



## Post Specification

<b>Post Title:</b>	PhD Studentship in Computational Cognitive Neuroscience
<b>Post Status:</b>	Full-time, 4 years
<b>Research Group / Department / School:</b>	Department of Computer Science & Statistics, Trinity College Dublin, the University of Dublin
<b>Location:</b>	Trinity College Institute of Neuroscience, Lloyd Building, Trinity College Dublin, the University of Dublin College Green, Dublin 2, Ireland
<b>Reports to:</b>	Dr. Seán Froudish-Walsh, Prof. Konstantinos Tsetsos
<b>Salary:</b>	An annual PhD studentship of €25,000 (tax-free), with University tuition fees covered
<b>Hours of Work:</b>	Full Time
<b>Closing Date:</b>	Thursday 5/FEB/2025, 11:59pm GMT (Dublin time zone)

## Post Summary

The purpose of this role is to undertake a PhD investigating “Cross-species mechanisms of evidence accumulation along prefrontal cortical gradients” in the laboratories of Dr. Seán Froudish-Walsh (50%) and Prof. Konstantinos Tsetsos (50%).

## Summary

Rodents and humans differ strikingly in evidence-accumulation behaviour: mice often integrate information optimally and with minimal leak, whereas humans show systematic recency biases. This project develops a mechanistic, cross-species account of these differences by examining how aspects of the **stimulus presentation interact with prefrontal cortical architecture**. The student will combine **new human MEG experiments, anatomy-informed neuro-AI model development** and **comparative analyses** across species.

## Scientific Background

Recent work shows that mice can accumulate sequences of stimuli with no detectable loss, while humans accumulate with clear temporal leak. We propose that this reflects the employment of different evidence accumulation regimes, determined by the **temporal spacing between stimuli** and other stimulus features.

- Rapid sequences → quasi-continuous accumulation in sensory and premotor/sensorimotor regions
- Intermediate spacing → working memory-based accumulation in dlPFC and fronto-parietal networks
- Long gaps → episodic or value-based integration in vmPFC and the default mode network

These regimes can be mapped onto a prefrontal gradient of increasing abstraction and intrinsic timescale. Since this gradient is **markedly compressed** in macaques and especially rodents, we hypothesise that the transition points between these regimes may occur at different temporal spacings across species. As a result, rodents may remain within “fast”, low-leak networks under conditions that drive humans into slower, leakier PFC systems.

## Project Aims

### **Aim 1 — Conduct new human MEG experiments to characterise how temporal spacing shapes evidence accumulation.**

The student will design and run MEG experiments that parametrically vary a) the temporal gap between stimulus elements and b) the number of elements. Behaviour and neural dynamics (including source-level analyses and representational methods) will reveal when humans switch between perceptual, working memory, and episodic accumulation regimes, and the cortical networks engaged by each regime.

### **Aim 2 — Develop cortically-embedded recurrent neural network (CERNN) models with gradients of timescales that reproduce these shifts across species.**

Developing cortically embedded RNNs with gradients of neuronal timescales, the student will model how stimulus sequences are routed through species-specific cortical anatomy. These models will make testable predictions for when leakless vs. leaky behaviour emerges in humans, macaques, and mice, and the corresponding cortical networks that are engaged.

### **Aim 3 — Generate cross-species predictions and reinterpret existing rodent/monkey findings.**

The student will integrate model predictions with human data and with existing rodent/monkey neural and behavioural datasets. The goal is to identify when species should diverge or converge in their integration dynamics, and to provide principled explanations for influential but puzzling cross-species results.

### **Training & Environment**

Based at **Trinity College Dublin**, the student will receive training in:

- Experimental design, acquisition, and analysis of human MEG experiments
- Neuroanatomy and physiology - Analysing prefrontal gradients across species
- Computational modelling of behaviour and neural circuits
- Neuro-AI model development integrating species-specific neuroanatomy

The postholder will be expected to present their work at major international conferences, publish in leading journals and engaging actively in the scientific environment of the Froudish-Walsh and Tsetsos groups, and the wider Trinity College Dublin neuroscience and AI environment.

### **Standard Duties and Responsibilities of the Post**

The successful candidate will be expected to:

- Undertake a PhD research programme under the supervision of Dr. Seán Froudish-Walsh and Prof. Konstantinos Tsetsos, leading to the submission of a doctoral thesis within the funded period.
- Develop and analyse computational models of decision-making and neural dynamics, including anatomy-informed recurrent neural network models.
- Design, implement, and analyse human behavioural and MEG experiments investigating evidence accumulation under varying temporal regimes.
- Integrate behavioural, neuroimaging, and modelling results to generate testable cross-species predictions.
- Conduct rigorous statistical analyses of behavioural and neural data.
- Maintain reproducible research workflows and well-documented codebases.
- Lead the preparation of manuscripts for publication in high-impact peer-reviewed journals.
- Present research findings at national and international conferences, workshops, and seminars.
- Engage actively in the scientific life of the Trinity College Institute of Neuroscience, the School of Computer Science & Statistics, and associated research groups.
- Participate in doctoral training activities, as required by Trinity College Dublin.

### **Funding Information**

This PhD studentship is funded through internal and external research funding held by Dr. Seán Froudish-Walsh (Start-up funding) and Prof. Konstantinos Tsetsos (ERC Consolidator Grant), covering:

- A tax-free stipend of €25,000 per annum
- Full tuition fees at Trinity College Dublin
- Access to computing resources, experimental facilities, and research travel support, including funding to visit University of Oxford (where 50% of the Froudish-Walsh group will be based).

## **Person Specification**

### **Qualifications**

#### **Essential**

- A primary degree (minimum 2.1 or equivalent) in a relevant discipline such as:
  - Neuroscience
  - Computer Science
  - Engineering
  - Psychology
  - Cognitive Science
  - Physics
  - Mathematics or a closely related field

#### **Desirable**

- A Master's degree (or equivalent experience) with a strong research component in computational neuroscience, cognitive neuroscience, machine learning, or decision-making.
- Prior research experience resulting in a thesis, preprint, or peer-reviewed publication.

## **Knowledge & Experience (Essential & Desirable)**

#### **Essential**

- Strong background in at least one of the following:
  - Cognitive neuroscience or experimental psychology
  - Computational modelling of cognition or neural systems
  - Decision-making and evidence accumulation models
  - Artificial intelligence
- Programming experience in at least one scientific language (e.g. Python, MATLAB, R, Julia).

#### **Desirable**

- Experience with quantitative data analysis.
- Experience with neuroimaging data (MEG, EEG, fMRI) or related analysis techniques.

- Knowledge of recurrent neural networks, or AI/ML model development.
- Experience with computational neuroscience and/or dynamical systems modelling.
- Experience working with behavioural experiments and psychophysics.
- Interest in comparative or cross-species neuroscience.

## **Skills & Competencies**

### **Essential**

- Strong analytical and problem-solving skills.
- Ability to work independently and manage a long-term research project.
- Excellent written and verbal communication skills in English.
- Motivation to engage with interdisciplinary research spanning neuroscience, AI, and psychology.
- Good organisational skills and attention to detail.
- Willingness to learn new experimental, computational, and analytical methods.

### **Desirable**

- Ability to collaborate effectively within an interdisciplinary research team.
- Experience presenting research to scientific audiences.

## **Application Procedure**

Applicants should electronically submit:

- A **full Curriculum Vitae**,
- The names and contact details of **two referees**
- A **short cover letter** (max. 2 pages) describing:
  - Research interests
  - Relevant experience
  - Motivation for applying to this project

With the title: [Comp Cog Neuro PhD Application]

To: Dr. Seán Froudish Walsh and Prof. Konstantinos Tsetsos

Email Addresses: [sfroudish@tcd.ie](mailto:sfroudish@tcd.ie); [tsetsosk@tcd.ie](mailto:tsetsosk@tcd.ie);

## **Further Information for Applicants**

URL Link to Area	<a href="http://www.tcd.ie">www.tcd.ie</a>
URL Link to Human Resources	<a href="https://www.tcd.ie/hr/">https://www.tcd.ie/hr/</a>

## Trinity College Dublin, the University of Dublin

Trinity is Ireland's leading university and is ranked 98th in the world (QS World University Rankings 2023). Founded in 1592, the University is steeped in history with a reputation for excellence in education, research and innovation.

Located on an iconic campus in the heart of Dublin's city centre, Trinity has 18,000 undergraduate and postgraduate students across our three faculties – Arts, Humanities, and Social Sciences; Engineering, Mathematics and Science; and Health Sciences.

Trinity is ranked as the 17th most international university in the world (Times Higher Education Rankings 2020) and has students and staff from over 120 countries.

The pursuit of excellence through research and scholarship is at the heart of a Trinity education, and our researchers have an outstanding publication record and strong record of grant success. Trinity has developed 19 broad-based multidisciplinary research themes that cut across disciplines and facilitate world-leading research and collaboration within the University and with colleagues around the world. Trinity is also home to 5 leading flagship research institutes:

- Trinity Biomedical Sciences Institute (TBSI)
- Trinity College Institute of Neuroscience (TCIN)
- Trinity Translational Medical Institute (TTMI)
- Trinity Long Room Hub Arts and Humanities Research Institute (TLRH)
- Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN)

Trinity is 1st in Europe for Producing Entrepreneurs for the 7th year in a row and Europe's only representative in the world's top-50 universities (Pitchbook 2021-2022).

Trinity is home to the famous Old Library and to the historic Book of Kells as well as other internationally significant holdings in manuscripts, maps and early printed material. The Trinity Library is a legal deposit library, granting the University the right to claim a copy of every book published in Ireland and the UK. At present, the Library's holdings span approximately 6.5 million printed items, 400,000 e-books and 150,000 e-journals. With over 120,000 alumni, Trinity's tradition of independent intellectual inquiry has produced some of the world's finest, most original minds including the writers Oscar Wilde and Samuel Beckett (Nobel laureates), the mathematician William Rowan Hamilton and the physicist Ernest Walton (Nobel laureate), the political thinker Edmund Burke, and the former President of Ireland Mary Robinson. This tradition finds expression today in a campus culture of scholarship, innovation, creativity, entrepreneurship and dedication to societal reform.

### **Rankings**

Trinity College Dublin is the top ranked university in Ireland. Using the QS methodology we are ranked 98<sup>th</sup> in the world and using the Times Higher Education World University Ranking methodology we are 146<sup>th</sup> in the World.

- Trinity College Dublin is Ireland's No.1 University (QS World University Ranking 2023, Times Higher Education Rankings 2022)
- Trinity is ranked 98<sup>th</sup> in the World (QS World University Ranking 2023)
- Trinity is ranked No.1 in Europe for Producing Entrepreneurs for the 7<sup>th</sup> year in a row Pitchbook 2021-2022

Full details are available at: [www.tcd.ie/research/about/rankings](http://www.tcd.ie/research/about/rankings).

### **The Selection Process in Trinity**

The Selection Committee (Interview Panel) may include members of the Academic and Administrative community together with External Assessor(s) who are expert in the area. Applications will be acknowledged by email. If you do not receive confirmation of receipt within 1 day of submitting your application online, please contact the named hiring lead on the job specification immediately and prior to the closing date/time.

Given the degree of co-ordination and planning to have a Selection Committee available on the specified date, the University regrets that it may not be in a position to offer alternate selection dates. Where candidates are unavailable, reserves may be drawn from a shortlist. Outcomes of interviews are notified in writing to candidates and are issued no later than 5 working days following the selection day.

In some instances the Selection Committee may avail of telephone or video conferencing. The University's selection methods may consist of any or all of the following: Interviews, Presentations, Psychometric Testing, References and Situational Exercises.

It is the policy of the University to conduct pre-employment medical screening/full pre-employment medicals. Information supplied by candidates in their application (Cover Letter and CV) will be used to shortlist for interview.

Applications from non-EEA citizens are welcomed. However, eligibility is determined by the Department of Business, Enterprise and Innovation and further information on the Highly Skills Eligible Occupations List is set out in Schedule 3 of the Regulations

<https://dbei.gov.ie/en/What-We-Do/Workplace-and-Skills/Employment-Permits/Employment-Permit-Eligibility/Highly-Skilled-Eligible-Occupations-List/> and the

Ineligible Categories of Employment are set out in Schedule 4 of the Regulations

<https://dbei.gov.ie/en/What-We-Do/Workplace-and-Skills/Employment-Permits/Employment-Permit-Eligibility/Ineligible-Categories-of-Employment/> . Non-EEA

candidates should note that the onus is on them to secure a visa to travel to Ireland prior to interview. Non-EEA candidates should also be aware that even if successful at interview, an appointment to the post is contingent on the securing of an employment permit.

## **Equal Opportunities Policy**

Trinity is an equal opportunities employer and is committed to employment policies, procedures and practices which do not discriminate on grounds such as gender, civil status, family status, age, disability, race, religious belief, sexual orientation or membership of the travelling community. On that basis we encourage and welcome talented people from all backgrounds to join our staff community. Trinity's Diversity Statement can be viewed in full at <https://www.tcd.ie/diversity-inclusion/diversity-statement>.

## **Pension Entitlements**

This is a pensionable position and the provisions of the Public Service Superannuation (Miscellaneous Provisions) Act 2004 will apply in relation to retirement age for pension purposes. Details of the relevant Pension Scheme will be provided to the successful applicant.

Applicants should note that they will be required to complete a Pre-Employment Declaration to confirm whether or not they have previously availed of an Irish Public Service Scheme of incentivised early retirement or enhanced redundancy payment. Applicants will also be required to declare any entitlements to a Public Service pension benefit (in payment or preserved) from any other Irish Public Service employment.

Applicants formerly employed by the Irish Public Service that may previously have availed of an Irish Public Service Scheme of Incentivised early retirement or enhanced redundancy payment should ensure that they are not precluded from re-engagement in the Irish Public Service under the terms of such Schemes. Such queries should be directed to an applicant's former Irish Public Service Employer in the first instance.

## Application Procedure

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Applicants should submit:

- A **full Curriculum Vitae**, including the names and contact details of **two referees**
- A **short cover letter** (max. 2 pages) describing:
  - Research interests
  - Relevant experience
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