

# 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, and I am open to data science and Healthtech opportunities.

## 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 - 1<sup>st</sup> 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. In *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.