

# Luca Dominik Kolibius, PhD

**Postdoctoral Research Scientist** (Start Date: May 16, 2023)

Department of Biomedical Engineering

Columbia University | Jacobs Lab

New York, NY, USA

**E-mail:** luca.kolibius@columbia.edu | **ORCID:** 0000-0001-5590-6879

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## Research Focus

I study how the human hippocampus encodes spatial and episodic memories at the level of single neurons. My PhD work provided the first direct evidence for episode-specific “index” neurons in humans and linked them to theories of hippocampal indexing and concept cells. My current research in Josh Jacobs’ lab at Columbia examines phase-based spatial and episodic coding by hippocampal neurons. I work with high-density hippocampal (Neuropixels and novel hybrid depth electrodes) and thalamic recordings to relate single neuron spiking, local field potentials, and behaviour in epilepsy patients.

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## Education

- **PhD, Cognitive Neuroscience (2018 – 2023)**  
*University of Birmingham (2018 – 2020) & University of Glasgow (2020 – 2023)*  
**Advisors:** Prof. Simon Hanslmayr, Prof. Howard Bowman  
**Thesis:** “*The hippocampus as an indexing machine for episodic memory*”
  - **Bachelor and Master of Science (2012 – 2018)**  
*Major: Cognitive Neuroscience, Minor: Clinical Psychology*  
*Goethe University Frankfurt (2012–2018)*  
*Rothberg International School at the Hebrew University of Jerusalem (2014–2015)*  
**Advisor:** Dr. Ursula Voss
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## Positions & Research Experience

**Postdoctoral Research Scientist (May 16, 2023 – Present)**

**Department of Biomedical Engineering, Columbia University (Jacobs Lab)**

**Advisor:** Prof. Josh Jacobs

- Developed a virtual navigation task with single-neuron and LFP recordings in epilepsy patients.
- Demonstrated phase-based spatial and episodic coding in the human hippocampus.
- Collaborate on high-density Neuropixels and hybrid depth-electrode recordings (hippocampus and anterior thalamus) and an NIH BRAIN platform for predicting memory states.

**Doctoral Candidate (2018 – 2023)**

**University of Birmingham & University of Glasgow**

**Advisors:** Prof. Simon Hanslmayr, Prof. Howard Bowman

- Identified hippocampal neurons hypothesized nearly 40 years ago as building blocks of episodic memory (Kolibius et al., 2023, Nat Hum Behav)

- Employed machine learning classification (Linear Discriminant Analysis, Support Vector Machine, k-Nearest-Neighbor) to map neuronal response patterns.

### **Research Intern (2016)**

#### **Institute for Medical Psychology and Behavioural Neurobiology, Universität Tübingen**

Advisor: Dr. Gordon Feld (Prof. Jan Born Lab)

- Studied sleep-dependent declarative memory consolidation and its limited capacity under various encoding loads.

### **Research Assistant (2015 – 2018)**

#### **Vitos Hochtaunus Psychiatric Clinic**

Advisor: Dr. Ursula Voss

- Investigated repeated transcranial alternating current stimulation and potential neurological markers of nightmares.

### **Research Assistant (2013 – 2014)**

#### **Ernst Strüngmann Institute (ESI)**

Advisor: Dr. Ayelet Landau (Prof. Pascal Fries Lab)

- Examined subjective perception of time using magnetoencephalography and electroencephalography to measure neural correlates of temporal judgments.

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## **Fellowships, Scholarships & Awards**

- **Center For The Neurobiology Of Learning And Memory: Best Data Blitz** (May 2024). *Title: "Hippocampal neurons code individual episodic memories in humans"*
- **Guarantors of Brain Travel Grant to the Federation of European Neuroscience Societies** (July 2022; \$735\*)
- **Conference Support Award** (July 2022) to attend Federation of European Neuroscience Societies conference (\$490\*)
- **Post Graduate Research Symposium** (June 2022): Runner-up, best talk
- **Guarantors of Brain Travel Grant to Society for Neuroscience Chicago** (Nov 2021; \$1,370\*; returned because in-person meeting was cancelled)
- **Society for Neuroscience Trainee Professional Development Award** (Dec 2020, \$1,035)
- **College of Life and Environmental Sciences Postgraduate Research Travel Prize** (May 2019): merit-based grant (\$565)
- **Deutschlandstipendium ("Germany Scholarship")** (Oct 2016 – July 2018; \$7,900\*) \*converted to USD

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## **Manuscripts in Preparation**

1. **Kolibius, L. D.**, Hermiller, M. S., Brandt, A., Khazali, M. F., Kahana, M. J., Hanslmayr, S., & Jacobs, J. Phase based spatial and episodic coding in human hippocampal neurons. *Manuscript in preparation.*
2. **Kolibius, L. D.\***, Parish, G.\*, Roux, F., Ter Wal, M., Van Der Plas, M., Chelvarajah, R., Sawlani, V., Rollings, D. T., Lang, J. D., Gollwitzer, S., Walther, K., Hopfengärtner, R., Kreiselmeyer, G., Hamer, H., Staresina, B. P., Wimber, M., Bowman, H., & Hanslmayr, S. Impact of referencing schemes on spike to LFP phase metrics in human intracranial recordings. *Manuscript in preparation.*

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## Peer-Reviewed Publications

1. **Kolibius, L. D.**, Josselyn, S. A., & Hanslmayr, S. (2025). And yet, the hippocampus codes conjunctively. *Trends in Cognitive Sciences*, 29(8), 689–690.
2. Melcón, M., van Bree, S., Sánchez-Carro, Y., Barreiro-Fernández, L., **Kolibius, L. D.**, Alzueta, E., ... & Hanslmayr, S. (2025). Evidence for a constant occipital spotlight of attention using MVPA on EEG data. *PloS one*, 20(3), e0320233.
3. **Kolibius, L. D.**, Josselyn, S., & Hanslmayr, S. (2025). On the origin of memory neurons in the human hippocampus. *Trends in Cognitive Sciences*, 29(5), 421-433.
4. Dijksterhuis, D. E., Self, M. W., ..., **Kolibius, L. D.**, Sawlani, V., Rollings, D. T., Dehaene, S., & Roelfsema, P. R. (2024). Pronouns reactivate conceptual representations in human hippocampal neurons. *Science*, 385(6716), 1478-1484.
5. **Kolibius, L. D.**, Roux, F., Parish, G., Ter Wal, M., Van Der Plas, M., Chelvarajah, R., ... & Hanslmayr, S. (2023). Hippocampal neurons code individual episodic memories in humans. *Nature Human Behaviour*, 7(11), 1968-1979.
6. van Bree, S., Melcón, M., **Kolibius, L. D.**, Kerrén, C., Wimber, M., & Hanslmayr, S. (2022). The brain time toolbox, a software library to retune electrophysiology data to brain dynamics. *Nature Human Behaviour*, 6(10), 1430-1439.
7. Roux, F., ..., **Kolibius, L. D.**, Staresina, B., Wimber, M., Self, M., & Hanslmayr, S. (2022). Oscillations support short latency co-firing of neurons during human episodic memory formation. *eLife*, 11, e78109. doi: 10.7554/eLife.78109
8. Ter Wal, M., Linde-Domingo, J., Lifanov, J., Roux, F., **Kolibius, L. D.**, Gollwitzer, S., ... & Wimber, M. (2021). Theta rhythmicity governs human behavior and hippocampal signals during memory-dependent tasks. *Nature Communications*, 12(1), 1-15. doi: 10.1038/s41467-021-27323-3.
9. **Kolibius, L. D.**, Born, J., & Feld, G. B. (2021). Vast amounts of encoded items nullify but do not reverse the effect of sleep on declarative memory. *Frontiers in Psychology*, 11, 3685. doi: 10.3389/fpsyg.2020.607070
10. Griffiths, B. J., Parish, G., Roux, F., Michelmann, S., van der Plas, M., **Kolibius, L. D.**, ... & Hanslmayr, S. (2019). Directional coupling of slow and fast hippocampal gamma with neocortical alpha/beta oscillations in human episodic memory. *Proceedings of the National Academy of Sciences of the United States of America*. doi: 10.1073/pnas.1914180116
11. Voss, U., D'Agostino, A., **Kolibius, L. D.**, Klimke, A., Scarone, S., & Hobson, J. A. (2018). Insight and dissociation in lucid dreaming and psychosis. *Frontiers in Psychology*, 9, 1-9. doi: 10.3389/fpsyg.2018.02164

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## Published Books

- Kolibius, L. D.** (2019). Computerspiele und Sucht. In Breiner, T. & Kolibius, L. D. (Ed.), *Psychologie der Computerspiele*. Heidelberg: Springer.
- Kolibius, L. D.** (2019). Potential von Computerspielen in psychologischen Interventionen. In Breiner, T. & Kolibius, L. D. (Ed.), *Psychologie der Computerspiele*. Heidelberg: Springer.

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## Presented and Organized Symposia

- **International Conference on Cognitive Neuroscience (ICON; September 2025)**
  - Session: The Electrophysiology Of Human Event Memory
  - **Talk:** *Spatial information in non-place cells*
- **Society for Neuroscience (SfN; October 2024)**
  - Session: Neurophysiology of the Human Medial Temporal Lobe [...]
  - **Talk:** *Spatial information in non-place cells.*
- **British Association of Cognitive Neuroscience (BACN; September 2024)**
  - Session: Understanding Spatial Cognition in the Hippocampal Network [...]
  - **Talk:** *Spatial information in non-place cells.*
- **British Neuroscience Association 2023 (BNA; April 2023) [Chair]**
  - Session: What do human hippocampal neurons code?
  - **Talk:** *Hippocampal neurons code individual episodic memories in humans*
- **Organization for Human Brain Mapping 2022 (OHBM; June 2022) [Chair]**
  - Symposium: “What information code hippocampal neurons?”
  - **Talk:** *Hippocampal neurons code individual episodic memories in humans*
- **Birmingham Epilepsy Research Network (October 2022)**
  - **Talk:** *Hippocampal neurons code individual episodic memories in humans.*
- **British Association of Cognitive Neuroscience (BACN; May 2022) [Chair]**
  - Session: What do human hippocampal neurons code?
  - **Talk:** *Hippocampal neurons code individual episodic memories in humans.*

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## Presentations

- **Columbia Hippocampus Club (October 2024)**
  - **Title:** *The Episodic Code in the Human Hippocampus: Index Neurons and Concept Neurons*
- **Center For The Neurobiology Of Learning And Memory: Spring Meeting (May 2024) [Best Data Blitz]**
  - **Talk:** *Hippocampal neurons code individual episodic memories in humans*
- **14th Birmingham Epilepsy Research Network (BERN) Meeting (October 2022)**
  - **Talk:** *Hippocampal neurons code individual episodic memories in humans*
- **Columbia University: Jacobs Lab (September 2022)**
  - **Talk:** *Hippocampal neurons code individual episodic memories in humans*
- **Annual Meeting on Imaging and Electrophysiology 2021 (September 2021)**
  - **Talk:** *Hippocampal neurons code individual episodic memories in humans*
- **Scottish Neuroscience Group Meeting (August 2021)**
  - **Talk:** *Hippocampal neurons code individual episodic memories in humans*

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## Academic Service & Peer Review

- **Primary Reviewer:** Nature Human Behaviour, Journal of Cognitive Neuroscience, The Journal of Neuroscience
  - **Co-reviewer:** Nature, Science, Nature Communications, Science Advances, Current Biology
  - **Conference Reviews:** Cognitive Computational Neuroscience
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## Workshops & Professional Development

- **Shaping Human Memories Via Sensory Entrainment (December 2022)**
    - Presentations on current research into oscillatory entrainment
  - **Analyzing Neural Time Series Data (August 2019)**
    - Fourier transform, convolution, time-frequency analysis, synchronization
    - Nonparametric statistics, simulating time series data
  - **Statistical Parametric Mapping for magneto/electroencephalography (May 2019)**
    - Data pre-processing, general linear model, classical inference
    - Multiple comparisons, Bayesian inference
    - Advanced applications of the general linear model, magneto/electroencephalography source analysis
    - Dynamic causal modeling
  - **Spiking Neural Networks (September 2019)**
    - Hardware implementations of spiking neural networks, neuromorphic systems
    - Tempotrons, neurophysiological spiking networks
  - **NVIDIA Deep Learning (November 2019)**
    - Fundamentals of deep neural networks, image classification, object detection
  - **Spike-Sorting Workshop (January 2019)**
    - Clustering single-neuron activity based on waveform shape using *wave\_clus3*
    - Unsupervised, nonparametric clustering via superparamagnetic clustering
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## Science Outreach & Leadership

- **Guest Professional, The School at Columbia University (Nov 2023)**
  - Guided kindergarten students in an engineering design process lesson.
- **STEAM Student Outreach (May 2023)**
  - Demonstrated augmented reality tasks to highlight immersive technology for neuroscience.
- **Three Minute Thesis (2021)**
  - Presented doctoral research for a non-specialist audience.
- **Mentorship (2019 – 2022)**
  - Mentored graduate students Declan Collins and Azka Ashraf (2019–2021; University of Birmingham), and undergraduate student Alessandra Bracci (2021–2022; University of Glasgow). Provided instruction in data analysis, coding, and single neuron data analysis.
- **Student Council Member (2016 – 2018)**
  - Served as an elected representative, supporting academic collaboration and policy.