

# CURRICULUM VITAE

**NAME** Rodney Graham DOWNEY

**Current Position** Professor of Mathematics

**ADDRESS** School of Mathematics, Statistics & Operations Research  
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**DATE OF BIRTH** 20 September, 1957

**MARITAL STATUS** Married, two children

**NATIONALITY** New Zealand and Australian

## **BACKGROUND:**

### **Academic:**

**1975-1978** Undergraduate at University of Queensland, St. Lucia, Queensland, Australia  
B.Sc. with first class honours in Mathematics

**1979-1982** Postgraduate at Monash University, Clayton, Victoria, Australia, Ph.D. in  
mathematics (November 1982)

### **Professional:**

**1982** Lecturer in mathematics at Chisholm Institute of Technology (now Monash University), Caulfield campus, Caulfield East Victoria Australia

**1983** (Spring) Visiting Assistant Professor at Western Illinois University, Macomb, Illinois, U.S.A.

**1983-1985** Lecturer at National University of Singapore Kent Ridge, Republic of Singapore

**1985-1986** Visiting Assistant Professor at University of Illinois at Urbana-Champaign, Urbana, Illinois, U.S.A.

**1986-1987** Lecturer in Mathematics, Victoria University of Wellington, Wellington, New Zealand

**1988-1990** Senior Lecturer in Mathematics, Victoria University of Wellington, Wellington, New Zealand

**1989** Member, Mathematical Sciences Research Institute, Berkeley, California, USA

**1991-95** Reader in Mathematics, Victoria University of Wellington, Wellington, New Zealand

**1992** Visiting Scholar, Mathematics Department, Cornell University, Ithaca, New York, USA

**1992** Member, Mathematical Sciences Institute, Cornell University, Ithaca, New York, USA

**1993** Lee Kong Chiang Visiting Fellow, National University of Singapore.

**1995** Visiting Professor, Mathematics Department, Cornell University.

**1997** Visiting Scholar, University of Siena.

**1999** Visiting Scholar, University of Wisconsin, Madison.

**1999** Visiting Professor, National University of Singapore.

**2000** Visiting Professor, University of Notre Dame, Indiana.

**2001** Visiting Scholar, University of Chicago.

**2003** Visiting Scholar, University of Chicago.

**2005** Visiting Professor, University of Chicago.

**2008** Visiting Professor, University of Chicago.

**2010** Visiting Scholar, University of Chicago.

**2014** Visiting Scholar, University of Chicago.

**2008** Visiting Scholar, University of Madison, Wisconsin.

**2005, 2011, 2017** Member, Institute for Mathematical Sciences, Singapore.

**2011** Visiting Professor, Nanyang University of Technology, Singapore.

**2003** Inaugural MacLaurin Fellow, New Zealand Institute for Mathematics and its Applications (Center of Research Excellence).

**2008-2010** James Cook Fellow, Royal Society of New Zealand.

**2009-2012** Chair MIS Panel and Member of Council, Marsden Fund.

**2012** Fellow, Isaac Newton Institute, Cambridge.

**2017** Fellow, Institute for Mathematical Sciences, National University of Singapore.

**2017,2018** Visiting Professor, University of Heidelberg.

**1995-** Personal Chair, Professor of Mathematics, Victoria University of Wellington, New Zealand.

## **Awards**

### **Prizes**

**1990** New Zealand Royal Society Hamilton Award for Science

**1991** Foundation Fellow of the Institute of Combinatorics and its Applications.

**1992** New Zealand Mathematical Society Award for Research.

**1994** New Zealand Association of Scientists Research Medal for the best New Zealand based scientist under 40.

**2007** Elected Fellow of the New Zealand Mathematics Society.

**2000** Vice-Chancellor's Award for Research Excellence.

**1996** Elected Fellow of the Royal Society (NZ)

**2006** Invited Speaker, International Congress of Mathematicians.

**2007** Invited Speaker, International Congress of Logic, Methodology, and Philosophy of Science.

**2008** Elected Fellow of the Association for Computing Machinery. (one of two New Zealanders)

**2008-2010** James Cook Fellowship, Royal Society of New Zealand.

**2008** Victoria University of Wellington Award for Research Excellence.

**2010** Shoenfield Prize (article) from the Association for Symbolic Logic.

**2011** Hector Medal, Royal Society of New Zealand. (New Zealand's oldest research medal)

**2012** Fellow Newton Institute (Cambridge) for the Alan Turing Programme.

**2012** Elected Fellow American Mathematical Society. (Inaugural intake, one of 3 New Zealand based)

**2013** Elected Fellow of the Australian Mathematical Society.

**2014** European Association for Theoretical Computer Science/International Symposium in Parameterized Complexity and Exact Computation Nerode Prize (joint with Bodlaender, Fellows, Hermelin, Fortnow and Santhanam)

- 2016-7** Humboldt Prize (60,000 Euros, October 2016) from Humboldt foundation.
- 2016** Shoenfield Prize (Book) Association for Symbolic Logic.
- 2018** Member  $\Sigma \Xi$ .
- 2018** Gödel Lecturer, Association for Symbolic Logic.
- 2018** Rutherford Medal (\$100,000), premier award New Zealand Royal Society.
- 2020** Victoria University Research Award.

## Grants

- 1979-1982** Commonwealth Postgraduate Research Award (Australia)
- 1983-1985** Research Grant (Singapore)
- 1986** Support Grant from U.S. National Science Foundation
- 1988-91, 92-95, 96-99** PI for three US/NZ Binational Cooperative Grants
- 1989** Support Grant from Mathematical Sciences Research Institute, Berkeley, USA
- 1992** Support Grant from Mathematical Sciences Institute, Ithaca New York, USA
- 1993** Support Grant from the Lee Foundation, National University of Singapore.
- 1995-** PI Research Grants continuously from The Marsden Fund for Basic Science.
- 2005-** AI on Catherine McCartin's Research Grant from The Marsden Fund for Basic Science.
- 1998-2004** AI on 2 Marsden Grants to support the *NZ Mathematical Sciences Research Institute*, of which I am one of the directors, along with Professors Marston Conder, David Gauld, Gaven Martin, and Vaughan Jones.
- 2002-10** PI on the CoRE grant from the New Zealand Government for the *New Zealand Institute for Mathematics and its Applications*
- 1997** Support grant from the Italian Government.
- 2003-** AI on NSFC Grand International Joint Project Grant No. 60310213 "New Directions in Theory and Applications of Models of Computation" (China)
- 2005-2008** AI on Noam Greenberg's Marsden Grant.
- 2008-2010** James Cook Fellowship, Royal Society of New Zealand.
- 2011** PI on NSF Grant 1135626 with Charles Steinhorn for Travel Grants for 12 US based researchers to speak at the 12th Asian Logic Conference in Wellington, December, 2011. (\$US 31K)

**2014** PI on Randomness and Computation programme, Institute for Mathematical Sciences, June 2014. (\$S 125K))

**2016** Fellowship, Institute for Mathematical Sciences, Singapore, *Aspects of Computation*.

**2018** January, Research in Pairs, Oberwolfach.

### **Postdoctoral Fellows Supervised.**

Current or last known Position Listed.

1. Michael Moses (George Washington University)
2. Peter Cholak (University of Notre Dame)
3. Geoff LaForte (Western Florida University) (deceased)
4. Richard Coles (Telecom, UK)
5. Reed Solomon (University of Connecticut).
6. Walker White (Cornell University)
7. Denis Hirschfeldt (University of Chicago).
8. Evan Griffiths (New Zealand Risk Assessment Programme)
9. Wu Guohua (Nanyang Technological University, Singapore)
10. Joe Miller (University of Wisconsin, Madison)
11. Yu Liang (Nanjing University, China)
12. Rebecca Weber (Dartmouth)
13. Noam Greenberg (Victoria University)
14. Antonio Montalbán (Berkeley)
15. George Barmpalias (Academia Sinica (China))
16. Laurent Bienvenu (CIRM Bordeaux University)
17. Asher Kach (Google)
18. Dan Turetsky (Wellington)
19. Alexander Melnikov (Massey University, Albany)
20. Greg Igusa (Pure Storage, Inc)
21. Matthew Harrison-Trainor (with Melnikov) (Michigan)

22. Li Liu (with Melnikov), VUW.

### **Ph. D. Students supervised**

Wu Guohua (1999-2002) (Nanyang University of Technology)

Catherine McCartin (1999-2003) (Massey University)

Ng Keng Meng (Selwyn) (2006-2009) (Nanyang University of Technology)

Adam Day (2008-2011) (Wellington)

Michael McInerney (joint with Greenberg) (2013-2016) (CSIRO (Australia))

Day, Wu and McCartin won the *Hatherton Award* for the best paper arising from a PhD paper by a New Zealand based PhD. Day won the *Sacks Prize* for the best PhD in logic worldwide from the *Association for Symbolic Logic*. He was the first New Zealand graduate to get a Fellowship to the Miller Institute at Berkeley.

### **M. Sc. Student supervised**

Stephanie Reid (2003), John Fouhy (2003), Michelle Porter (2015), Katherine Arthur (2015), Ellen Hammatt (joint with Greenberg) (2021). Long Qian (jointly with Greenberg) (2021), Matthew Askes (2022).

All received masters with distinction.

### **Professional Service:**

- Managing Editor *Bulletin of Symbolic Logic*, 2004-2010. (full term)
- Editor *Journal of Symbolic Logic*, 1999-2004, Coordinating editor 2000-2004. (full term)
- Editor, *Theory of Computing Systems* (formerly *Math. Systems Theory*), 2006-
- Editor, *Archive for Mathematical Logic*, 2009-
- Editor, *Computability*, 2011-
- Editor, *New Zealand Journal of Mathematics*, 2017-
- Co-director, New Zealand Mathematical Sciences Research Institute (1995-2017).
- Co-director, New Zealand Institute for Mathematics and its Applications for its duration.
- Vice-President, New Zealand mathematics Society 2000-2001.
- President, New Zealand Mathematical Society 2001-2003, immediate past president, 2004.

- Prizes committee, council, and Australasian committee Association for Symbolic Logic 2000-16.
- Nominating committee and committee on plagiarism Association for Symbolic Logic.
- Fellows' Committee Royal Society New Zealand 1999-2001. Hamilton Prize Committee, 2004.
- Marsden panel for Mathematical and Information Sciences 1997, 2002, 2003, (chair) 2009-2011, 2021, 2022.
- Marsden Council 2009-2011.
- Royal Society Travel Grants Committee 2008-2010
- New Zealand Mathematical Sciences Advisory Group 1999-2003.
- New Zealand representative on the International Mathematics Union 2001-2004.
- Fellows Selection Panel, Royal Society, 2005.
- Chair of the Steering Committee for *Computability, Complexity and Randomness* series 2003-.
- Steering Committee for *International Workshop of Parameterized Complexity and Exact Computation*, 2005-2009.
- Chair review committee, science faculty, University of Samoa.
- PC member of 28 computer science conference committees in the last 6 years.
- Judge, Alan Turing Research Fellowship Awards, 2012.
- Fellows panel Royal Society, 2015
- Assessor, Rutherford Discovery Fellowships (2016)
- 2015-17 Council, Association for Symbolic Logic.
- 2016-, Editor, *Mathematical Logic Quarterly*.
- 2020, Prizes committee, Association for Symbolic Logic.
- 2021-, Editor, *Computer Science Review*.

**Hobbies:** Surfing, Tennis, Scottish Country Dancing.

**AREAS OF INTEREST:** Algebra, Logic, Complexity theory

**PUBLICATIONS:**

**Thesis:**

*Abstract Dependence, Recursion Theory and the Lattice of Recursively Enumerable Filters* Thesis, Monash University, Clayton, Victoria, Australia, (1982). J.N. Crossley, Supervisor.

## Publications

### Books

1. *Parameterized Complexity*, (with M. Fellows) Springer-Verlag, Monographs in Computer Science, 1999 xiii+533 pages.
2. *Algorithmic Randomness and Complexity* (with D. Hirschfeldt), Springer-Verlag , Computability in Europe Series No 1, December 2010. xxvi+855 pages.
3. *Fundamentals of Parameterized Complexity*, (with M. Fellows), Springer-Verlag, 2013, texts in computer science, ISBN 978-1-4471-5559-1, online <http://link.springer.com/book/10.1007/978-1-4471-5559-1>, xxx+763 pages.
4. *Minimal Weak Truth Table Degrees and Computably Enumerable Turing Degrees*, (with Keng Meng Ng and Reed Solomon) Memoirs of the American Mathematical Society, Vo. 265, No. 1284, (2020), vii + 98 pages.
5. *A Hierarchy of Turing Degrees: A Transfinite Hierarchy of Lowness Notions in the Computably Enumerable Degrees, Unifying Classes and Natural Definability*, (with Noam Greenberg), Annals of Mathematics Studies, Vol. 206 Princeton University Press 2020, 240 pages, ISBN 9780691199658.
6. *Computable Structure Theory; A Unified Approach* (with Alexander Melnikov and Keng Meng Ng), in preparation.
7. *Computability and Complexity Theory: A First Course*, in preparation.

### Books Edited

1. *Aspects of Complexity*, (with D. Hirschfeldt, editors), de Gruyter Series in Logic and Its Applications, Volume 4, 2001, vi+172 pages.
2. *Proceedings of the 7th and 8th Asian Logic Conferences*, (Chief Editor, with Ding Decheng, Tung Shi Ping, Qiu Yu Hui, Mariko Yasugi, and Wu Guohua, editors) World Scientific, 2003, viii+471 pages.
3. *Parameterized and Exact Computation: First International Workshop, IWPEC 2004, Bergen, Norway, September 14-17, 2004. Proceedings* (Rod Downey, Frank Dehne, Michael Fellows, editors) Springer-Verlag Lecture Notes in Computer Science, Vol 3162, Springer Verlag, 2004. 300 pages.
4. *Mathematical Logic in Asia: Proceedings of the 9th Asian Logic Conference*, (Rod Downey, Sergei S. Goncharov and Hiroakira Ono, eds) World Scientific, 2006, Singapore, viii+319 pages.



5. *Proceedings Fifteenth Computing: The Australasian Theory Symposium (CATS 2009)*, Wellington, New Zealand. CRPIT, 94. (Downey, R. and Manyem, P., Eds.) ACS.
6. *Proceedings of the 10th Asian Logic Conference*: (with Joerg Brendle, Chong Chi Tat, Hirotaka Kikyo, Hiroakira Ono and Feng Qi), World Scientific, 2009.
7. *The Multivariate Algorithmic Revolution and Beyond, Essays Dedicated to Michael R. Fellows on the Occasion of His 60th Birthday*, Lecture Notes in Computer Science, Vol. 7370 Subseries: Theoretical Computer Science and General Issues (Bodlaender, H.L.; Downey, R.; Fomin, F.V.; Marx, D. (Eds.)) 2012, 2012, XXII, 506 p. 32 illus.
8. *Proceedings of the 11th Asian Logic Conference*, (with Rob Goldblatt, Joerg Brendle and Bungham Kim), 2013, World Scientific, 325 pages.
9. *Turing's Legacy*, Cambridge University Press, Lecture Notes in Logic, Cambridge University Press, 2014. (Featured in the 19th Annual ACM Computing Reviews Notable Books and Articles (2014).)

### Journal Special Issues Edited

1. Special Issue of the *Annals of Pure and Applied Logic* Volume 138, Issues 1-3, Pages 1-222 (March 2006), devoted to the NZIMA Logic Programme (with Rob Goldblatt).
2. Special Issue of *Theoretical Computer Science*, devoted to *Parameterized Complexity and Exact Computation*, (with Mike Langston, and Rolf Niedermeier) Volume 351, Issue 3, Pages 295-460 (28 February 2006) *Parameterized and Exact Computation*
3. Special Issue of *Theory of Computing Systems* *Exact Computation and Parameterized Complexity*. Vol 41 No 3 (October 2007).
4. Two special issue of *The Computer Journal* devoted to *Parameterized Complexity* (with Mike Fellows and Mike Langston). Volume 58 Numbers 1 and 3, 2008, Oxford University Press.
5. Special issue of *Theory of Computing Systems*, *Theory of Computing Systems*, Vol. 52, Issue 1, 2013, *Computability, Complexity and Randomness*.
6. Special Issue of *New Zealand Journal of Mathematics*, *Vaughan Jones Special Issue*. (with Marston Conder, David Gauld, and Gaven Martin). Vol. 52 (2021).

### Electronic Article

1. *Algorithmic randomness*, (with Jan Reimann) for *Scholarpedia*, (Rodney G. Downey and Jan Reimann (2007) *Algorithmic randomness*. *Scholarpedia*, 2(10):2574) [http://www.scholarpedia.org/article/Algorithmic\\_Randomness](http://www.scholarpedia.org/article/Algorithmic_Randomness)

### Papers

1. On a question of A. Retzlaff, *Z. Math. Logik Grund. der Math.*, **29** (1983) 379-384.
2. Abstract dependence, recursion theory and the lattice of recursively enumerable filters, *Bull. Aust. Math. Soc.*, **27** (1983) 461-464.
3. Nowhere simplicity in matroids, *J. Aust. Math. Soc. (Series A)* **35** (1983) 28-45.
4. Co-immune subspaces and complementation in  $V_\infty$ , *J. Symbolic Logic*, **49** (1984) 528-538.
5. Perfect McLain groups are super-perfect, (with A.J. Berrick), *Bull. Aust. Math. Soc.*, **29** (1984) 249-257.
6. Bases of supermaximal subspaces and Steinitz systems, *J. Symbolic Logic*, **49** (1984) 1146-1159.
7. Decidable subspaces and recursively enumerable subspaces, (with C.J. Ash), *J. Symbolic Logic*, **49** (1984) 1137-1145.
8. Some remarks on a theorem of Iraj Kalantari concerning convexity and recursion theory, *Z. Math. Logik Grund. der Math.*, **30** (1984) 295-302.
9. The universal complementation property, (with J.B. Remmel), *J. Symbolic Logic*, **49** (1984) 1125-1136.
10. A note on decomposition of recursively enumerable subspaces, *Z. Math. Logik Grund. der Math.*, **30** (1984) 456-470.
11. Automorphisms of supermaximal subspaces, (with G.R. Hird), *J. Symbolic Logic*, **50** (1985) 1-9.
12. Effective extensions of linear forms in a recursive vector space over a recursive field, (with I. Kalantari), *Z. Math. Logik Grund. der Math.*, **31** (1985) 193-200.
13. The degrees of r.e. sets without the universal splitting property, *Trans. Amer. Math. Soc.*, **291** (1985) 337-351
14. Sound, totally sound, and unsound recursive equivalence types, *Annals Pure and App. Logic*, **31** (1986) 1-22.
15. Splitting properties of r.e. sets and degrees (with L.V. Welch), *J. Symbolic Logic*, **51** (1986) 88-109.
16. Recursion theory and ordered groups, (with S. Kurtz) *Annals Pure and App. Logic.*, **32** (1986) 137-151.
17. Undecidability of  $L(F_\infty)$  and other lattices of r.e. substructures, *Annals Pure and App. Logic*, **32** (1986) 17-26. (Corrigendum in *ibid* 48 (1990) 299-301.)
18. Bases of supermaximal subspaces and Steinitz systems II, *Z. Math. Logik Grund. der Math.*, **31** (1986) 203-210.
19. Structural interactions of the recursively enumerable T- and W-degrees, (with M. Stob), *Annals Pure and App. Logic.*, **31** (1986) 205-236.

20. Orbits of creative subspaces, *Proc. Amer. Math Soc.*, **99** (1987) 163-170.
21. Subsets of hypersimple sets, *Pacific J. Math.*, **127** (1987) 299-319.
22. Maximal theories, *Annals Pure and App. Logic.*, **33** (1987) 245-282.
23. Degrees of splittings and bases of an r.e. vector space, (with J.B. Remmel and L.V. Welch), *Trans Amer. Math Soc.*, **302** (1987) 683-714.
24. Localization of a theorem of Ambos-Spies and the strong anti-splitting property. *Archiv. für Math Logik Grundlagenforschung*, **26** (1987) 127-136.
25.  $\Delta_2^0$  degrees and transfer theorems, *Illinois J. Math.*, **31** (1987) 419-427.
26.  $T$ -degrees, jump classes and strong reducibilities, (with C. Jockusch). *Trans. Amer. Math. Soc.*, **301** (1987) 103-136.
27. Automorphisms and recursive structures, (with J.B. Remmel), *Z. Math. Logik Grund. der Math.*, **33** (1987) 339-345.
28. Two theorems on truth table degrees, *Proc. Amer. Math. Soc.*, **103** (1988), 281-287.
29. Recursively enumerable  $m$ -degrees and  $tt$ -degrees II : the distribution of singular degrees. *Archive for Mathematical Logic*, **27** (1988), 135-148.
30. Intervals and sublattices in the r.e. weak truth table degrees, Part I : density, *Ann. Pure and Appl. Logic*, **41** (1989) 1-27.
31. Completely mitotic r.e. degrees (with T. Slaman), *Ann. Pure and Appl. Logic*, **41** (1989) 119-153.
32. D-r.e. degrees and the nondiamond theorem. *Bull. London Math. Soc.*, **21** (1989) 43-50.
33. Classification of degree classes associated with r.e. subspaces, (with J.B. Remmel), *Ann. Pure and Appl Logic*, **42** (1989) 105-125
34. Degrees bounding minimal degrees, (with C.T. Chong), *Math. Proc. Cambridge Phil. Soc.*, **105** (1989) 211-222.
35. Honest polynomial reductions, non relativizations and  $P =?NP$  (with W. Gasarch, S. Homer and M. Moses) *Proceedings of the 4th Annual Conference on Structures in Complexity Theory*, (1989), IEEE Publ. 196-207.
36. Recursively enumerable  $m$ -degrees and  $tt$ -degrees I : the quantity of  $m$ -degrees. *J. Symb. Logic*, **54** (1989) 553-567
37. On choice sets and strongly nontrivial self-embeddings of recursive linear orders. (with M.F. Moses) *Z. Math. Logik Grundlagen Math.*, **35** (1989) 237-246.
38. Intervals and sublattices in the r.e. weak truth table degrees, Part II : nonbounding, *Ann. Pure and Appl. Logic*, **44** (1989) 153-172

39. On hyper-torre isols, *J. Symbolic Logic*, **54** (1989) 1160-1166
40. A contiguous nonbranching degree, *Z.Math Logic Grundlagen Math.*, **35** (1989) 375-383.
41. On Ramsey-type theorems and their applications, *Singapore Math. Medley*, **17** (1989) 58-78.
42. Lattice nonembeddings and initial segments of the recursively enumerable degrees, *Annals Pure and Appl. Logic*, **49** (1990) 97-119.
43. Automorphism and splittings of recursively enumerable sets, (with M Stob) in *Proceedings of the Forth Asian Logic conference, CSK publication*, Tokyo (1990) 75-87.
44. Array recursive sets and multiple permitting arguments (with M. Stob and C. Jockusch) in *Proceedings Oberwolfach 1989*, Springer Verlag, *Lecture Notes in Mathematics 1990*, 141-174.
45. Notes on the  $\mathbf{0}'''$  priority method with special attention to density theorems, in *Proceedings Oberwolfach 1989*, Springer Verlag, *Lecture Notes in Mathematics 1990*, 111-140.
46. Superbranching degrees, (with J. Mourad) in *Proceedings Oberwolfach 1989*, Springer Verlag, *Lecture Notes in Mathematics 1990*, 175-186.
47. Minimal degrees recursive in 1-generic degrees, (with C.T. Chong), *Annals Pure and Appl. Logic*, **48** (1990) 215-225.
48. On complexity theory and honest polynomial time degrees, *Theoretical Computer Science*, **78** (1991) 305-317.
49. Jumps of hemimaximal sets, (with M. Stob), *Z. Math. Logik Grundlagen Math.*, **37** (1991) 113-120.
50. Recursive linear orderings with incomplete successivities (with M.F. Moses), *Trans. Amer. Math.Soc.*, **326** (1991) 653-668.
51. Automorphisms of the lattice of recursively enumerable sets : Orbits (with M. Stob), *Advances in Math.*, **92** (1992) 237-265.
52. Tabular degrees and  $\alpha$ -recursion theory, (with C. Bailey), *Annals Pure and Applied Logic*, **55** (1992),205-236.
53. Splitting theorems in recursion theory, (with M. Stob) *Annals Pure and Applied Logic*, **65** (1)(1993) 1-106).
54. Orderings with  $\alpha$ -th jump degree  $\mathbf{0}^\alpha$  (with J.F. Knight), *Proc. Amer. Math. Soc.*, **114** (1992) 545-552.
55. On  $\Pi_1^0$  classes and their ranked points, *Notre Dame J. of Formal Logic*, **32** (1991) 499-512.
56. An invitation to structural complexity, *New Zealand Journal of Mathematics*, **21** (1992) 33-91.

57. On co-simple isols and their intersection types (with T. Slaman), *Annals pure and Appl. Logic*, (Special issue in honour of John Myhill), **56** (1992) 221-237.
58. Fixed parameter intractability, (with M. Fellows), *Proceedings Structure in Complexity, Seventh Annual Conference, IEEE Publication*, (1992) 36-50.
59. Fixed parameter tractability and completeness, (with M. R. Fellows), *Congressus Numerantium*, **87** (1992) 161-187.
60. Automorphisms of the lattice of recursively enumerable sets: promptly simple sets (with P. Cholak and M. Stob), *Trans. American Math. Society*, **332** (1992) 555-570.
61. Fixed parameter intractability II, (with K. Abrahamson and M. F. Fellows) in *Proceedings Tenth Annual Symposium on Theoretical Aspects of Computer Science (STACS'93)*(Ed. G. Goos and J. Hartmanis), Springer-Verlag Lecture Notes in Computer Science, Vol 665 (1993) 374-385.
62. Parameterized computational feasibility, (with M. Fellows) in *Feasible Mathematics II* (ed. P. Clote and J. Remmel) Birkhauser (1995) 219-244.
63. Nondiamond theorems for polynomial time reducibility, *Journal of Computing and System Sciences*, **45** (1992) 385-395.
64. Computability Theory and Linear Orderings, in *Handbook of Recursive Mathematics* (ed Ershov, Goncharov, Nerode and Remmel ) Vol 2, North Holland, (1998), 823-977.
65. Effective algebras and relational systems; coding properties (with J.B. Remmel), in *Handbook of Recursive Mathematics* (ed Ershov, Goncharov, Nerode and Remmel) Vol 2, North Holland, (1998), 977-1041.
66. Friedberg splittings of recursively enumerable sets (with M. Stob), *Annals Pure and Applied Logic*, **59** (1993) 175-199.
67. Degrees of inferability (with P. Cholak, L. Fortnow, W. Gasarch, E. Kinber, M. Kummer, S. Kurtz, and T. Slaman), *Proceedings of Colt '92 (Fifth Annual Workshop on Computational Learning Theory, 1992)*, 180-192.
68. On the Cantor-Bendixon rank of recursively enumerable sets, (with P. Cholak), *J. Symbolic Logic*, **58** (1993) 629-640.
69. Countable thin  $\Pi_1^0$  classes, (with D. Cenzer, C. Jockusch, and R. Shore), *Annals Pure and Applied Logic*, **59** (1993) 79-139.
70. Array nonrecursive sets and lattice embeddings of the diamond, *Illinois J. Mathematics*, **37** (1993) 349-374.
71. Embedding Lattices into the wtt-degrees below  $\mathbf{0}'$ , (with C. Haught), *J. Symbolic Logic*, **59** (1994) 1360-1382.
72. Effectively and noneffectively nowhere simple subspaces, (with J.B. Remmel), *Logical Methods* (ed. Crossley, Remmel, Shore, and Sweedler) Birkhauser, Boston, 1994, 314-351.

73. Permutation and presentations (with P. Cholak), *Proc. Amer. Math. Soc.* **122** (1994) 1237-1249.
74. Every recursive boolean algebra is isomorphic to one with incomplete atoms, *Annals Pure and Applied Logic*, **60** (1993) 193-206.
75. Fixed-parameter tractability and completeness II: on completeness for  $W[1]$  (with M. Fellows), *Theoretical Comput. Sci.* **141** (1995) 109-131.
76. Recursively enumerable  $m$ - and  $tt$ -degrees III: realizing all finite distributive lattices (with P. Cholak), *J. London Math. Soc.*, (2) **50** (1994) 440-453.
77. Fixed-parameter tractability and completeness III: some structural aspects of the  $W$ -hierarchy (with M. Fellows) in *Complexity Theory: Current Research* (Ed. K. Ambos-Spies, S. Homer and U. Schöningh) Cambridge University Press, (1993) 166-191.
78. Lattice nonembeddings and intervals in the recursively enumerable degrees, (with P. Cholak), *Annals Pure and Applied Logic*, **61**, (1993), 195-222.
79. Decidability and definability for parameterized polynomial time  $m$ -reducibilities, (with P. Cholak) *Logical Methods*, (ed. Crossley, Remmel, Shore, and Sweedler) Birkhauser, Boston, 1994, 194-221.
80. On irreducible  $m$ -degrees, *Rendiconti Seminario Matematico Dell'Universita e Del Politecnico di Torino*, (Rend. Sem. Mat. Univ. Pol. Torino), **51**, (1993) 109-112.
81. Parameterized learning complexity, (with M. Fellows and P. Evans) in *Proceedings of the Sixth Annual Conference on Computational Learning Theory*, ACM Press, New York, (1993) 51-57.
82. The parameterized complexity of some problems in logic and linguistics, (extended abstract) (with M. Fellows, B. Kapron, M. Hallett, and T. Wareham), in *Proceedings of the Workshop on Structural Complexity and Recursion Theoretical Methods in Logic Programming*, October 29, Vancouver, Canada (ed. Blair, H., V. Marek, A. Nerode, J. Remmel) Mathematical Sciences Institute Publ. (1993) 44-58. Final version in *Logic at St. Petersburg* (Ed. A. Nerode and Yu. Matiyasevich) Springer Verlag Lecture Notes in Computer Science, Vol 813, (1994) 89-101
83. Every low boolean algebra is isomorphic to a recursive one, (with C. Jockusch) *Proceedings Amer. Math. Society*, **122**, No. 3, November 1994, pp. 871-880.
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232. Dynamic Dominating Set and Turbo-Charging Greedy Heuristics, (with Judith Egan, Michael Fellows, Frances Rosamond, and Peter Shaw) *Tsinghua Science and Technology*, Vol. 19 (2014), 329-337.
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259. Notes on Computable Analysis, (with Adam Day and Michelle Porter) *Theory of Computing Systems*, 60(1) (2017), 53-111
260. A hierarchy of computably enumerable degrees, (with Noam Greenberg), *Bulletin of Symbolic Logic*, Vol. 24 March (2018), 53 - 89
261. Splitting into degrees with Low Computational Strength, (with Keng Meng Ng), *Annals of Pure and Applied Logic* (2018), Vol. 169(8), pp. 803-834.
262. Maximality and collapse in the Hierarchy of  $\alpha$ -c.a. Degrees (with Arthur and Greenberg) *Computability*, Vol. 25 (2021), 1-34.
263. Splitting Theorems and Low Degrees, (with Ellen Chih), *Computability*. Vol. 8, no. 3-4, pp. 243-252, 2019.
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270. Enumerating abelian  $p$ -groups, (with Alexander Melnikov and Keng Meng Ng), *Journal of Algebra*. Vol. 560 (2020), 745-790.
271. Foundations of online structure theory, (with Bazhenov, Melnikov and Kalimullin), *Bulletin of Symbolic Logic* Vol. 25 (2019), 141-181.
272. Categorical Linearly Ordered Structures, with Alexander Melnikov and Keng Meng Ng, *Annals of Pure and Applied Logic*, Volume 170, Issue 10, October 2019, Pages 1243-1255
273. Three topological reducibilities for discontinuous functions. (with Day and Westrick) *Transactions of the American Mathematical Society, B*. Vol. 9 (2022), 859-895.

274. A Hierarchy of Computably Enumerable Degrees II: Some Recent Developments and New Directions, with Noam Greenberg and Ellen Hammatt, *New Zealand Journal of Mathematics, Vaughan Jones Special Issue*. Vol. 52 (2021), 175-231.
275. Relationships between Computability-Theoretic Properties of Problems (With Greenberg, Harrison-Trainor, Patey and Turetsky) *Journal of Symbolic Logic*. Vol. 87 (2022), 47-71.
276. Randomness and Computation, *Contemporary Logic and Computing*, College Publications, London 2020 in *Landscapes in Logic Series* Vol 1. (Adrian Rezus ed.), 468-517.
277. Foundations of Online Structure Theory, II: The operator approach, (with Melnikov and Ng), *Logical Methods in Computer Science*. Volume 17, Issue 3, 2021, pp. 6:1-35. (lmcs:6641 - Logical Methods in Computer Science, July 21, 2021, Volume 17, Issue 3 - [https://doi.org/10.46298/lmcs-17\(3:6\)2021](https://doi.org/10.46298/lmcs-17(3:6)2021))
278. On realisation of index sets in  $\Pi_1^0$ -classes, (with A. Melnikov), *Algebra i Logika* Vol. 58 (2019), 659-663 (Russian).
279. Computable Analysis and classification problems, (with Melnikov), in *Proceedings CiE 2020*. Springer Nature Switzerland AG 2020. Anselmo et al. (Eds.): CiE 2020, LNCS 12098, (2020) 100-111.
280. Some Notes on the wtt-Jump, (with K. Ambos-Spies and Martin Monath), accepted, *Proceedings of the 2019 Asian Logic Conference and Computability, Complexity and Randomness Conference*.
281. Lowness Properties for Strong Reducibilities and The Computational Power of Maximal Sets, (with Ambos-Spies and Monath) accepted, *Computability*.
282. Relativizing Computable Categoricity, (with Matthew Harrison-Trainor and Alexander Melnikov), *Proceedings American Mathematical Society*. Vol. 149, No. 9, (2021), 3999-4013.
283. A minimal set low for speed. (with Harrison-Trainor) *Journal of Symbolic Logic*. Vol. 87 (2022), 1693-1728.
284. On Supersets of Non-low<sub>2</sub> Sets, (with K. Ambos-Spies and M. Monath), *Journal of Symbolic Logic*. Vol. 86 (2021), 1282 - 1292.
285. Realizing computably enumerable degrees in separating classes, (with Cholak, Greenberg, and Turetsky), accepted in "Higher Recursion Theory and Set Theory", (James Cummings, Andrew Marks, Yue Yang and Liang Yu, eds) volume in celebration of Ted Slaman and Hugh Woodin, Lecture Notes Series Institute for Mathematical Sciences. National University of Singapore, Singapore.
286. Cousin's Lemma in Second Order Arithmetic, (with J. Barrett and N. Greenberg), *Proceedings of the American Mathematical Society. Series B* Vol. 9 (2022), 111-124.
287. Online, Computable, and Punctual Structure Theory, (with Matthew Askes) *Logic Journal of the IGPL*, (Crossley Special Volume). *jzac065*, <https://doi.org/10.1093/jigpal/jzac065> Vol 31, Issue 6, (2023), 1251-1293

288. Computably Compact Spaces, (with Melnikov), *Bulletin Symbolic Logic*, Vol 29 (2) (2023), 170 - 263
289. The Complexity of the Successivity Relation in Computable Linear Orderings, (with Lempp and Wu), submitted.
290. Limit Complexities, Minimal Descriptions, and  $n$ -Randomness, (with Liu, Ng, and Turetsky), submitted.
291. On the c.e. degrees realizable in  $\Pi_1^0$  classes, (with Csima and Ng), accepted, *Journal of Symbolic Logic*.
292. Notes on Sacks' Splitting Theorem, (with Ambos-Spies, Monath and Ng), accepted *Journal of Symbolic Logic*.
293. Algorithmically random series and uses of algorithmic randomness in mathematics, (with Noam Greenberg and Andrew Tangarra), accepted, *Computability*.
294. Punctually presented structures II: Comparing presentations, (with Marina Dorzheiva, Ellen Hammatt, Alexander Melnikov and Keng Meng Ng), accepted, *Archive for Mathematical Logic*.

#### **Papers in preparation**

295. Sacks' Splitting Theorem Revisited, with Guohua Wu.
296. Lower bounds for the SJT hard sets, (with David Diamondstone, Noam Greenberg and Dan Turetsky)

#### **Professional Societies:**

I am a member of the following societies American Math. Society (life member), Australian Math. Society, New Zealand Math. Society, European Association for Theoretical Computer Science, London Math. Society (senior member), Association for Symbolic Logic, (ex-Council) Combinatorial Mathematics Society of Australasia (life member), Royal Society of New Zealand, The Association for Computing Machinery (life member).

#### **Other Information:**

I am a reviewer for Mathematical Reviews, Zentralblatt für Mathematik, and the Journal of Symbolic Logic. For these I have over 400 reviews including 14 book reviews. I am a referee for various journals such as the Journal of Symbolic Logic, Annals of Pure and Applied Logic, the Transactions of the American Math. Society, the Archive for Mathematical Logic, Theoretical Computer Science, Journal of Computer and System Sciences, Journal of Computing and System Sciences, SIAM Journal of Computing, Journal of Graph theory, and the Australasian Journal of Combinatorics. I have been on numerous programme committees for Computer Science and logic meetings. I have given numerous invited addresses at international meetings and colloquia.

For instance, here are some recent invited lectures:

- 2002 September Plenary and Keynote (first) speaker, 8th Asian Logic Conference, Chongqing China.
- 2002 July Plenary and closing address to the international meeting at Schloss Dagstuhl on Parameterized Complexity.
- 2002 January Plenary speaker at the Annual meeting of the Association for Symbolic Logic, San Diego.
- 2002 January Keynote speaker for special session on Computability Theory for the American Mathematical Society Winter Meetings, San Diego.
- 2003 August Keynote speaker in the Kolomogorov Centenary meeting in Heidelberg.
- 2003 July Plenary Speaker in the Annual Conference on Computational Complexity, Aarhus, Denmark.
- 2003 September, Plenary speaker at the Conference on Computability and Complexity in Analysis, Cincinnatti, USA.
- 2004 January Plenary Speaker at the international meeting VIC 2004, Wellington, 2004.
- 2004 July Invited Tutorial Speaker (3 lectures) NZIMA Combinatorics Program: Workshop on Combinatorics and its Applications, Auckland
- 2004 August, Plenary Speaker at the Annual Mathematical Foundations of Computer Science, Prague.
- 2004 December Joint Plenary speaker at Automata, Structures and Logic and Developments in Language Theory, Auckland.
- 2005 February Plenary Speaker at the UCLA Meeting for the opening of its Logic Center, sponsored by the ASL, NSF and UCLA.
- 2005 May. Invited speaker at University of Chicago for 4 lectures on algorithmic randomness, whilst Visiting Scholar.
- 2005 July-August. One of the only 2 invited Tutorial Speakers (in computability theory, the second month, the other being Ted Slaman at Berkeley) at the 2 month meeting Computational Prospects of Infinity, Singapore. Five Lectures on Algorithmic Randomness.
- 2005 September Invited Speaker at the 16th Australasian Workshop on Combinatorial Algorithms
- 2006 May. Plenary speaker at Theory and Applications of Models of Computation, Beijing.
- 2006 July. Tutorial Speaker at The European Logic Colloquium, Nijmegen, Holland. Three Lectures.
- 2006 August. Invited 45 minute Speaker, International Congress of Mathematicians, Madrid.

- 2007 August. Invited Lecture, International Congress of Logic Methodology and Philosophy of Science, Beijing.
- 2007 December. Plenary Lecture, First Joint Meeting of the New Zealand Mathematical Society and the American Mathematical Society, Wellington.
- 2008 February, Tutorial speaker, NZIMA Algorithmics Meeting, Napier.
- 2008 March, Invited speaker, American Math. Society Special Session on Computability, Irvine.
- 2008 June, Invited Speaker, Logic Computability and Randomness, Nanjing, China.
- 2008 December, Invited Speaker, special session on algorithmics, NZMS/Aust MS annual Meeting, Christchurch.
- 2009 February, Royal Society Invited Speaker for Rutherford Foundation Dinner, Wellington Town Hall.
- 2009 May, Invited Speaker, Algorithmic Randomness Meeting, Madison.
- 2009 June, Plenary Speaker, Asian Logic Meeting, Singapore.
- 2010 May, Invited Speaker, Midwest Computability Seminar, University of Chicago.
- 2010 May, Plenary Speaker, 5th Logic, Computability and Randomness Conference, University of Notre Dame, USA.
- 2011 February, Plenary Speaker, 6th Computability and Randomness Conference, Cape Town, South Africa.
- 2011 July, Invited Speaker Computational prospects of Infinity II, National University of Singapore.
- 2012 January, Schloss Dagstuhl, Computability and Randomness
- 2012 February, Oberwolfach, Computability
- 2012 March, Tutorial Speaker, Language, Automata Theory and Applications, A Coruna, Spain.
- 2012, April, University of Leicester.
- 2012, April, Tutorial Speaker, British Computer and Theoretical Computer Science, University of Manchester. (London Mathematical Society Discrete Mathematics Keynote Speaker)
- 2012, June, Special Session Speaker, The Incomputable, Chichley Hall.
- 2012, June, Plenary Lecture, How The World Computes-The Turing Centenary Conference, CIE, Cambridge, UK.
- 2012, June, Data Reduction and Problem Kernals, Schloss Dagstuhl.

- 2012, July, plenary speaker, Computability and Randomness, Isaac Newton Institute, UK
- 2012, August, Plenary Speaker, Turing Memorial Programme, Palacio De La Magdalena, Santander, Spain.
- 2012, October, Alan Turing, the Birth of Computers and the Power of Mathematics, Public Lecture, Victoria University.
- 2012, November, Seminar on parameterized complexity, Cornell University.
- 2012, November, Seminar on the Finite Intersection property.
- 2012, November, Harvard/MIT logic seminar. Finite Intersection property.
- 2012, November, Plenary Lecture, Alan Turing Centenary Conference TURING 100, Boston University.
- 2012, December, Plenary Lecture, Midwest Computability Seminar, University of Chicago.
- 2013, January, Plenary Lecture: My Mathematical Encounters with Anil Nerode, Logical Foundations of Computer Science, San Diego.
- 2013, January, Parameterized complexity basics, Joint Meetings special session on incremental and multivariate computation.
- 2013, January, Effective Torsion-Free abelian groups, special session on Effective Mathematics, Joint meetings, San Diego.
- 2013, April, Effectivity in Abelian Group Theory, Kobe University.
- 2013, May, What have I been thinking about in parameterized Complexity, Shonan Village Conference Center, Japan.
- 2013, May, Alan Turing and Randomness, Workshop on Information Theory and Randomness, invited Lecture, University of Tokyo.
- 2013, May, Integer Valued Randomness, Workshop on Information Theory and Randomness, invited Lecture, University of Tokyo.
- 2013, May, Recent Progress in Multivariate Algorithmics, Colloquium Lecture, University of Auckland.
- 2014, May, Integer Valued Randomness, Invited Lecture, Midwest Computability (Chicago)
- 2014, May, Effectivity in Abelian Group Theory, University of Notre Dame.
- 2014, Courcelle's Theorem for Triangulations, Invited Lecture, Subfactors in Mathematics and Physics, Maui.
- 2015, Alan Turing, Computing, Bletchley, and Mathematics, Public Lecture, February 2015.



- 2015, Courcelle’s Theorem for Triangulations, Invited Lecture, TAMC, Singapore, May.
- 2015, June Courcelle’s Theorem for Triangulations, Invited Lecture, Computability, Probability and Logic, Radboud University, Nijmegen.
- 2015, June Computability in Mathematics-Turing’s Legacy MATCH Kolloquium Lecture, University of Heidelberg.
- 2015, July, Alan Turing, Computing, Bletchley, and Mathematics, Singapore Public Library, Singapore (Public Lecture).
- 2015, April, The Life of  $\pi$ , CAPT Masters Lecture Singapore
- 2016, April, Parameterized Complexity, Chinese Academy of Sciences Colloquium, and Tsinghua University.
- 2016, June, Logic for Algorithms, University of Montpellier, colloquium lecture
- 2016, June, The Computational Power of Random Strings, Plenary Lecture, Luminy Conference Center, Computability, Complexity and Randomness.
- Graph Colouring as Mathematical Miniature, CAPT Masters tea, Singapore, Feb 2017.
- June 2017, Some Applications of Computability to Mathematics Darmstadt.
- June 2017, Some Applications of Computability to Mathematics, plenary lecture for Paul Schupp’s 80th Birthday conference “Groups and Computation” Stevens Institute of Technology.
- June 2018, Algorithmic Randomness, Kolloquium Lecture, Darmstadt.
- August 2018, Algorithmic Randomness, Gödel Lecture, European Logic Summer Meeting (Logic Colloquium, 18), Udine.
- December 2018, Post’s Programme Revisited, CCR 2018, Santiago, Chile.
- January 2019, Logic and Invariants, Modern Analysis and Geometry, (Gaven Martin’s 60th), Massey Albany.
- May 2019, Foundations of Online Model Theory, Invited Lecture, IMS Singapore (Slaman-Woodin Programme).
- June 2019, Post’s Programme Revisited, Asian Logic Conference, Special Session on Computability Theory, Nur-Sultan, Kazakhstan.
- June 2019, A Hierarchy of Degrees, CCR 2019 Nur-Sultan, Kazakhstan.
- May, August, Logic, 2019, Mathematics and Modern Society, Rutherford Lecture Series, New Zealand (Auckland, Palmerston North, Wellington, Christchurch, Dunedin)
- The Life of  $\pi$  (extended version), The Fascination of Science, Public Lecture Massey, Albany, July, 2019.

- Foundations of Online Structure Theory, Madison-Lempp-fest September, 2019
- Realizing c.e. degrees in  $\Pi_1^0$  classes, September, Madison, 2019.
- Foundations of Online Structure Theory, Berkeley, September, 2019
- Our Mathematical Age, NZ Math Teachers Conference, October 2019, Lower Hutt
- Sacks Splitting Theorem Re-visited (Again), Zoom Computability Seminar, July 2020
- The Operator Approach to Online Model Theory, Zoom MCA Workshop, August 2020.
- Mathematics and Scottish Country Dancing, Public Lecture to the RSNZ Napier Branch, August 2020.
- Courcelle's Theorem for Triangulations, Vaughan Jones Memorial Conference, Auckland University, December 2020.
- Some New Directions in Online Structure Theory, Sochi Computability Conference (Zoom), November 2021
- Some New Directions in Online Structure Theory, Chengdu University, Zoom, December 2021.
- Notes on Sacks Splitting Theorem, Computability Theory Seminar, Madison (Zoom) March 2022.
- New Directions in Online Structure Theory, J. N. Crossley Symposium, (Zoom), June 2022.
- My Mathematical encounters with Anil Nerode-Updated!, Nerode 90th meeting, (zoom), June 2022.
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I am also a reviewer for various granting bodies such as the New Zealand-U.S. Cooperative Science Foundation, and the United States National Science Foundation (both in Mathematics and Computer Science), European Research Council, Saudi Arabian Granting Agency, NSERC (Canada), EPSRC, the Irish NSF, South African NSF, and the Chinese NSF.

From 1987-1996 I edited the New Zealand Mathematical Society publication "Postgraduate Topics in Mathematics and Related Areas".

I have been a member of the Publications Committee of the New Zealand Mathematical Society, the Committee of the Wellington Mathematical Society, was a member of the Board of Governors of Newlands College from 1987-1989, and am currently a member of the Council and the Australasian Committee of the Association for Symbolic Logic. I served on the National Committee for Mathematics of the Royal Society from 1992-1995, and 2000-. In 1991 I was on the organising committee of the New Zealand Association

of Mathematics Teachers Biennial Conference. In 2000, I organized the major NZMRI summer meeting in Kaikoura. In 2002, I am co-organizing the NZMRI meeting in New Plymouth. I co-organized the VIC 2004 meeting in Wellington, and 4 conferences on parameterized complexity and exact computation, such as Dagstuhl 2005. I have been on many (>50) conference committees for computer science conferences. I organized the Asian Logic Meeting in Wellington in December 2011. I am co-organizer of Dagstuhl “Computability” in 2017, and earlier ones in Oberwolfach 2012.

In 1997, 2001, 2004, 2021, 2022 I was on the Marsden Mathematical and Information Sciences panel. I chaired the panel from 2008-2011. Since 1997, I have been on the Royal Society of New Zealand Fellows Committee for Mathematical and Information Sciences, and 1999-2002 I have served as the Fellows representative on the New Zealand National Mathematical & Information Sciences Advisory Group.

My name appears in -Marquis “Who’s Who in the World”, and “Who’s Who Aotearoa”.