly Solved Models $10,000.

ARC *Small Grant*, *1999*:
(Sole Chief Investigator),
Interacting self-avoiding walks and trails in four dimensions, $10,000.

ARC *Senior Research Fellowship*, *1999-2004*:
(Sole applicant), F69930007
Lattice Walks in Statistical Mechanics,
5 year Fellowship with total funding of $455,649

ARC *Small Grant*, *2000*:
(Sole Chief Investigator),
Lattice Walks in Statistical Mechanics, $13,000.

Melbourne University internal grant (*MRDGS*), *2001:*
(Sole Chief Investigator),
Computer simulations of lattice polymers: breaking paradigms, $17,000.

ARC *Large Grant*, *2001-2003:*
(Chief Investigator with one other Chief Investigator),
Universal distributions for fluctuations in Statistical Mechanical models of Growth and Disorder
3 year grant with total funding of $179,000.

ARC *Discovery grant*, *2002-2006* (indicative):
(Chief Investigator with 3 other Chief Investigators),
Advanced computational and analytic studies in lattice statistical mechanics and applications,
5 year grant with total funding of $620,000
(relinquished when *Centre of Excellence* listed below came into effect the following year)

ARC *Centre of Excellence,* *2003-2007:*
(Chief Investigator along with 12 other Chief Investigators):
Mathematical and Statistical Modelling of Complex Systems,
5 year grant with total initial funding of $10,906,575.

ARC *Network,* *2004-2009*:
Named Participant (one of 50) and Node Coordinator (one of 13),
Complex Open Systems Network,
5 year grant with total funding of about $1,500,000

Melbourne Research Grant Scheme *2005*:
(Sole Chief Investigator),
Development and application of novel stochastic enumeration techniques,
1 year grant with funding of $30,940

ARC *Discovery Grant*, *2007-2011*:
(Sole Chief Investigator with 2 successful Fellows attached: one QEII and one ARF)
Searching for solvability in statistical mechanics and beyond using advanced Enumerative Combinatorics,
5 year grant with total indicative funding of $891,000

ARC *Centre of Excellence*, *2008–2010*: Renewal
One of four '*Theme Leaders*' in renewal application. (Note: other three theme Leaders are full Professors)
Also Chief Investigator along with 13 other Chief Investigators (all but one other CI is a full Professor)
ARC Centre of Excellence for Mathematics and Statistics of Complex Systems,
3 years extra funding with indicative amount $5,400,000

ARC *Discovery Grant*, *2012-2014*:
(Principal Chief Investigator)
Advanced numerical and analytical techniques for exact studies in combinatorics and statistical mechanics,
3 year grant with total indicative funding of $300,000

ARC *Discovery Grant, 2016-2019*:
(Sole Chief Investigator)
Interplay of Topology and Geometry in Polymeric Critical Phenomena
3 year grant with total indicative funding of $334,000

Research Student Supervision

PhD/Masters student supervision

- D. Bennett-Wood (1993 - 1997),
  Co-Supervisor (Joint with A. Guttmann), PhD Student,
  Numerical Studies of self-avoiding walks [Awarded PhD].

- P. Nidras (1994 - 1997),
  Co-Supervisor: (Joint with R. Brak), PhD Student,
  Critical Behaviour of Geometric Cluster Models [Awarded PhD].

- A. Rechnitzer (1997 - 2000),
  Principal Supervisor (Joint with A. Guttmann and M. Bousquet-Melou), PhD Student,
  Some Problems in the Counting of Lattice Animals, Polyominoes, Polygons and Walks
  [Awarded PhD].

- A. Oppenheim (1999 - 2001),
  Principal Supervisor (Joint with R. Brak), Research Masters Student,
  Some Enumerative Results for Directed walks on Site-equivalent planar Lattices
  [Awarded Masters].

- Henry Wong (2000 - 2003),
  Co-Supervisor (Joint with A. Guttmann), PhD Student
  Topics on Lattice Models in Statistical Mechanics [Awarded PhD].

- Will James (2001-2007),
  Co-Supervisor: (Joint with A. Guttmann and R. Brak) PhD Student
  The Enumeration of Heaps and Almost-convex Polygons [Awarded PhD].

- Judy-Anne Osborn (2003-2007),
  Co-Supervisor: (Joint with R. Brak): PhD Student
  Combinatorics of Pavings and Paths [Awarded PhD]

- Peter Fox (2003-2005),
  Supervisor: (Sole) Masters Student.

- Paul Fijn (2005-2011)
  Co-Supervisor: (Joint with R. Brak) PhD student.
  Playing with paths: Enumerating Sets of Embellished Lattice Paths [Awarded PhD]

- Heather Lonsdale (2006-2012),
  Principal Supervisor: (Sole) PhD student .

Directed Compact Percolation near a damp wall [Awarded PhD]

- Rami Tabarra (2011- 2015)
  Principal Supervisor (Sole) PhD student [Awarded PhD]
  This Thesis was nominated for the Chancellor's Prize

- Eduardo Dagrosa (2011- 2016)
  Principal Supervisor (Sole) PhD student [Awarded PhD]

- Ruijie Xu (2017-)
  Principal Supervisor PhD student

Key Conferences and selected seminars since 2000

Speaker annually at the *Australian Statistical Mechanics and subsequently at the Australian New Zealand Mathematical Physics meetings* over the past two decades

Invited Speaker at the **Fields Institute for Research in Mathematical Sciences** as part of the `*Mathematical Physics of Polymers and Percolation'* workshop, Toronto, 1998. (while prior to 2000 this is noteworthy)

Invited Speaker at the International Workshop `*The Baxter Revolution in Mathematical Physics*', 2000 (Noteworthy: of 32 invited speakers only 4 were not full Professors).

Invited Speaker at the *Australian Mathematical Society Annual Conference* 2000, UQ, July, 2000.

Invited Speaker at the *Australian Mathematical Society Annual Conference* 2001, ANU, September, 2001.

Invited Speaker at the *Canadian Mathematical Society Summer Meeting* 2001, Saskatoon, June, 2001.

Invited Speaker at Joint Theoretical Physics/Mathematics seminar, *Technical University of Clausthal*, Germany, 2002

Invited Speaker at the *International Workshop Statistical Mechanics of Polymer Models*, **Banff International Research Station for Mathematical Innovation and Discovery**, Banff, May 2003.

Invited Speaker at `*Monte Carlo in Complex Systems'* workshop, AMSI, 2003

Speaker at the `*Mathematical Physics and Lie theory*' conference, QLD, 2004

Invited Speaker at the *International workshop `Counting Complexity'* QLD, 2005.

Invited to speak at Department of Mathematics, Queen Mary College London, March 2006

Invited to be the Keynote of one of the *Tracks* of *Complex'07*, QLD, July 2007.

Invited Speaker at the *International Workshop on 'Random Polymers'* at **EURANDOM**, Netherlands, June 2007

Invited speaker at Workshop on "*Combinatorics and Statistical Mechanics*" ESI Programme on "Combinatorics and Statistical Physics" May 18 - 31, 2008, Erwin Schroedinger International Institute for Mathematical Physics, University of Vienna, Austria

Invited speaker at the *American Mathematical Society (AMS) Sessional Meeting*, University of British Columbia, Canada, October, 2008**.**

Invited Speaker at the *International Workshop on 'Random Polymers'* at **EURANDOM**, Netherlands, January 2013

Invited Speaker at ***CanaDAM***, Newfoundland, Canada, June, 2013

Invited Speaker at SIAM, Minneapolis, June, 2014

Speaker at the *Australia-New Zealand 8th National Convention*, December 2015

Invited Speaker at ***CanaDAM***, Saskatoon, Canada, June, 2015

Invited Speaker at Conference on *Means, Methods and Results in the Statistical Mechanics of Polymeric Systems II,* Field Institute, *June, 2017*

Invited Speaker at workshop *Lattice walks at the Interface of Algebra, Analysis and Combinatorics*, **Banff International Research Station**, Canada, September 2017.

Teaching and Learning

The types of changes I have initiated in the curriculum have reflected my philosophy of teaching and learning. This focuses on providing material at the *right level* for a student, drawing on the prior knowledge of the student, while challenging the student with material that will excite their imagination and stretch their abilities. Additionally, I believe in providing novel educational structures that cut across traditional tutorial-lecture-practice class boundaries that suit the way many students learn. This can be seen in the initiatives I have made in the subject Graph Theory and in my fostering of a novel practice class style in the Department while Head. This relates to the University's principles of teaching, in that an atmosphere of intellectual excitement is certainly paramount in my thoughts when I am planning curricula and when I am teaching. I strive to have a *dynamic* adaptive curriculum and one that connects to an intensive research culture.

The other principles of teaching in the University are also evident in my teaching plans. I foster technological learning solutions that uses our finite staffing resources to maximum effect both my providing individually tailored interactions and multiple resources for students. I am also committed to providing meaningful *feedback* to students on their work to assist them in their journey of learning. These can be seen in the initiatives I am involved with in Calculus 1 this year.

The curriculum modifications mentioned above are precisely the type of renovation of the 3rd year subject `Graph Theory' I undertook over the years 2004 onwards. I introduced a programme of learning rigorous mathematical proof into the subject, something that is challenging to the best students, in such a way that it connected to the alternate algorithmic approach to the course. It relates to the way research occurs in pure mathematics and so connects the students to research. I also provided a new hybrid tutorial-practice class structure that complemented this. As a consequence I increased student satisfaction, introduced traditionally *difficult* material which stretched the students and decreased to almost nothing the failure rate in the subject while enhancing the academic standard of the subject. This requires a careful understanding of the knowledge base of students and it is these types of considerations that informs the curriculum planning that I have been driving in our New Generation Undergraduate degrees and which I plan to pursue in future course structure planning at a Master's level.

I strongly believe that it is through an exciting curriculum which challenges students and gives them the means to meet those challenges that the University of Melbourne can enhance its reputation in teaching and learning as a world class university. I have been striving to lead curriculum changes that promote a *coherent* curriculum which gives students the opportunity to enjoy a coherent course plan. In this way students will be enthused with a passion for learning as they come to see the connectedness of their learning.

[1994-1995] Lectured 4th year course: *Statistical Mechanics (618-482).*

[1996] Prepared and Lectured 3rd Year Course: *Statistical Mechanics (618-340).*

[1997-1998] Prepared and Lectured 1st Year Course (multi-stream):
Intermediate Mathematics B (620-142)
(The subject contained single and multi-variable Calculus) . (class sizes: 250 to 290)

[1999] Coordinated, Lectured and Tutored 1st Year Course (single stream):
Intermediate Mathematics (620-180)
(single and multi-variable Calculus course). (class size 72)

[2001-2003] *Introduction to Biomedical Mathematics (620-151),* 1st Year subject (single stream):
Subject Coordinator and Lecturer,
(class sizes: 145 to 166)
The subject entailed a combination of linear algebra, optimisation, calculus and differential equations

The `Question 2' Quality of Teaching[1] survey results were
3.9 in 2001, 4.1 in 2002, and 4.1 in 2003

[2005] *Applied Mathematics (620-143)* 1st Year subject (Four streams):
Lecturer,
(The total size of the subject 780: my class size was 150)
This was a subject requiring a partially renewed curriculum and so new materials were produced in conjunction with co-lecturers.

The`Question 2' Quality of Teaching survey result of 3.8

[2005-2008] *Topics in Graph Theory and Enumeration (620-443)* Honours class
Co-Subject Coordinator and Lecturer
(class sizes: around 10)

[2004-2008] *Graph Theory (620-352)*, 3rd Year subject (single stream)
Subject Coordinator and Lecturer:
(class sizes: 60 to 90)
I have modified the curriculum of this course to emphase the relationship between algorithms in computer science and abstract proofs in pure mathematics.
I have also introduced a tutorial–like class which bridges the gap between traditional early year tutorials and the less interactive higher year practice classes. This has been received very well by the students.

The `Question 2' Quality of Teaching survey results were
4.1 in 2004, 4.2 in 2005, 4.4 in 2006, 4.4 in 2007 and 4.6 in 2008.

I point out that in the three years 2006, 2007 and 2008 **not a single student** in the classes of total enrollment near 270 disagreed *to any extent* with the proposition that the

[1] The Quality of Teaching at the University of Melbourne has a question (Question 2) that asks "Was this subject well-taught?" To which a student may reply with 5 numerical (categorical) responses (5 being the most favourable and 1 the least). The numbers given are mean values.

course was *well taught.*

The other indication of my success in teaching this subject is the pass rate. Despite making the subject matter more challenging for the students by emphasizing methods of proving rigorously theorems in Mathematics only 10 students who took the exam out of those 270 odd students enrolled between 2006 and 2008 failed to pass the subject. To put this into perspective the exams did not rate as particularly easy relative to other 300-level Mathematics subjects based upon numbers of students achieving 90 plus scores either (one or two per year).

[2009] *Enumerative Combinatorics (620-647)* Master's subject
Co-Subject Coordinator and Lecturer
(class sizes: around 10)

[2009] : *Calculus 1 (620-154)* 1st Year subject (Four streams):
Lecturer
(subject size 850, lecture group size 150)

Here there was the introduction by the lecturing team of innovative interactive web based materials via the book publisher's materials and video capture technologies for providing feedback on assignment solutions.

Service to the Discipline and Engagement

General

- Interview for newspaper article, in *Goslarsche Zeitung* 2002, Goslar, Germany.
- *Node Coordinator* for ARC network at Melbourne: CoSNet (2004-2009)
- Organiser (Contact for Australian Bureau of Statistics) of new RFCD codes for Mathematical Physics, on behalf of the Australian academic community, 2007
- AMSI (*Australian Mathematical Sciences Institute*) Board member, 2008-2012, 2017-
- *National Chair of ARC Journal Ranking exercise 2008 for Mathematical Physics*
- *Deputy Chair of Australian Council of Heads of Mathematics Departments*, 2015-2016
- As Head of School introduced *Female-only academic positions* into School (2017)
- Media (radio, television and print) regarding Female-only positions in School (2017)
- Member of the Board of *MATRIX* (2017-)

Reviewing and editorial activities

- Regular referee for the *Journal of Physics A: Mathematical and Theoretical* and *Physical Review E*.
- Editor for CD-ROM publication *Proceedings of the Formal Power Series and Algebraic Combinatorics Conference*, 2002, ISBN: 0 7340 2215 8
- Reviewer (`International') for ARC Discovery Programme (2003 onwards)
- Reviewer for National Science Foundation (USA) (2004)
- *Invited* by Institute of Physics during 2006 to be a special editor for focus area of combinatorics in statistical mechanics
- *Advisory Editor* for *Journal of Physics* A (2013-

Conference organisation

- Member of *Organising Committee* for the international conference *Formal Power Series and Algebraic Combinatorics* 2002 (duties during 2001 and 2002)
- *Chair* of the Organising Committee for `Monte Carlo in Complex Systems' conference held at *Australian Mathematical Sciences Institute* 10th-14th November 2003
- *Organiser* of a Special session on `Complex Systems' for the Australian Mathematical Society Meeting, 2004.
- *Chair* of the Organising Committee for `Counting Complexity' International Workshop, held in July, 2005
- *Organiser* of a Special session for the Australian Mathematical Society Meeting, 2007.
- *Organising Committee for International "StatPhys24" conference, 2010. This is a major International Conference held once every three years.*
- *Co-C*hair of the organizing committee for "StatPhys" Satellite meeting "Statistical Physics of Lattice Polymers" to be held at the University of Melbourne in 7th-9th July, 2010

Leadership and Service to the University

Department/School

- Committee Membership in Department/School
    - *Equipment/IT Committee (2001-2009)*
    - *Departmental Working Group on Postgraduate Enrolment s(2001-2009)*
    - *Department Research and Graduate studies Committee (2001-2009)*
    - *Access Grid Room Committee* (2004-2005)
    - *Management Committee* (2003 -2016)
    - *Growing Esteem Working Group* (2006-2009)
    - *Strategic Planning Committee* (2007 onwards)
    - Advisory Board of *Melbourne Operations Research* (MoRe) Consulting Centre (2008 onwards)
    - Advisory Board for *Statistical Consulting Centre* (2007-2016)
    - *Department Masters/Honours Committee* (2008 -2016)

- *Supervisor* of Department IT Manager (Professional staff-member) (2002-2009)
- Departmental *confirmation and promotion* panels from level A to D Staff (2004-2009)
- *Chair* of the *Department Equipment and IT Committee* (2002-2009)
- *Chair* of *Research and Graduate Studies Committee* (2006-2008)

  One outcome over this time of which I am proud is the introduction of a *Grant Mentoring Scheme* within the Department which has led to an increase in ARC grant applications and success.
- *Coordinator* for Department's *Major* in the New BSc (2006-2007):
- Department *Coordinator* for Melbourne Model transition (2008-2009)
- Member of *Faculty of Science IT Working Group* (2006-2007).
- Member of *Faculty Board* (2006-2009)
- *Annual Appraisal* (PDF) of Department's Academic staff on behalf of the Head (2006-2009) including *mentoring* junior academic staff. This has varied between 5 and 18 in number.
- Participated in the Annual *Heads and Deans Conference* in place of Head of Department, for the three years 2006, 2008 and 2009 and as Head of Department/School 2010-2016. Now as Deputy Dean to *Melbourne Leadership Conference* 2017, 2018
- ***Deputy Head of Department*** (2006, 2007, 2008, 2009)
- Participant in the University's *HeadSTART* programme 2007
- *Faculty of Science 'Mini' IT Reference Group to advise the Dean and Heads on the rationalization of IT in the Faculty (2008-2009)*
- *Faculty representative on the University's Promotion to Level D panel (2009)*
- ***Acting Head of Department*** *(1 July, 2008 until 31 December 2008) as an Associate*

Professor in a Department with 12 staff at the rank of Professor.

- Regular attendee at *Academic Board* (2010 – ongoing)
- Member of inaugural new generation *Bachelor of Science Course Standing Committee* (2006-2007)
- Member of *Bachelors of BioMedicine and Science Course Standing Committee* (2008-2014)
- CEBRA Board (2013-2016)
- Member of University's *ICT Taskforce* (2010)
- Member of *Research Commission* and Chair of "*Assessing Research Performance*" Green paper (2011)
- Member of the University's *BSc Pathways Working Group* (2011)

As Associate Dean (Graduate Programs) (2009-2016)

- Chair of the Graduate Programs Committee (2009-2016)
- Member of University's RTAC (Research Training Advisory Committee) (2009-2016)
- Member of the Melbourne Model Committee (2009-2010)
- Member of the Associate Dean's Teaching and Learning Committee (2010-2014)
- Member of Associate Dean's Teaching and Learning Forum (2015-2016)
- Member of Graduate Directors Forum (2012-2014)
- Faculty of Science Level D Promotion Committee (2009)
- Involvement in SPR/APR VC Dialogue (2010-ongoing
- UAPC representative on Faculty of Business and Economics FAPC (Faculty Appointments and Promotions Committee) for level D, (2013-2014)
- Member/Chair of CUPC rounds (2009-2016)
- Special Consideration Committees (2009-2014)
- Chair Student Academic Misconduct Committees (2010-2016)
- Represent Faculty at Student Appeals (2010-2016)
- Attendance in lieu of Dean and Deputy Dean at Senior Executive/University Executive (2010-2016)
- Attendance at Senior Appointments and Promotions Committee (SAPC) (2010-2016) in lieu of Dean and Deputy Dean
- Member of P&R (Planning and Resources) Committee (2009-2016) (also as Head of Department/School (2010-2016))
- Chair of Faculty's Scholarships and Prizes for Students Committee (2010-2016)

- Member of School of Physics Review Panel (2014)
- BIP Reference group (2013)
- Awards for Excellence Committee – University (2014)

As Deputy Dean (2017-

- Chair of Faculty Appointments and Promotions Committee (FAPC)
- Attendance at University Appointments and Promotions Committee (UAPC) (2017-)
- Chair of the Faculty's SEFS Taskforce (2017)
- Member of Review Panel for School of Geography (2017)
- Chair of the Faculty's Education Executive (2017-)
- Chair of Faculty SSP panel (2017-)
- Chair of Chancellor's Prize for PhD thesis in Tri-Faculty group (2017 -)
- Member/Chair of CUPC rounds (2017-)
- Member of P&R (Planning and Resources) Committee (2017-)
- Member of Office of Environmental Programs (OEP) Industry Advisory Board (CIAB) (2017 -)
- Member of the University's Westpac Fellowship Committee (2016-2017)
- Member of the Graduate Admissions Working Group (2017)
- Member of the MSE2025 Board (2017-)
- Member of AMSI Board (2017-)
- Contributed Consultation: Innovation and Science Australia's 2030 Strategic Plan
- Member of Engagement@Melbourne Academic Leadership Committee (2017-)
- Member of the Buyers Committee (Business Service) (2017-)
- Attendance in lieu of Dean at University Executive (2017-)
- Attendance in lieu of Dean at Western Edge Biosciences Committee (2017 -)
- Attendance in lieu of Dean at Carlton Connect Initiative Committee (2017 -)
- Co-wrote "Mathematics in the Curriculum" paper for University Executive, November, 2017
- Member of the Employment Fundamentals Governance Committee (2017-)
- Chair of the Faculty's Indigenous Engagement Advisory Committee (2018 -)
- Report for Assistant Dean (Diversity and Inclusion) (2017-)
- Supervisor for Faculty's *Environmental Sciences Hub Director* (2017-)