Rudolf N. Cardinal MA PhD MB BChir MD FRCP FRCPsych CPsychol AFBPsS FRSB FIBMS FFCI   *Curriculum vitae*

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Oct 2023

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Qualifications

2015	**Certificate of Completion of Training,** general adult and liaison psychiatry	
2009	**Membership of the Royal College of Psychiatrists**	All parts at first attempt.
2007	**Membership of the Royal Colleges of Physicians of the United Kingdom**	All parts at first attempt.
2006	**Doctor of Medicine,** University of Cambridge	No corrections.
2001	**Doctor of Philosophy,** Experimental Psychology, University of Cambridge	No corrections.
2001	**Bachelor of Medicine & Bachelor of Surgery** (*), University of Cambridge	(*) Distinction
2000	**Master of Arts,** University of Cambridge	
1996	**Bachelor of Arts** (with Honours), University of Cambridge	
	Part IA: Anatomy, Biochemistry, Physiology, Sociology, Genetics	Class I
	Part IB: Anatomy, Neurobiology, Pathology, Pharmacology, Psychology, Reproductive Biology and Endocrinology	Class I
	Part II: Neuroscience	Class I [Ranked first]
1992	**S-Level:** Physics (1: distinction), Chemistry (1: distinction)	
1992	**A-Level:** Physics (A), Chemistry (A), Biology (A), Further Mathematics (A)	
1991	**A-Level:** Mathematics (A) (self-taught)	

Clinical status

Clinically qualified; clinically active.

Current positions

2023–present	**Clinical professor of psychiatry and informatics,** Department of Psychiatry, University of Cambridge.
2016–present	**Honorary consultant liaison psychiatrist,** Cambridgeshire & Peterborough NHS Foundation Trust (CPFT) and Cambridge University Hospitals NHS Foundation Trust (CUH).

Previous positions

2021–2023	**Associate professor of clinical informatics,** Department of Psychiatry, University of Cambridge.
2016–2021	**University lecturer in clinical informatics,** Department of Psychiatry, University of Cambridge.
2011–2016	**Clinical lecturer in psychiatry,** University of Cambridge.
2010–2016	**Honorary specialist registrar in general adult/liaison psychiatry,** CPFT.

- 2015–2016: community, Cambridge/Ely.
- 2014–2015: ST6, acute inpatient and crisis resolution/home treatment, Fulbourn Hospital.
- 2013–2014: ST5, liaison psychiatry, Addenbrooke's Hospital.
- 2010–2013: ST4, liaison psychiatry, Addenbrooke's Hospital.
- 2010–2010: ST4, rehabilitation and recovery team, Lucille van Geest Centre, Peterborough.

2010–2014	**Wellcome Trust fellow,** Brain Mapping Unit, Department of Psychiatry, University of Cambridge.

- 2012: Visiting fellow, Center for Computational Neuroscience & Neural Technology, Boston University.
- 2010: Visiting fellow, Gatsby Computational Neuroscience Unit, University College London.
- 2010–2011: Clinical research associate, University of Cambridge.

2007–2010	**Academic clinical fellow in psychiatry,** CPFT and University of Cambridge.

- 2010–2010: ST3, general adult psychiatry, intake and treatment team, Peterborough.
- 2009–2010: ST3, liaison psychiatry, Addenbrooke's Hospital.
- 2009–2009: ST2, child and adolescent psychiatry, Darwin Centre for Young People, Cambridge.
- 2008–2009: ST2, general adult psychiatry, Hinchingbrooke Hosp./Newtown Centre, Huntingdon.
- 2008–2008: ST1, old age psychiatry, Addenbrooke's & Fulbourn Hospitals.
- 2007–2008: Specialty registrar (ST1), general adult psychiatry, Fulbourn Hospital, Cambridge.

2005–2007 **Senior house officer (SHO) in medicine.**
- 2007–2007: Cardiology and acute general internal medicine, Addenbrooke's.
- 2006–2007: Respiratory medicine, Papworth Hospital, Cambridge (respiratory support and sleep centre; cystic fibrosis and lung defence service; pulmonary vascular diseases unit).
- 2006–2006: Geriatrics and acute general internal medicine, Addenbrooke's.
- 2005–2006: Hepatology and general internal medicine, Addenbrooke's.

2002–2005 **Lecturer in neuroscience,** Behavioural and Clinical Neuroscience Centre (later Institute) and Department of Experimental Psychology, University of Cambridge.

2001–2002 **House officer.**
- 2002–2002 (surgery): trauma and orthopaedic surgery, general surgery, and colorectal surgery; Norfolk & Norwich University Hospital, Norwich.
- 2001–2002 (medicine): general internal medicine, respiratory medicine, geriatrics, stroke medicine, and infectious diseases; Addenbrooke's Hospital, Cambridge.

1989–1996 **Systems support programmer** (1996), **programmer/systems manager** (1995), **computer assistant** (1994), **computer technician** (1992–3), South Kent College, Folkestone; **clerk** (1992), Saga Services Ltd, Folkestone; freelance **systems consultant** (1994–5) and **communications programmer** (1989–90), inc. for Mencap, South East Kent Doctors On Call Ltd, H. V. Wooding Ltd, Shepway Community Health Care Trust.

Education

1980–1985 Sandgate Primary School, Folkestone.

1985–1992 The Harvey Grammar School, Folkestone.

1993–2001 St John's College, Cambridge.

Prizes and distinctions

1994 & 1995 Wright Prize (for Medical & Veterinary Sciences), St John's College, Cambridge.

1996 Parke–Davis Prize for Neuroscience, University of Cambridge.

1996 Northcott Prize (for Neuroscience) and Hughes Year Prize, St John's College.

2001 Peter Brook Award for Psychiatric Research, University of Cambridge.

2001 College Prize (for Medicine), St John's College.

2002 British Psychological Society Award for Outstanding Doctoral Research Contributions to Psychology.

2003 Runner-up, international Eppendorf & *Science* Prize for Neurobiology.

2007 Ralph Noble Prize (for MD dissertation in psychiatry), University of Cambridge.

2007 Sir Lionel Whitby Medal & Prize (for MD of exceptional merit), University of Cambridge.

2011 Associate Fellow, British Psychological Society (AFBPsS).

2013 Fellow, Institute of Biomedical Science (FIBMS).

2014 Higher Psychiatric Trainee of the Year, Royal College of Psychiatrists.

2019– NHS Clinical Excellence Award.

2020 Fellow, Faculty of Clinical Informatics (FFCI).

2021 Fellow, Royal Society of Biology (FRSB).

2021 Fellow, Royal College of Psychiatrists (FRCPsych).

2023 Fellow, Royal College of Physicians (FRCP).

Publications

ⓘ *https://orcid.org/0000-0002-8751-5167*
PMID: PubMed identifier. DOI: digital object identifier. Underlined text: hyperlink. ▤ *Preprint/thesis link.*
† *indicates ≥100 citations (source: ISI);* ‡ *≥300 citations (ISI citation classic);* ♦ *≥1,000 citations.*
📷 *International popular press coverage.* ► *Additional impact.*

Books

1. **Cardinal RN,** Aitken MRF (2006). *ANOVA for the Behavioural Sciences Researcher.* Lawrence Erlbaum Associates, Mahwah, NJ, USA (later Routledge, later Psychology Press). DOI: 10.4324/9 780 203 763 933.

2. **Cardinal RN,** Bullmore ET (2011). *The Diagnosis of Psychosis.* Cambridge University Press, Cambridge, UK. DOI 10.1017/CBO9 780 511 686 917.

► World Health Organization core textbook for medical faculty libraries (WHO, 2013).

Peer-reviewed primary data papers and review articles

2000

1. Everitt BJ, **Cardinal RN,** Hall J, Parkinson JA, Robbins TW (2000). Differential involvement of amygdala subsystems in appetitive conditioning and drug addiction. Chapter 10 of Aggleton JP (ed.), *The amygdala: a functional analysis* (second edition), pp. 353–390. Oxford University Press, New York. ISBN 0 198 505 019.

† 2. Parkinson JA, **Cardinal RN,** Everitt BJ (2000). Limbic cortical-ventral striatal systems underlying appetitive conditioning. *Progress in Brain Research* 126: 263–285. PMID 11 105 652.

† 3. **Cardinal RN,** Robbins TW, Everitt BJ (2000). The effects of *d*-amphetamine, chlordiazepoxide, alpha-flupenthixol and behavioural manipulations on choice of signalled and unsignalled delayed reinforcement in rats. *Psychopharmacology* 152: 362–375. PMID 11 140 328.

2001

† 4. Rahman S, Sahakian BJ, **Cardinal RN,** Rogers RD, Robbins TW (2001). Decision-making and neuropsychiatry. *Trends in Cognitive Sciences* 5: 271–277. PMID 11 390 298.

📷 ‡ 5. **Cardinal RN,** Pennicott DR, Sugathapala CL, Robbins TW, Everitt BJ (2001). Impulsive choice induced in rats by lesions of the nucleus accumbens core. *Science* 292: 2499–2501. PMID 11 375 482.

† 6. Dalley JW, McGaughy J, O'Connell MT, **Cardinal RN,** Levita L, Robbins TW (2001). Distinct changes in cortical acetylcholine and noradrenaline efflux during contingent and non-contingent performance of a visual attentional task. *Journal of Neuroscience* 21: 4908–4914. PMID 11 425 918.

† 7. Di Ciano P, **Cardinal RN,** Cowell RA, Little SJ, Everitt BJ (2001). Differential involvement of NMDA, AMPA/kainate, and dopamine receptors in the nucleus accumbens core in the acquisition and performance of Pavlovian approach behavior. *Journal of Neuroscience* 21: 9471–9477. PMID 11 717 381.

2002

† 8. **Cardinal RN,** Parkinson JA, Lachenal G, Halkerston KM, Rudarakanchana N, Hall J, Morrison CH, Howes SR, Robbins TW, Everitt BJ (2002). Effects of selective excitotoxic lesions of the nucleus accumbens core, anterior cingulate cortex, and central nucleus of the amygdala on autoshaping performance in rats. *Behavioral Neuroscience* 116: 553–567. PMID 12 148 923.

◆ 9. **Cardinal RN,** Parkinson JA, Hall J, Everitt BJ (2002). Emotion and motivation: the role of the amygdala, ventral striatum, and prefrontal cortex. *Neuroscience and Biobehavioral Reviews* 26: 321–352. PMID 12 034 134.

10. **Cardinal RN,** Daw ND, Robbins TW, Everitt BJ (2002). Local analysis of behaviour in the adjusting-delay task for assessing choice of delayed reinforcement. *Neural Networks* 15: 617–634. PMID 12 371 516.

† 11. Parkinson JA, Dalley JW, **Cardinal RN,** Bamford A, Fenhert B, Lachenal G, Rudarakanchana N, Halkerston KM, Robbins TW, Everitt BJ (2002). Nucleus accumbens dopamine depletion impairs both acquisition and performance of appetitive Pavlovian approach behaviour: implications for mesoaccumbens dopamine function. *Behavioural Brain Research* 137: 149–163. PMID 12 445 721.

2003

12. **Cardinal RN,** Robbins TW, Everitt BJ (2003). Choosing delayed rewards: perspectives from learning theory, neurochemistry, and neuroanatomy. Chapter 6 of Vuchinich RE, Heather N (eds), *Choice, Behavioural Economics and Addiction*, pp. 183–213 and 217–218. Elsevier, Amsterdam. DOI 10.1016/B978-008 044 056-9/50 048-8.

† 13. Everitt BJ, **Cardinal RN,** Parkinson JA, Robbins TW (2003). Appetitive behavior: the impact of amygdala-dependent mechanisms of emotional learning. *Annals of the New York Academy of Sciences* 985: 233–250. PMID 12 724 162.

14. **Cardinal RN,** Parkinson JA, Djafari Marbini H, Toner AJ, Bussey TJ, Robbins TW, Everitt BJ (2003). Role of the anterior cingulate cortex in the control over behavior by Pavlovian conditioned stimuli in rats. *Behavioral Neuroscience* 117: 566–587. PMID 12 802 885.

15. **Cardinal RN,** Parkinson JA, Hall J, Everitt BJ (2003). The contribution of the amygdala, ventral striatum, and prefrontal cortex to emotion and motivated behaviour. *International Congress Series* 1250: 347–370. DOI 10.1016/S0531-5131(03)01 013-6. In: Ono T, Matsumoto G, Llinás RR, Berthoz A, Norgren R, Nishijo H, Tamura R (eds), *Cognition and Emotion in the Brain*. Elsevier, Amsterdam.

2004

† 16. **Cardinal RN,** Winstanley CA, Robbins TW, Everitt BJ (2004). Limbic corticostriatal systems and delayed reinforcement. *Annals of the New York Academy of Sciences* 1021: 33–50. PMID 15 251 872.

† 17. **Cardinal RN,** Everitt BJ (2004). Neural and psychological mechanisms underlying appetitive learning: links to drug addiction. *Current Opinion in Neurobiology* 14(2): 156–162. PMID 15 082 319.

‡ 18. Dalley JW, **Cardinal RN,** Robbins TW (2004). Prefrontal executive and cognitive functions in rodents: neural and neurochemical substrates. *Neuroscience and Biobehavioral Reviews* 28: 771–784. PMID 15 555 683.

‡ 19. Winstanley CA, Theobald DEH, **Cardinal RN,** Robbins TW (2004). Contrasting roles of basolateral amygdala and orbitofrontal cortex in impulsive choice. *Journal of Neuroscience* 24: 4718–4722. PMID 15 152 031.

† 20. Dalley JW, Theobald DE, Bouger P, Chudasama Y, **Cardinal RN,** Robbins TW (2004). Cortical cholinergic function and deficits in visual attentional performance in rats following 192 IgG-saporin-induced lesions of the medial prefrontal cortex. *Cerebral Cortex* 14: 922–932. PMID 15 084 496.

2005

21. **Cardinal RN,** Cheung THC (2005). Nucleus accumbens core lesions retard instrumental learning and performance with delayed reinforcement in the rat. *BMC Neuroscience* 6: 9. PMID 15 691 387.

22. Cheung THC, **Cardinal RN** (2005). Hippocampal lesions facilitate instrumental learning with delayed reinforcement but induce impulsive choice in rats. *BMC Neuroscience* 6: 36. PMID 15 892 889.

† 23. **Cardinal RN,** Howes NJ (2005). Effects of lesions of the nucleus accumbens core on choice between small certain rewards and large uncertain rewards in rats. *BMC Neuroscience* 6: 37. PMID 15 921 529.

† 24. Winstanley CA, Theobald DEH, Dalley JW, **Cardinal RN,** Robbins TW (2005). Double dissociation between serotonergic and dopaminergic modulation of medial prefrontal and orbitofrontal cortex during a test of impulsive choice. *Cerebral Cortex* 16: 106–114. PMID 15 829 733.

2006

25. Robbins TW, **Cardinal RN,** Di Ciano P, Halligan PWG, Hellemans KGC, Lee JCL, Everitt BJ (2006). Neuroscience of drugs and addiction. UK Office of Science and Technology *Foresight: Brain Science, Addiction and Drugs* project, 13 July 2005. Chapter 3 of Nutt D, Robbins TW, Stimson GV, Ince M, Jackson A (eds), *Drugs and the Future: Brain Science, Addiction and Society,* pp. 11–88. Academic Press, London, 2006. DOI 10.1016/B978-012 370 624-9/50 006-2.

† 26. **Cardinal RN** (2006). Neural systems implicated in delayed and probabilistic reinforcement. *Neural Networks* 19: 1277–1301. PMID 16 938 431.

► *Neural Networks* "Most Cited Article 2006–2010" award, Elsevier.

27. Chamberlain SR, Müller U, Deakin JB, Corlett PR, Dowson J, **Cardinal RN,** Aitken MRF, Robbins TW, Sahakian BJ (2006). Lack of deleterious effects of buspirone on cognition in healthy male volunteers. *Journal of Psychopharmacology* 21: 210–215. PMID 17 329 302.

2007

28. Zernig G, Ahmed SH, **Cardinal RN,** Morgan D, Acquas E, Foltin RW, Vezina P, Negus SS, Crespo JA, Stöckl P, Grubinger P, Madlung E, Haring C, Kurz M, Saria A (2007). Explaining the escalation of drug use in substance dependence: Models and appropriate animal laboratory tests. *Pharmacology* 80: 65–119. PMID 17 570 954.

2009

29. **Cardinal RN,** Gregory CA (2009). Osteomalacia and vitamin D deficiency in a psychiatric rehabilitation unit: case report and survey. *BMC Research Notes* 2: 82. PMID 19 426 538.

30. **Cardinal RN,** Shah DN, Edwards CJ, Hughes GRV, Fernández-Egea E (2009). Psychosis and catatonia as a first presentation of antiphospholipid syndrome. *British Journal of Psychiatry* 195: 272. PMID 19 721 128.

2010

31. **Cardinal RN** (2010). Analysis of variance. In: Weiner IB, Craighead WE (eds), *Corsini Encyclopedia of Psychology* (fourth edition), pp. 92–98. John Wiley & Sons, Hoboken, New Jersey. DOI 10.1002/9 780 470 479 216.corpsy0054.

32. **Cardinal RN,** Everitt BJ (2010). Neural systems of motivation. In: Koob GF, Thompson RF, Le Moal M (eds), *Encyclopedia of Behavioral Neuroscience*, volume 2, pp. 376–386. Elsevier/Academic Press, Oxford. DOI 10.1016/B978-0-08-045 396-5.00167-6.

† 33. **Cardinal RN,** Aitken MRF (2010). Whisker: a client–server high-performance multimedia research control system. *Behavior Research Methods* 42: 1059–1071. PMID 21 139 173.

2013

34. Gillan CM, Morein-Zamir S, Kasar M, Fineberg NA, Sule A, Sahakian BJ, **Cardinal RN,** Robbins TW (2013). Counterfactual processing of economic action–outcome alternatives in obsessive–compulsive disorder: Further evidence of impaired goal-directed behavior. *Biological Psychiatry* 75: 639–646. PMID 23 452 663.

2014

35. Clarke HF*, **Cardinal RN*,** Rygula R, Hong YT, Fryer TD, Sawiak SJ, Ferrari V, Cockcroft G, Aigbirhio FI, Robbins TW, Roberts AC (2014). Orbitofrontal dopamine depletion upregulates caudate dopamine and produces behavioral changes akin to schizophrenia. *Journal of Neuroscience* 34: 7663–7676. PMID 24 872 570. (*Joint first authors.)

36. Rygula R, Clarke HF, **Cardinal RN,** Cockroft GJ, Xia J, Roberts TW, Roberts AC (2014). Role of central serotonin in anticipation of rewarding or punishing outcomes: effects of selective amygdala or orbitofrontal 5-HT depletion. *Cerebral Cortex* 25: 3064–3076. PMID 24 879 752.

2015

37. Barker V, Romaniuk L, **Cardinal RN,** Pope M, Nicol K, Hall J (2015). Impulsivity in borderline personality disorder. *Psychological Medicine* 45: 1955–1964. PMID 25 600 066.

38. Brydges NM, Holmes MC, **Cardinal RN,** Harris AP, Hall J (2015). Early life stress produces compulsive-like behavior in females. *Behavioral Neuroscience* 129: 300–308. PMID 26 030 429.

39. Weed MR, Bookbinder M, Polino J, Keavy D, **Cardinal RN,** Simmermacher-Mayer J, Cometa FL, King D, Thangathirupathy S, Macor JE, Bristow LJ (2015). Negative allosteric modulators selective for the NR2b subtype of the NMDA receptor impairs cognition in multiple domains. *Neuropsychopharmacology* 41: 568–577. PMID 26 105 137.

40. **Cardinal RN,** Savulich G, Mann LM, Fernández-Egea E (2015). Association between antipsychotic/antidepressant drug treatments and hospital admissions in schizophrenia assessed using a mental health case register. *npj Schizophrenia* 1: 15 035. PMID 27 336 041.

2017

41. **Cardinal RN** (2017). Clinical records anonymisation and text extraction (CRATE): an open-source software system. *BMC Medical Informatics and Decision Making* 17: 50. PMID 28 441 940.

42. Wallis CU, **Cardinal RN,** Alexander L, Roberts AC, Clarke HF (2017). Opposing roles of primate areas 25 and 32 and their putative rodent homologs in the regulation of negative emotion. *Proceedings of the National Academy of Sciences of the USA* 114: E4075–E4084. PMID 28 461 477.

43. Giuliano C, Peña-Oliver Y, Goodlett CR, **Cardinal RN,** Robbins TW, Bullmore ET, Belin D, Everitt BJ (2017). Evidence for a long-lasting compulsive alcohol seeking phenotype in rats. *Neuropsychopharmacology* 43: 728–738. PMID 28 553 834.

44. Price AC, Farooq R, Yuan J-M, Menon VB, **Cardinal RN,** O'Brien JT (2017). Mortality in dementia with Lewy bodies compared to Alzheimer's dementia: a retrospective naturalistic cohort study. *BMJ Open* 7: e017 504. PMID 29 101 136.

2018

45. O'Callaghan C, Vaghi MM, Brummerloh B, **Cardinal RN,** Robbins TW (2018). Impaired awareness of action–outcome contingency and causality during healthy ageing and following ventromedial prefrontal cortex lesions. *Neuropsychologia* 128: 282–289. PMID 29 355 648.

46. Osimo EF, **Cardinal RN,** Jones PB, Khandaker GM (2018). Prevalence and correlates of low-grade systemic inflammation in adult psychiatric inpatients: an electronic health record-based study. *Psychoneuroendocrinology* 91: 226–234. PMID 29 544 672.

47. Skandali N, Rowe J, Voon V, Deakin JB, **Cardinal RN,** Cormack F, Regenthal R, Chamberlain SR, Robbins TW, Sahakian BJ (2018). Dissociable effects of acute SSRI (escitalopram) administration on executive, learning and emotional functions in healthy humans. *Neuropsychopharmacology* 43: 2645–2651. PMID 30 305 705.

48. Jalal B, Bruhl A, O'Callaghan C, Piercy T, **Cardinal RN,** Ramachandran VS, Sahakian BJ (2018). Novel smartphone interventions improve cognitive function and obsessive–compulsive disorder symptoms in individuals with contamination fears. *Scientific Reports* 8: 14 923. PMID 30 353 111.

49. Vaghi MM, **Cardinal RN,** Apergis-Schoute AM, Fineberg NA, Sule A, Robbins TW (2018). Action–outcome knowledge dissociates from behavior in obsessive–compulsive disorder following contingency degradation. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging* 4: 200–209. PMID 30 545 754.

2019

50. Zeredo JL, Leung SKQ, Wallis CU, Alexander L, Cockcroft G, Santangelo AM, Xia J, Shiba Y, Dalley JW, **Cardinal RN,** Roberts AC, Clarke HF (2019). Glutamate within the marmoset anterior hippocampus interacts with area 25 to regulate the behavioral and cardiovascular correlates of high-trait anxiety. *Journal of Neuroscience* 39: 3094–3107. PMID 30 718 320.

51. Moylett S, Price AC, **Cardinal RN,** Aarsland D, Mueller C, Stewart R, O'Brien JT (2019). Clinical presentation, diagnostic features, and mortality in dementia with Lewy bodies. *Journal of Alzheimer's Disease* 67: 995–1005. PMID 30 776 008. [Open Access DOI 10.17863/CAM.37481.]

52. Wallis CU, Cockcroft GJ, **Cardinal RN,** Roberts AC, Clarke HF (2019). Hippocampal interaction with area 25, but not area 32, regulates marmoset approach–avoidance behavior. *Cerebral Cortex* 29: 4818–4830. PMID 30 796 800.

53. Alsiö J, Phillips BU, Sala Bayo J, Nilsson SRO, Calafat-Pla TC, Rizwand A, Plumbridge J, López-Cruz L, Dalley JW, **Cardinal RN,** Mar AC, Robbins TW (2019). Dopamine D2-like receptor stimulation selectively blocks negative feedback in visual and spatial reversal learning in the rat: behavioural and computational evidence. *Psychopharmacology* 236: 2307–2323. PMID 31 218 428.

54. Robbins TW, **Cardinal RN** (2019). Computational psychopharmacology: a translational and pragmatic approach. *Psychopharmacology* 236: 2295–2305. PMID 31 273 400.

55. Kanen JW, Ersche KD, Fineberg NA, Robbins TW, **Cardinal RN** (2019). Computational modelling reveals contrasting effects on reinforcement learning and cognitive flexibility in stimulant dependence and obsessive–compulsive disorder: remediating effects of dopaminergic D2/3 receptor agents. *Psychopharmacology* 236: 2337–2358. PMID 31 324 936.

56. Lim TV, **Cardinal RN,** Savulich GJ, Moustafa AA, Robbins TW, Ersche KD (2019). Impairments in reinforcement learning do not explain enhanced habit formation in cocaine use disorder. *Psychopharmacology* 236: 2359–2371. PMID 31 372 665.

2020

57. Fernández-Egea E, Walker R, Ziauddeen H, **Cardinal RN,** Bullmore ET (2020). Birth weight, family history of diabetes and diabetes onset in schizophrenia. *BMJ Open Diabetes Research & Care* 8: e001 036. PMID 32 049 635.

58. Kanen JW, Arntz FE, Yellowlees R, **Cardinal RN,** Price AC, Christmas DM, Sahakian BJ, Apergis-Schoute AM, Robbins TW (2020). Probabilistic reversal learning under acute tryptophan depletion in healthy humans: a conventional analysis. *Journal of Psychopharmacology* 34: 580–583. PMID 32 066 325.

59. Ive J, Viani N, Kam J, Yin L, Verma S, Puntis S, **Cardinal RN,** Roberts A, Stewart R, Velupillai S (2020). Generation and evaluation of artificial mental health records for natural language processing. *npj Digital Medicine* 3: 69. PMID 32 435 697.

60. Rose E*, Chen S*, Turrion C, Jenkins C, **Cardinal RN,** Fernández-Egea E (2020). Causes of death in clozapine-treated patients in a catchment area: a 10-year retrospective case-control study. *European Neuropsychopharmacology* 36: 160–166. PMID 32 546 415. (*Joint first authors.) [Open Access DOI 10.17863/CAM.52877.]

61. Osimo EF, Perry BI, **Cardinal RN,** Lynall M-E, Lewis JR, Kudchadkar A, Murray G, Perez J, Jones PB, Khandaker GM (2020). Inflammatory and cardiometabolic markers at presentation with first episode psychosis and long-term clinical outcomes: a longitudinal study using electronic health records. *Brain, Behavior, and Immunity* 91: 117–127. PMID 32 950 620.

62. Chen S, Jones PB, Underwood BR, Moore A, Bullmore ET, Banerjee S, Osimo EF, Deakin JB, Hatfield CF, Thompson FJ, Artingstall JD, Slann MP, Lewis JR, **Cardinal RN** (2020). The early impact of COVID-19 on mental health and community physical health services and their patients' mortality in Cambridgeshire and Peterborough, UK. *Journal of Psychiatric Research* 131: 244–254. PMID 33 035 957. 🗎

63. Wang Z, Ive J, Moylett S, Mueller C, **Cardinal RN**, Velupillai S, O'Brien J, Stewart R (2020). Distinguishing between dementia with Lewy bodies (DLB) and Alzheimer's disease (AD) using mental health records: a classification approach. In: Rumshishky A, Roberts K, Bethard S, Naumann T (eds.), *Proceedings of the 3rd Clinical Natural Language Processing Workshop*, pp. 168–177. DOI 10.18653/v1/2020.clinicalnlp-1.19.

64. Kershenbaum AD, **Cardinal RN,** Chen S, Underwood B, Seyedsalehi A, Lewis JR, Rubinsztein JS (2020). Investigation of risk of dementia diagnosis and death in patients in older people's secondary care mental health services. *International Journal of Geriatric Psychiatry* 36: 573–582. PMID 33 113 255.

65. Chen S, She R, Qin P, Kershenbaum AD, Fernández-Egea E, Nelder JR, Ma C, Lewis JR, Wang C, **Cardinal RN** (2020). The medium-term impact of COVID-19 lockdown on referrals to secondary care mental health services: a controlled interrupted time series study. *Frontiers in Psychiatry* 11: 585 915. PMID 33 324 258.

2021

66. Kanen JW, Arntz FE, Yellowlees R, Price AC, Christmas DM, Apergis-Schoute AM, Sahakian BJ, **Cardinal RN,** Robbins TW (2021). Effect of tryptophan depletion on conditioned threat memory expression: role of intolerance of uncertainty. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging* 6: 590–598. PMID 33 631 385. 🗎

67. Bhardwaj A, Moore A, **Cardinal RN,** Bradley C, Cross L, Ford TJ (2021). Survey of CAMHS clinicians about their experience of remote working: brief report. *BJPsych Open* 7: e34. PMID 33 436 136.

68. Kanen JW, Arntz FE, Yellowlees R, **Cardinal RN,** Price AC, Christmas DM, Apergis-Schoute AM, Sahakian BJ, Robbins TW (2021). Serotonin depletion amplifies distinct human social emotions as a function of individual differences in personality. *Translational Psychiatry* 11: 81. PMID 33 518 708. 🗎

69. **Cardinal RN,** Meiser-Stedman CE, Christmas DM, Price AC, Denman C, Underwood BR, Chen S, Banerjee S, White SR, Su L, Ford TJ, Chamberlain SR, Walsh CM (2021). Simulating a community mental health service during the COVID-19 pandemic: effects of clinician–clinician encounters, clinician–patient–family encounters, symptom-triggered protective behaviour, and household clustering. *Frontiers in Psychiatry* 12: 620 842. PMID 33 716 821. 🗎

70. Alabaf S, Kirkpatrick B, Chen S, **Cardinal RN,** Fernández-Egea E (2021). Early versus late risk factors for deficit and nondeficit schizophrenia. *Revista de Psiquiatría y Salud Mental* 15: 38–46. PMID 33 813 046. [Open Access DOI 10.17863/CAM.66921.]

71. Giuliano C, Puaud M, **Cardinal RN,** Belin D*, Everitt BJ* (2021). Individual differences in the engagement of

habitual control over alcohol seeking predicts the development of compulsive alcohol seeking and drinking. *Addiction Biology* 26: e13 041. PMID 33 955 649. (*Joint last authors.*) 🗎

72. Bakolis I, Stewart R, Baldwin DS, Beestock J, Bibby P, Broadbent M, **Cardinal RN,** Chen S, Chinnasamy K, Cipriani A, Douglas S, Horner P, Jackson C, John A, Joyce DW, Lee SC, Lewis JR, McIntosh A, Nixon N, Osborn DPJ, Phiri P, Rathod S, Smith T, Sokal R, Waller R, Landau S (2021). Changes in daily mental health service use and mortality at the commencement and lifting of COVID-19 'lockdown' policy in ten UK sites: a regression discontinuity in time design. *BMJ Open* 11: e049 721. PMID 34 039 579.

73. Burrin C, Daniels NF, **Cardinal RN,** Hayhurst C, Christmas D, Zimbron J (2021). Iatrogenic complications of compulsory treatment in a patient with personality disorder and self-harm. *Case Reports in Psychiatry* 2021: 6 615 723. PMID 34 136 300.

74. Fernández-Egea E, Chen S, Jenkins C, Turrion C, Mitchell SP, Dodwell DJF, Mann LM, Deakin JB, Syed ZH, Hafizi S, Zimbron J, Praseedom AS, **Cardinal RN** (2021). The effect of clozapine on self-reported duration of sleep and its interaction with other medications: a 5-year naturalistic study. *Journal of Clinical Psychopharmacology* 41: 534–539. PMID 34 519 455. [Open Access DOI 10.17863/CAM.66742.]

75. Duan LY, Horst NK, Cranmore SAW, Horiguchi N, **Cardinal RN,** Roberts AC, Robbins TW (2021). Controlling one's world: identification of sub-regions of primate PFC underlying goal-directed behaviour. *Neuron* 109: 2485–2498. PMID 34 171 290. 🗎
    ► Comment: PMID 34 352 212.

76. Lim TV, **Cardinal RN,** Bullmore ET, Robbins TW, Ersche KD (2021). Impaired learning from negative feedback in stimulant use disorder: dopaminergic modulation. *International Journal of Neuropsychopharmacology* 24: 867–878. PMID 34 197 589.

77. Chen S, Jones PB, Underwood BR, Fernández-Egea E, Qin P, Lewis JR, **Cardinal RN** (2021). Risk factors for excess deaths during lockdown among older users of secondary care mental health services without confirmed COVID-19: A retrospective cohort study. *International Journal of Geriatric Psychiatry* 36: 1899–1907. PMID 34 382 242. 🗎

78. Kanen JW, Apergis-Schoute AM, Yellowlees R, Arntz FE, van der Flier FE, Price AC, **Cardinal RN,** Christmas DM, Clark L, Sahakian BJ, Crockett MJ, Robbins TW (2021). Serotonin depletion impairs both Pavlovian and instrumental reversal learning in healthy humans. *Molecular Psychiatry* 26: 7200–7210. PMID 34 429 517. 🗎

79. Chen S, **Cardinal RN** (2021). Accessibility and efficiency of mental health services, United Kingdom of Great Britain and Northern Ireland. *Bulletin of the World Health Organization* 99: 674–679. PMID 34 475 604.

80. Chen S, Fernández-Egea E, Jones PB, Lewis JR, **Cardinal RN** (2021). Longer-term mortality following SARS-CoV-2 infection in patients with severe mental illness: a retrospective case-matched study. *BJPsych Open* 7: e201. PMID 34 745 650.

81. Chen S, Aruldass AR, **Cardinal RN** (2021). Mental health outcomes after SARS-CoV-2 vaccination in the United States: a national cross-sectional study. *Journal of Affective Disorders* 298: 396–399. PMID 34 774 648.

82. **Cardinal RN,** Burchell M (2021). The Cambridge cognitive and psychiatric assessment kit (CamCOPS): a secure open-source client–server system for mobile research and clinical data capture. *Frontiers in Psychiatry* 12: 578 298. PMID 34 867 492.

83. Banerjee S, Liò P, Jones PB, **Cardinal RN** (2021). A class-contrastive human-interpretable machine learning approach to predict mortality in severe mental illnesses. *npj Schizophrenia* 7: 60. PMID 34 880 262. 🗎

2022

84. Parkin K, Chen S, Biria M, Plaistow J, Beckwith H, Jarratt-Barnham I, Segarra N, Worbe Y, Fineberg NA, **Cardinal RN,** Robbins TW, Fernández-Egea E (2022). Clozapine-related obsessive–compulsive symptoms and their impact on wellbeing: a naturalistic longitudinal study. *Psychological Medicine* 53: 2936–2945. PMID 35 469 587. 🗎

85. Chen S, Jones LA, Jiang S, Jin H, Dong D, Chen X, Wang D, Zhang Y, Xiang L, Zhu A, **Cardinal RN** (2022). Difficulty and help with activities of daily living among older adults living alone during the COVID-19 pandemic: a multi-country population-based study. *BMJ Geriatrics* 22: 181. PMID 35 246 064.

📷 86. Chen S, Underwood BR, Jones PB, Lewis JR, **Cardinal RN** (2022). Association between lithium use and the incidence of dementia and its subtypes: a retrospective cohort study. *PLOS Medicine* 19: e1 003 941. PMID 35 298 477.

87. Chen S, Ford TJ, Jones PB, **Cardinal RN** (2022). Prevalence, progress, and subgroup disparities in pharmacological antidepressant treatment of those who screen positive for depressive disorders: a repetitive cross-sectional study in 19 European countries. *The Lancet Regional Health—Europe* 17: 100 368. PMID 35 373 171.

88. Jones LA, Nelder JR, Fryer JM, Alsop PH, Geary MR, Prince M, **Cardinal RN** (2022). Public opinion on sharing data from health services for clinical and research purposes without explicit consent: an anonymous online survey in the UK. *BMJ Open* 12: e057 579. PMID 35 477 868. 🗎

89. Banerjee S, Alsop PH, Jones LA, **Cardinal RN** (2022). Patient and public involvement to build trust in artificial intelligence: a framework, tools, and case studies. *Patterns* 3: 100506. PMID 35755870.

90. Osimo EF, Lewis JR, **Cardinal RN*,** Khandaker GM* (2022). Clozapine treatment and risk of COVID-19. *BJPsych Open* 8: e141. PMID 35815763. (*Joint last authors.)

91. Patel R, Wickersham M, Jackson RG, **Cardinal RN,** Fusar-Poli P, Correll CU (2022). Natural language processing: unlocking the potential of electronic health record data to support transdiagnostic psychiatric research. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging.* PMID 36089285.

92. Kanen JW, Luo Q, Rostami Kandroodi M, **Cardinal RN,** Nutt DJ, Robbins TW, Carhart-Harris RL, den Ouden HEM (2022). Effect of lysergic acid diethylamide (LSD) on reinforcement learning in humans. *Psychological Medicine.* PMID 36411719. 🗎

93. Chen S, Price AC, **Cardinal RN,** Moylett S, Kershenbaum AD, Fitzgerald J, Mueller C, Stewart R, O'Brien JT (2022). Association between antidementia medication use and mortality in people diagnosed with dementia with Lewy bodies in the UK: a retrospective cohort study. *PLOS Medicine* 19: e1004124. PMID 36472984.

2023

94. Wolpe N, Chen S, Kirkpatrick B, Jones PB, Jenkins C, **Cardinal RN,** Fernández-Egea E (2023). Longitudinal effect of clozapine-associated sedation on motivation in schizophrenia: naturalistic longitudinal study. *British Journal of Psychiatry* 223: 295–297. PMID 36624935.

> ► Comment: PMID 37424201. Authors' reply: PMID 37424199.

95. Osimo EF, Perry BI, Mallikarjun P, Pritchard M, Lewis J, Katunda A, Murray G, Perez J, Jones PB, **Cardinal RN,** Howes OD, Upthegrove R, Khandaker GM (2023). Predicting treatment resistance from first-episode psychosis using routinely collected clinical information. *Nature Mental Health* 1: 25–35. PMID 37034013. 🗎

📷 96. Langley C, Armand S, Luo Q, Savulich G, Segerberg T, Søndergaard A, Pedersen EB, Svart N, Overgaard-Hansen O, Johansen A, Borgsted C, **Cardinal RN,** Robbins TW, Stenbæk DS, Knudsen GM, Sahakian BJ (2023). Chronic escitalopram in healthy volunteers has specific effects on reinforcement sensitivity: a double-blind, placebo-controlled semi-randomised study. *Neuropsychopharmacology* 48: 664–670. PMID 36683090.

97. Chen S, **Cardinal RN,** Gräf S, O'Brien JT, Underwood BR (2023). Risk factors for longer-term mortality in discharged patients with dementia and SARS-CoV-2 infection: a matched case–control study. *Journal of Alzheimer's Disease* 92: 295–309. PMID 36744344.

98. Hannah LA, Walsh CM, Perez J, Jopling L, **Cardinal RN,** Cameron R (2023). Economic evaluation of interventions for treatment-resistant depression: a systematic review. *Frontiers in Psychiatry* 14: 1056210. PMID 36873195.

99. Chen S, Zhang H, Underwood BR, Wang D, Chen X, **Cardinal RN** (2023). Trends in gender and racial/ethnic disparities in physical disability and social support among US older adults with cognitive impairment living alone, 2000–2018. *Innovation in Aging* 7: igad028. PMID 37223006.

100. **Cardinal RN,** Moore A, Burchell M, Lewis JR (2023). De-identified Bayesian personal identity matching for privacy-preserving record linkage despite errors: development and validation. *BMC Medical Informatics and Decision Making* 23: 85. PMID 37147600. 🗎

101. Kershenbaum AD, Price AC, **Cardinal RN,** Chen S, Fitzgerald JM, Lewis J, Moylett S, O'Brien JT (2023). Mortality rates and proximal causes of death in patients with Lewy body dementia versus Alzheimer's disease: longitudinal study using secondary care mental health records. *International Journal of Geriatric Psychiatry* 38: e5937. PMID 37208979.

In press

in press   Apergis-Schoute AM, van der Flier FE, Ip HYS, Kanen JW, Vaghi MM, Fineberg NA, Sahakian BJ, **Cardinal RN,** Robbins TW (in press). Perseveration and shifting in obsessive–compulsive disorder as a function of uncertainty, punishment, and serotonergic medication. *Biological Psychiatry: Global Open Science.* DOI: 10.1016/j.bpsgos.2023.06.004.

in press   **Cardinal RN** (in press). Basic techniques in neuroscience. In Lynall ME, Jones PB, Stahl SM (eds), *Cambridge Textbook of Neuroscience for Psychiatrists.* Cambridge University Press.

Dissertations

1996   **Cardinal RN** (1996). *Disruption of latent inhibition and perceptual learning.* Neuroscience Part II project, Department of Experimental Psychology, University of Cambridge. Supervisors: Claire H. Bennett, Nicholas J. Mackintosh.

2001   **Cardinal RN** (2001). *Neuropsychology of reinforcement processes in the rat.* PhD thesis, University of Cambridge. DOI 10.17863/CAM.16462. Supervisor: Barry J. Everitt. Co-supervisor: Trevor W. Robbins. Examiners: Nicholas J. Mackintosh, Dai N. Stephens.

2006	**Cardinal RN** (2006). *Neural systems involved in delay and risk assessment in the rat.* MD thesis, University of Cambridge. DOI 10.17863/CAM.16465. Unsupervised. Examiners: Susan D. Iversen, Dai N. Stephens.

Software for research and clinical practice: major packages

1997–	**Cardinal RN.** *Assorted open-source code* at pobox.com/~rudolf and github.com/RudolfCardinal.
2000–	**Cardinal RN,** Aitken MRF. *Whisker.* Behavioural research control software. See www.whiskercontrol.com and PMID 21 139 173.
	▶ To 2011, used in >180 primary data papers and by 27 academic institutions across Europe and North America, 6 government agencies (in China, Israel, Singapore, UK, and the USA), and >16 commercial entities including 6 of the largest 12 pharmaceutical companies worldwide.
2000–	**Cardinal RN.** Behavioural clients for Whisker, including *MonkeyCantab.* See www.whiskercontrol.com.
2013–	**Cardinal RN,** Burchell M. *CamCOPS: the Cambridge Cognitive and Psychiatric Assessment Kit.* Open-source secure cross-platform software for cognitive and psychiatric assessment. See camcops.readthedocs.io and PMID 34 867 492.
2015–	**Cardinal RN.** *CRATE: clinical records anonymisation and text extraction.* Open-source cross-platform pipeline supporting anonymisation/de-identification, data linkage, a natural language processing framework, clinical and research query tools, and consent-to-contact management. See crateanon.readthedocs.io and PMID 28 441 940.

Other publications, except abstracts

1998	**Cardinal RN** (1998). Hooked on hash? *Cambridge Medicine.*
2003	**Cardinal RN** (2003). Succumbing to instant gratification without the nucleus accumbens. Finalist review essay for Eppendorf & *Science* Prize for Neurobiology, 2003. *Science* Online, cited in: *Science* 302: 801, via https://www.sciencemag.org/site/feature/data/prizes/eppendorf/2003/2003winners.xhtml.
2004	**Cardinal RN** (2004). Waiting for better things. *The Psychologist* 17: 684–687.
2005	**Cardinal RN** (2005). Animal testing. *The Times,* 1 September 2005, p. 18.
2005	**Cardinal RN** (2005). Power to detect reduction in mortality [Rapid Response]. *BMJ,* 4 September 2005; response to DOI 10.1136/bmj.331.7515.468.
2008	**Cardinal RN** (2008). Calculation of cost-effectiveness of resident medical cover for psychiatric hospitals [Rapid Response]. *BMJ,* 24 August 2008; response to DOI 10.1136/bmj.39541.443611.80.
2012	**Cardinal RN** (2012). Book review. "Case Studies: Stahl's Essential Psychopharmacology" by Stephen M. Stahl. *Acta Psychiatrica Scandinavica* 125: 504. DOI 10.1111/j.1600-0447.2012.01856.x.
2013	**Cardinal RN** (2013). Steroid-induced psychosis. *Crohn's and Colitis UK* newsletter, summer: 7.

Funding

Past

1997–2000	James Baird award, University of Cambridge School of Clinical Medicine.
1997–2000	**PhD studentship:** UK Medical Research Council (MRC) research studentship.
2002–2007	**Lectureship:** UK MRC Lectureship in Neuroscience (Behavioural and Clinical Neuroscience Centre/Institute; taken until 2005).
2007–2010	**Fellowship:** UK NHS National Institute for Health Research (NIHR) Academic Clinical Fellowship in Psychiatry (ACF-2007-14-006).
2010–2014	**Fellowship:** Wellcome Trust (WT) Postdoctoral Fellowship for MB/PhD Graduates (091 998/Z/10/Z). *Developing models of thalamocortical unsupervised attentional selection and competitive learning.* £194k.
2010–2015	Faculty: MRC/WT Behavioural and Clinical Neuroscience Institute (principal investigators [PIs]: Trevor W. Robbins & Edward T. Bullmore; MRC G1 000 183, WT 093 875/Z/10/Z). £5M. [Dimensions]
2014–2021	Collaborator: WT Senior Investigator Award in Biomedical Science (PI: Trevor W. Robbins, 104 631/Z/14/Z). *Fronto-striatal systems in impulsive–compulsive disorders.* £2.9M.
2016–2021	Collaborator: WT Investigator Award in Biomedical Science (PI: Angela C. Roberts; 108 089/Z/15/Z). *Fractionating the functions of primate ventromedial prefrontal cortex of relevance to depression.* £2M. [Dimensions]
2017–2022	Collaborator: Alzheimer's Society Project Grant (PI: John T. O'Brien; 326/AS-PG-16-006). *Using medical records to diagnose dementia with Lewy bodies.* £399k.
2018–2019	**Co-investigator:** UK Engineering and Physical Sciences Research Council (EPSRC) Healtex award (PI: Julia Ive). *Towards shareable data in clinical natural language processing: generating synthetic electronic health records.* £25k.

2018–2021   **Principal investigator:** MRC Mental Health Data Pathfinder award (University of Cambridge, CPFT; MC_PC_17 213). £1.5M. [Dimensions]

2019–2020   **Co-investigator:** EPSRC Healtex award (PI: Natalia Viani). *Modelling and extracting disease progression from multiple patient documents: a study of psychosis symptom trajectories.* £20k.

2020–2021   **Co-investigator:** MRC, UK Arts and Humanities Research Council (AHRC), and UK Economic and Social Research Council (ESRC) "Adolescence, Mental Health and the Developing Mind" Engagement Award (PI: Anna Moore; MR/T046 430/1). *Towards early identification of adolescent mental health problems (TIMELY).* £101k. [Dimensions]

2021–2021   **Principal investigator:** NIHR Cambridge Biomedical Research Centre (BRC) project (part of BRC-1215-20 014). *Development of CamCOPS/CRATE for broader clinical/research use.* £23k.

2021–2021   **Principal investigator:** NIHR Cambridge BRC project (part of BRC-1215-20 014). *Patient/public involvement for underrepresented views on data use and for Cambridge BRC data linkage.* £19k.

2021–2021   **Principal investigator:** CPFT Research & Development Strategic Funding award. *Improving mental health data use through patient/public involvement and software development.* £20k.

2021–2022   **Co-investigator:** NIHR Artificial Intelligence for Multiple Long-Term Conditions award (PIs: Deepti Gurdasani & Golam M. Khandaker; NIHR202 646). *Using deep learning approaches to examine serious mental illness and physical multimorbidity across the life-course: from mechanisms towards novel interventions.* £117k.

2021–2022   **Co-investigator:** EPSRC/Alan Turing Institute "Towards Turing 2" grant (PI: Anna Moore; T2-15). *TIMELY: towards early identification of child and adolescent mental health problems.* £251k.

2022–2022   **Co-investigator:** MRC/HDR UK Data and Analytics Research Environments (DARE) UK Sprint Exemplar grant (PI: Anna Moore; MC_PC_21 025). *FAIR TREATMENT: Federated analytics and AI Research across TREs [trusted research environments] for AdolescenT MENTal health.* £343k.

Current

2020–2024   Collaborator: MRC Research Grant (PI: Hannah F. Clarke, MR/T033 967/1). *Non-human primate investigations into hippocampal–prefrontal interactions and cognitive dysfunction of relevance to schizophrenia.* £1M.

2021–2024   **Co-investigator:** MRC/Health Data Research UK (HDR UK) Mental Health Data Hub (PI: Ann John; MR/W014 386/1). *DATAMIND—Data Hub for Mental Health Informatics Research Development.* £2M. [Dimensions]

2021–2026   Collaborator: MRC Programme Grant (PI: Angela C. Roberts; MR/V033 492/1). *Psychological, pharmacological and developmental insights into the prefrontal circuits underlying threat regulation and negative bias in marmosets.* £2.6M.

2022–2027   Collaborator: WT Investigator Award (PI: Angela C. Roberts; 224 432/Z/21/Z). *Functional heterogeneity in the prefrontal cortex of adult and developing marmosets: insight into the individual variation in depression and its symptoms.* £2.6M.

2022–2026   **Co-investigator:** NIHR Health Services and Delivery Research Programme grant (PI: Robbie Duschinsky; NIHR134 922). *What CAMHS interventions predict positive outcomes for which young people with a social worker: a mixed-methods study of clinical support and cost-effectiveness utilising linked operational data. [Or: CAMHS (Child and Adolescent Mental Health Services) Referrals and Outcomes for Adolescents and Children with Social Workers (COACHES).]* £1.3M.

2022–2027   Mental Health Theme deputy lead: NIHR Cambridge Biomedical Research Centre (PI: Miles Parkes, NIHR203 312), £86.2M (mental health component £1.72M).

Research supervision

Undergrad.   Undergraduate (Part II) research projects:
- 1999–2000: David R. Pennicott[1], C. Lakmali Sugathapala[1]. *Role of anterior cingulate cortex in choice involving delayed reinforcement.*
- 1999–2000: Andrew J. Toner[1,ORCID], Hosnieh Djafari-Marbini[1]. *Role of anterior cingulate cortex in Pavlovian conditioning.*
- 2002–2003: Laura C.E. Sorensen[1], Aidyn Kussainov[1], Shahzad M. Alikhan[1], Rosemary A.B. Marsh[1]. *Effects of buspirone on human cognition.*
- 2002–2003: Timothy H.C. Cheung[1,ORCID]. *Effect of nucleus accumbens core lesions on free-operant learning with delayed reinforcement.*
- 2003–2004: Minh L. Lam[1], Ranbir S. Sandhu[1]. *Effects of guanfacine on human cognition.*
- 2003–2004: Nathan J. Howes[1]. *Effects of nucleus accumbens core lesions on choice involving uncertain reward.*
- 2004–2005: Christopher Burnie[1], Louis G.S. Verdi[1], Steven T. Romans[1]. *Developing an audiovisual intradimensional/extradimensional set-shifting task for the rat.*

Clinical medical student research projects:
- 2022–: Mc Stephen Padilla[7]. *Association between psychotropic drug treatments and use of urgent/*

	emergency/inpatient care in emotionally unstable personality disorder: retrospective study using a mental health case register.
Master's	Master's degrees by research, or equivalent:
	• 1999, Maîtrise: Guillaume Lachenal[1,4]. *Effect of limbic lesions on autoshaping performance.*
	• 2003–2004, MPhil: Timothy H.C. Cheung[1,ORCID]. *Contributions of the ventral striatum and the hippocampus to the processing of delayed reinforcement in the rat.*
	• 2020–2021, MPhil (as advisor): Lukas Cincikas[2]. *Decision-making in substance use disorders.* Principal supervisor: Karen Ersche[2,ORCID].
RA/ACF	Predoctoral research assistant (RA), pre/postdoctoral Academic Clinical Fellow (ACF), or equivalent level:
	• 2018–2020: Anne Kershenbaum[3,ORCID] (ACF).
	• 2022–, Laura Hannah[3,ORCID].
	• 2023–, Laura Angco (Applied Research Collaboration [ARC] East of England Research Fellow).
PhD	Doctoral students:
	• 2003–2006, PhD (as advisor): Sanne de Wit[1,ORCID]. *Resolution of conflict between goal-directed actions.* Supervisor: Anthony Dickinson.[1]
	• 2015–2020, PhD (as computational co-supervisor): Jonathan W. Kanen[1,ORCID]. *Neurochemical modulation of affective and behavioural control: Models and applications for psychiatry.* 🗎 Principal supervisor: Trevor Robbins[1,ORCID].
	• 2017–2022, PhD (as advisor): Tsen Vei Lim[2,ORCID]. *The desconstruction of reinforcement learning in human substance use disorder.* 🗎 Principal supervisor: Karen Ersche[2,ORCID].
	• 2017–2022, PhD (as clinical supervisor): Emma Rocheteau[2,5,ORCID]. *Representation learning for patients in the intensive care unit.* 🗎 Principal supervisor: Pietro Liò[5,ORCID].
	• 2022–, PhD (as advisor): Ariadna Garcia-Vergara.[6] Principal supervisor: Angela Roberts[6,ORCID].
Postdoc	Postdoctoral research associates/equivalent:
	• 2017–2020: Sinéad Moylett[2,ORCID,*].
	• 2018–2020: Soumya Banerjee[2,ORCID].
	• 2018–2021: Joel Parkinson[2,ORCID,*].
	• 2018–2021: Kristel Klaus[2,8,ORCID,*].
	• 2019–2020: Samantha Ip[2].
	• 2019–2021: Shanquan Chen[2,ORCID].
	• 2019–: Christelle Langley[2,ORCID,*].
Other	Other research staff:
	• 2013–: Jonathan Lewis[3,ORCID], research database manager.
	• 2018–: Linda Jones[2,ORCID], patient and public involvement lead.
	• 2018–2019: Francesca Spivack[2], software developer.
	• 2018–2019: Joe Kearney[2], software developer.
	• 2018–2020: Jenny Nelder[2], research project manager.
	• 2019–: Martin Burchell[2,ORCID], software developer.
Mentoring	Mentoring:
	• 2019–: Anna Moore[2,3,ORCID], academic clinical lecturer.

With others. [1]Department of Psychology, University of Cambridge (UCam). [2]Department of Psychiatry, UCam. [3]Cambridgeshire and Peterborough NHS Foundation Trust. [4]École Normale Supérieure, Paris. [5]Computer Laboratory, UCam. [6]Department of Physiology, Development and Neuroscience, UCam. [7]Clinical School, UCam. [8]MRC Cognition and Brain Sciences Unit, Department of Psychiatry, UCam.

External invited lectures and talks (accepted); public engagement

2002	*Choosing delayed rewards: perspectives from learning theory, neurochemistry, and neuroanatomy. Choice, Behavioral Economics and Addiction.* Birmingham, Alabama, USA, 15–17 March 2002.
2003	*The Anatomical Basis of Desire and Addiction.* British Neuropsychiatry Association Annual Meeting; London, UK, 14 February 2003.
2003	*Fronto-executive functions in rodents: neural and neurochemical substrates. Neurobiology of Cognition in Laboratory Animals.* Symposium within the International Behavioral Neuroscience Society Annual Meeting; San Juan, Puerto Rico, 23–27 April 2003.
2003	*Limbic corticostriatal systems and delayed reinforcement. Adolescent Brain Development: Vulnerabilities and Opportunities.* New York Academy of Sciences; New York City, New York, USA, 18–20 September 2003.
2003	*Delayed reinforcement: neurochemistry and neuroanatomy.* Gatsby Computational Neuroscience Unit, UCL, Queen Square, London, 21 October 2003.
2004	*Neuropsychology of Reinforcement Processes in the Rat.* Award lecture for the British Psychological Society Annual Conference, London, 15–17 April 2004.

2004	*Is it worth the wait? Neurobiology of delayed reinforcement. Neural Mechanisms of Decision Making.* Symposium within the Autumn School in Cognitive Neuroscience, University of Oxford, 27–30 September 2004.
2008	*Managing behavioural problems in dementia.* British Geriatric Society, Cambridge, 1 April 2008.
2010	*Delayed reinforcement: an update on animal studies.* Gatsby Computational Neuroscience Unit, UCL, Queen Square, London, 26 May 2010.
2013	*Ghosts in the mind: the nature and causes of psychosis.* Bedford School Medical Association, 15 Mar 2013.
2017	*De-identified clinical records for research and recruitment.* NIHR Clinical Research Network Mental Health Specialty Group, 13 Oct 2017.
2018	*De-identified clinical records for research and recruitment.* University of Sussex, Brighton, 6 Mar 2018.
2018, 2022	*Clinical research databases.* Thomas Deacon Academy (for BTEC [Business and Technology Education Council] diploma course, Applied Science Level 3), Peterborough; 30 Nov 2018, 29 Nov 2022.
2018	*The Cambridge Mental Health Data Pathfinder.* Medical Research Council, London, 20 Jul 2018.
2018	*Developing clinical informatics for mind and brain health in Cambridge.* CRIS 10th Anniversary, King's College London / NIHR Maudsley Biomedical Research Centre, 6 Dec 2018.
2019	*The medium matters: tools for mental health data capture and clinical research.* MQ Data Science, Edinburgh, 9 Sep 2019.
2020	*The early impact of COVID-19 on mental health and community physical health services and their patients' mortality in Cambridgeshire and Peterborough, UK.* MQ Data Science, online/Univ. of Edinburgh, 8 Sep 2020.
2020	*Computational psychiatry and clinical informatics.* University of Southampton, 30 Oct 2020.
2020	*Public opinion on sharing data from UK health services for clinical and research purposes without explicit consent.* MQ Data Science, online/Univ. of Edinburgh, 4 Dec 2020.
2020	*Using routinely collected clinical data for research and recruitment.* Suffolk R&D Forum, 14 Dec 2020.
2021	*The CPFT Research Database: using routinely collected clinical data for research and recruitment.* NIHR ARC East of England Knowledge Exchange Seminar series, 9 Feb 2021.
2021	*Approaches to computational psychiatry.* Centre for Lifelong Learning and Individualised Cognition, Nanyang Technological University, Singapore, 22 Sep 2021.

Teaching and teaching awards

University of Cambridge	MB BChir, School of Clinical Medicine: *Depression* (lecture, 2016–). *Fatigue* (clinicopathological conference, 2017–18, 2020–). *Mental Health Act and Ethics* (2022). *Psychiatric classification and diagnosis* (2022).
	► "Excellent Teaching Award", Cambridge University Clinical Students' Society (2015, 2018), plus other commendations.
	NST II (third year) Neuroscience/Psychology: *Brain Mechanisms of Memory and Cognition* (2002–5).
	MVST IB (second year) Neurobiology & Human Behaviour: *Reasoning about uncertainty and learning strategies in medicine* (self-directed exercise, 2005–6). *Neuroanatomy practicals,* psychiatry component (2021).
	NST IB (second year) Psychology: *Introduction to Neurobiology* (2003–5). *Statistics practical series* (2003–5). *Emotion and Motivation* (2002–4).
	Department of Psychiatry: *Bayesian model selection and fitting for reinforcement learning,* Computational Psychiatry Workshop (2018). *MPhil Thesis Writing Workshop* (2019–).
	Cambridge Neuroscience research community (selected): *Computational modelling and its relevance to psychiatry,* Cambridge Neuropsychiatry Day, University of Cambridge and CPFT (2013). *Investigating behavioural change with hierarchical Bayesian modelling.* Computation@Cambridge, 30 Mar 2022.
	Department of Experimental Psychology: *Guide to ANOVA* (2003–4). *Graduate programming classes* (2003–4). Large-group (30–200) and small-group (1–6) teaching in neuroscience and psychology at second- and third-year undergraduate level (2002–5). Coordinating supervisor for some colleges. Teaching related to own courses, plus *Brain Mechanisms of Motivation* (third-year psychology), *Neurobiology and Human/Animal Behaviour* (second-year medicine and veterinary medicine).
	College teaching: Supervisor in endocrinology, reproductive biology, neurophysiology/neurobiology/neuroscience, and psychology (1996–2001). St John's College, Downing College, New Hall, and Clare College.
NHS	Cambridge MRCPsych course: *Emotion and Motivation* (2003–4, 2014–15, 2017–20, 2023). *Motivation* (2018). *Memory* (2004, 2014–15, 2017–20, 2023). *Physical examination in psychiatry* (2010). *Schizophrenia: early intervention and assessment* (2012). *Post-traumatic stress disorder* (2013). *Psychosis: mechanisms, investigations, rating scales, outcome measures* (2015). *Psychiatric presentations of organic disease* (2015). *Learning theory* (2017–20, 2023).
	Clinical supervision of junior doctors; ad hoc teaching (medical students, junior doctors, others; 2005–). MHA Approved Mental Health Professional (AMHP) training, CPFT: *Mental disorder* (2017).

	Sixth form careers talks/outreach: *Psychiatry* (2015–).
Other	*Masterclass: latest advances in psychopharmacology: Case discussion* (2013–14). Cambridge Psychopharmacology Programme, CUP/Neuroscience Education Institute, Cambridge.

Examining

2003	Assessor (examiner) for the MVST Experimental Psychology I$_B$ Option, University of Cambridge.
2003–2005	Assessor (examiner) for the Natural Sciences Tripos (NST) Part II Neuroscience, University of Cambridge.
2004–2005	Senior Assessor (examiner) for the Medical & Veterinary Sciences Tripos (MVST) Experimental Psychology I$_B$ Option, University of Cambridge.
2007–	PhD examiner (11). *Cambridge:* Sietse Jonkman, 2009; Joshua Keeler, 2013; Michael Gottschalk, 2015; Suyi Zhang, 2018; Matthew Leming, 2020; Romit Samanta, 2021. *King's College London:* Giouliana Kadra-Scalzo, 2017; Aurelie Mascio, 2022. *Nottingham:* Lourdes Valencia-Torres, 2011. *Oxford:* Peter Rudebeck, 2007. *University College London:* Anahita Talwar, 2022.
2021–	MPhil (by research) examiner (3). *Cambridge*: Simon Williamson (2021), Sabina London (2022).

Leadership and administration

CPFT	*Research:* **Academic lead clinician** (2012–) and **principal investigator** (2017–), **CPFT Research Database** (2012–, NHS Research Ethics references 12/EE/0407, 17/EE/0442) and **CPFT Clinical Data Linkage Service** (2020–, NHS Research Ethics reference 17/EE/0442, Confidentiality Advisory Group reference 20/CAG/0087). Research & Development Leadership Team (2015–). **Chair, Research Database Oversight Committee** (2016–).
	Clinical informatics: **Chair, Clinical Reference Group** (2016–2019), subsequently **Clinical Design Authority** (2019–). Clinical Systems Programme Board (2016–2019), subsequently Digital Transformation Board (2019–). Deputy chair, OneVision Steering Group for electronic health records (2019–2021). Clinical lead for rapid videoconferencing rollout (2020). Clinical lead prescriber, Electronic Prescribing and Medicines Administration (DigiMeds) Steering Group (2022–).
	Other: Medical Education Committee & Rota Group (redesigned rota; 2008–2009). Clinical Effectiveness Group (2021–).
CUH	Junior doctor rota redesigner, medicine (2006). Research Data Governance Committee (2016–2020). Epic speciality lead for Liaison Psychiatry (2021–).
CUH/CPFT	Member, Cambridge Children's Hospital (CCH) Digital Steering Group (2022–).
NHS	*Local:* Leadership training course, NHS East of England Multiprofessional Deanery (2013–2014). Cambridgeshire and Peterborough (C&P) Sustainability and Transformation Partnership (STP) Digital Enabling Group and Local Architecture Board (2020–21); C&P Integrated Care System (ICS) Digital Clinical Committee (2022–).
	National: **UK National Institute for Health and Care Excellence (NICE) Specialist Committee Member and Lead Team Member,** Diagnostics Advisory Committee: *6-lead electrocardiogram (ECG) for monitoring cardiac health in people having antipsychotic medication* (2022, Diagnostics Advisory Programme #62, Early Value Assessment).
University of Cambridge	*University:* MVST Neurobiology and Human Behaviour Committee (2004–2005). Second MB (Bachelor of Medicine) Exemptions Committee (2004–2005). MVST Part I (preclinical medical/veterinary education) Committee (2004–2005). Gender Equality Steering Group (2016–2017). Open Research Infrastructure Sub-Group (2019).
	Cross-departmental: optimization problems (including Research Excellence Framework, 2018–; undergraduate project allocation for Physiology, Development & Neuroscience, 2019).
	School of Clinical Medicine: Athena SWAN Steering/Governance Group (2012–2017). Review Panel on General Practice Academic Clinical Fellowships (2012–2013). Senior Gender Equality Champion (2016–2017).
	Department of Psychiatry: Senior staff (2016–). Postgraduate Education Committee (2021–). Biomedical Research Centre mental health theme leadership (2021–). Chair, emergency response Silver Command (2022–).
	Department of Experimental Psychology: Senior staff (2002–2005). Appointment interviewer (2002). **Director of Undergraduate Teaching** (2003). **Chair, Computer Management Group** (2003–2005). **Course organizer,** MVST I$_B$ Experimental Psychology Special Option course (2004–2005). **Course organizer,** Experimental Psychology component of the MVST I$_B$ Neurobiology & Human Behaviour course (2004–2005).
	Behavioural and Clinical Neuroscience Institute: Protocol Review Panel (2010–2014).
	Selwyn College, Cambridge: Undergraduate admissions interviewer (2004).

Editorial work

2016–2021   **Handling Editor,** *Computational Psychiatry* (MIT Press).

Refereeing

Papers   *Addiction; Behavioral Neuroscience; Behavioural Brain Research; Behavioural Pharmacology; Behavioural Processes;* **Biological Psychiatry;** *BMC Neuroscience; BMJ Open;* **Brain; BJPsych;** *BJPsych Bulletin; BJPsych Open; Drug and Alcohol Dependence; European Journal of Neuroscience; International Journal of Neural Systems; Journal of Comparative Psychology; Journal of Ethnopharmacology; Journal of Experimental Psychology: Animal Behavior Processes;* **Journal of Neuroscience;** *Journal of Pediatric Endocrinology and Metabolism; Journal of Psychiatric Research; Neural Networks;* **Neuropsychopharmacology; Neuroscience & Biobehavioral Reviews;** *PLoS Computational Biology; Progress in Neuro-Psychopharmacology and Biological Psychiatry;* **Psychological Medicine;** *Psychology & Neuroscience; Psychopharmacology; Quarterly Journal of Experimental Psychology;* **Science.**

Books   Cambridge University Press.

Grants   Academy of Medical Sciences; **Agence Nationale de la Recherche** (ANR, French National Research Agency); MQ; **Nederlandse Organisatie voor Wetenschappelijk Onderzoek** (NWO, Dutch Research Council); **Royal Society of New Zealand; UK Biotechnology and Biological Sciences Research Council; UK Medical Research Council; Wellcome Trust.**

Fellowships   Christ's College, Cambridge; Downing College, Cambridge; Queens' College, Cambridge; **UK Medical Research Council; Wellcome Trust.**

Other skills

Clinical procedures. *At some point experienced in:* peripheral venous cannulation, venepuncture, arterial blood sampling, suturing and wound closure, electrocardiography, spirometry, urinary catheterization, pleural fluid aspiration, thoracocentesis, ascitic fluid aspiration, paracentesis, central venous cannulation (internal jugular and femoral approaches), DC cardioversion, external cardiac pacing, exercise tolerance test supervision, care and removal of pericardial drains, lumbar puncture, intercostal drain insertion (Argyle and Seldinger techniques) and removal, and electroconvulsive therapy (ECT). *Performed:* endotracheal intubation, echocardiography, oesophagogastroduodenoscopy with biopsy, nasogastric tube insertion, rigid sigmoidoscopy, and rectal biopsy, temporary pacing wire insertion, dynamic hip screw insertion, and minor surgical procedures. *Advanced Life Support (ALS) provider certification,* 2007–2011 (selected for ALS Instructor training).

Computing. I have been using computers since 1983 and programming since 1985. I am fluent in the computer languages C++ (with Boost, DirectX, MFC, MPI, ODBC, Qt, STL, and multithreading environments), Javascript, Python, R, and SQL in various flavours. I have previously been fluent in C, 6502 assembler, ARM assembler, BASIC, and Perl. I am familiar with bash, markup languages including HTML, and Java, and have also used x86 assembler, Awk, CMake, Lisp, Lua, Matlab, Pascal, Octave, and Sage. I have experience of using, programming for and administering Android, iOS, Linux and UNIX, MS-DOS, OS/2, Novell Netware (3, 4), RISC OS, Windows (2, 3, NT, 95, 98, 2000, XP, Vista, 7, 8, 10), database engines (DBase, Dataflex, MySQL/MariaDB, Oracle, PostgreSQL, SQLite, SQL Server), IP and IPX networks, and hundreds of application programs, along with associated hardware. I am the Assignee and Contact for port 3233 (Internet Assigned Numbers Authority).

Behavioural neuroscience. Stereotaxic neurosurgery in rodents, including intracranial cannulation and excitotoxic lesion techniques. Tissue perfusion; histological staining and assessment. Behavioural task design and real-time control programming. Intracerebral infusion in freely-moving animals. Systemic psychopharmacology. Computer simulation. Statistical analysis. Manuscript preparation and editing, public speaking, and refereeing.

Animals (Scientific Procedures) Act. UK Home Office Personal Licence holder (1997–2007; modules 1–4, 1997; module 5, 2003) and Deputy Project Licence holder (2004–2005).

Mental Health Act. Approved under section 12(2) of the Mental Health Act as having special experience in the diagnosis or treatment of mental disorder (2010–). Approved as an Approved Clinician (2015–).

Office for National Statistics (ONS) Accredited Researcher (2020–); Accredited Researcher #34 471.

Music. Associated Board of the Royal Schools of Music: trumpet, grade 4 (merit, 1985); theory of music, grade 5 (distinction, 1990); piano, grade 8 (distinction, 2022).

Financial declarations other than income from primary/honorary employers

2002–	Software royalty income from the sales of Whisker and related software by licensee companies: Cambridge Cognition Ltd, 2002–2004; Campden Instruments Ltd, 2004– (owned by the Lafayette Instrument Company Inc.). Royalties are paid via companies owned by the University of Cambridge (Cambridge University Technical Services Ltd; Cambridge Enterprise). I have also been paid as a consultant to Campden Instruments Ltd (2004–) and the University of Cambridge (2009–) regarding these software products. End users of our software include universities, companies, and government research organizations.
2006–	Book royalty income from: Taylor & Francis Group, previously Lawrence Erlbaum Associates (2006–); Cambridge University Press (2011–).
2010–2015	Occasional fees from UK state agencies for Mental Health Act assessments.
2014	Occasional lecture fee from the Neuroscience Education Institute (2014).

Professional societies and invited positions

1996–	Member, Medical Protection Society.
1999–	Member, European Behavioural Pharmacology Society.
2000–	Member, British Neuroscience Association.
2000–	Member, Society for Neuroscience.
2001–	Medical practitioner registered with the UK General Medical Council. Provisional registration 2001; full registration 2002; licensed to practise from the introduction of licensing (2009–); Specialist Register (general psychiatry and liaison psychiatry, 2015–); registration #6 029 215.
2003–2019	Member, New York Academy of Sciences.
2005–	Member, British Medical Association.
2005–	Associate (2005–2007), Member (2008–2013), and Fellow (2013–), Institute of Biomedical Science (FIBMS).
2006–	Chartered Biologist (2006–2017); Member, Institute of Biology (2006–2009), later Society of Biology (2009–2015), later Royal Society of Biology (2015–2021); Fellow (2021–), Royal Society of Biology (FRSB).
2007–	Chartered Psychologist (CPsychol); Member (2007–2011) and Associate Fellow (2011–), British Psychological Society (AFBPsS).
2007–	Member, British Neuropsychiatry Association.
2007–	Member (2010–) and Fellow (2023–), Royal College of Physicians of London.
2010–	Member (2010–) and Fellow (2021–), Royal College of Psychiatrists.
2012–	Member, British Association for Psychopharmacology.
2020–	Fellow, Faculty of Clinical Informatics (FFCI).