

Sean Cavanagh, MBBS PhD

I am a clinical academic doctor working for the NHS in London. I completed my PhD on the neural basis of working memory and decision making in 2019. I plan to combine my interests in medicine and research through pursuing a career in clinical research. I have extensive experience in machine learning analyses with large datasets.

Research Overview

My research has addressed the neural mechanisms of decision-making and working memory. To gain insight to these mechanisms, I have trained animals to performed complex cognitive tasks and analysed the activity of single neurons. I then use mathematical models to relate the behavioural and neural data.

Current Position

2022 - Academic Foundation Doctor

Aug 23 to Dec 23: Emergency Department – I assessed and managed undifferentiated patients presenting to the Emergency Department at a major trauma centre.

Apr 23 to Aug 23: Liaison and Perinatal Psychiatry – I assessed inpatients who present with symptoms of mental illness in the general hospital, new patients presenting to the emergency department, and outpatients in the perinatal clinic.

Dec 22 to Apr 23: General Internal Medicine – I worked on a diabetes and endocrinology ward, treating patients with endocrine disorders, diabetic emergencies, as well as general medical problems. I was part of the medical on-call rota, covering medical wards out-of-hours, and treating and admitting new patients in the acute medical unit.

Aug 22 to Dec 22: Trauma and Orthopaedics - I was involved in the care of paediatric trauma patients at a major trauma centre, and covered the general surgical wards out-of-hours

Education

2015 - 2022 MBPhD Programme, University College London

Examination Results: First clinical year (92%); Second clinical year (81%); Final clinical year (85%)

2015 - 2019 PhD in Neuroscience, University College London

“Neural computations for working memory and decision making” supervised by Dr SW Kennerley, Dr S Farmer and Dr LT Hunt.

2012 - 2015 BSc (Hons) Medical Sciences with Neuroscience, University College London - 1st Class

Dissertation (80%): “Differential modulation of the excitability of inputs to corticospinal neurones during action preparation for choice reaction time” supervised by Professor JC Rothwell.

Examination Results: First year (86%); Second year (88%); Final year (77%).

Skills

- Data analysis:
 - Neural encoding and decoding analyses (regression, SVMs, LDA, PCA)
 - Behavioural psychophysics (logistic regression, fitting connectionist models)
- Software:
 - Analysis: Matlab (>5 years experience), Python (1 year experience)
 - Visualisation: Adobe illustrator (4 years experience)
 - Web design in HTML
- Experimental:
 - Training of animals to perform complex cognitive tasks
 - Administration of pharmacological agents

- Transcranial magnetic stimulation (TMS) and electromyography (EMG)

Selected Awards and Media Coverage

2022: Betuel Prize (first prize for written examinations in MBBS finals)
 2022: Atchison Prize (fifth prize for overall performance in MBBS final exams)
 2021: Distinction in medical school examinations
 2020: Foulkes Foundation fellowship (£6,000)
 2020: Media coverage of Cavanagh et al. 2020 (eLife) – including [Naked Scientists Podcast](#)
 2019: Media coverage of Cavanagh et al. 2019 (PNAS) in [Medical Xpress](#)
 2019: [Jon Driver Prize](#) (£500).
 2017: Art of Neuroscience Competition Winner (€1,000). Media coverage in [Scientific American](#) and [Atlas Obscura](#)
 2016: Brain travel award to attend Society for Neuroscience meeting, USA (£800)
 2015: PhD studentship funding from Middlesex Hospital Medical School General Charitable Trust (£77,076)
 2015: Dean's List, Faculty of Life Sciences
 2014: Wolfson Foundation Intercalated Degree Fellowship (£5,000)
 2013: The Kaye, Carter, Cayley and Keene Prize (fourth prize for overall performance)

Invited Talks

2019: Jon Driver prize talk: The role of neuronal timescales in cognition. UCL Neuroscience Symposium ([Video](#)).
 2019: Swartz program in theoretical neuroscience seminar. Yale University, USA.
 2018: Circuit mechanisms of working memory and decision-making. Oxford Centre for Human Brain Activity, University of Oxford.
 2018: Reconciling persistent and dynamic hypotheses of working memory coding in prefrontal cortex. Society for Neuroscience Meeting, San Diego, USA.
 2018: Circuit mechanisms of working memory and decision-making. Max Planck UCL Centre for Computational Psychiatry and Ageing.

Publications

Cavanagh, S.E., Hunt, L.T. & Kennerley, S.W. (2020) A Diversity of Intrinsic Timescales Underlie Neural Computations. *Front Neural Circuits*, **14**, 615626.

Cavanagh, S.E., Lam, N.H., Murray, J.D., Hunt, L.T. & Kennerley, S.W. (2020) A circuit mechanism for decision-making biases and NMDA receptor hypofunction. *Elife*, 9.

Cavanagh, S. E., Malalasekera, W. M. N., Miranda, B., Hunt, L. T., & Kennerley, S. W. (2019). Visual fixation patterns during economic choice reflect covert valuation processes that emerge with learning. *Proceedings of the National Academy of Sciences*, 201906662.

Cavanagh, S. E., Towers, J. P., Wallis, J. D., Hunt, L. T., & Kennerley, S. W. (2018). Reconciling persistent and dynamic hypotheses of working memory coding in prefrontal cortex. *Nature Communications*, 9(1).

Hannah, R., **Cavanagh, S. E.**, Tremblay, S., Simeoni, S., & Rothwell, J. C. (2018). Selective suppression of local interneuron circuits in human motor cortex contributes to movement preparation. *Journal of Neuroscience*, 38(5), 1264–1276.

Hannah, R., Sommer, M., **Cavanagh, S.**, Jerjian, S., & Rothwell, J. C. (2017). Motor outcomes of repetitive transcranial magnetic stimulation are dependent on the specific interneuron circuit targeted. *Biosystems and Biorobotics* (Vol. 15, pp. 3–7).

Cavanagh, S. E., Wallis, J. D., Kennerley, S. W., & Hunt, L. T. (2016). Autocorrelation structure at rest predicts value correlates of single neurons during reward-guided choice. *ELife*.

Cavanagh, S., Malalasekera, N., & Kennerley, S. (2015). In the blink of an eye: Value and novelty drive saccades. *Annals of Medicine and Surgery*, 4(3), 319–320.