Curriculum Vitae

Contact

Address	University Hospital Bonn, Department of Epileptology Venusberg-Campus 1, 53127 Bonn, Germany
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Lab website	www.spatialmemorylab.com

Professional

- **Assistant Professor and Junior Research Group Leader: Neural mechanisms of navigation and memory in human health and disease** — 5/2023–present
  University Hospital Bonn, Bonn, Germany
  Department of Epileptology
- **Walter Benjamin Fellow: Neuronal mechanisms of associative memory formation in the human medial temporal lobe** — 3/2021–4/2023
  Columbia University, New York City, NY, USA
  Department of Biomedical Engineering (PI: Prof. Dr. Joshua Jacobs)
- **Postdoctoral researcher: The roles of grid and place cells and phase precession in human episodic memory** — 1/2018–2/2021
  University of Freiburg, Freiburg, Germany
  Epilepsy Center (PI: Prof. Dr. Andreas Schulze-Bonhage)
  - **Visiting scholar: Single-neuron representations of goal-directed navigation in the human medial temporal lobe** — 11/2019–1/2020
    Columbia University, New York City, NY, USA
    Department of Biomedical Engineering (PI: Prof. Dr. Joshua Jacobs)

Education

- **PhD (Dr. rer. nat.). Thesis: Neural mechanisms underlying spatial navigation in the human medial temporal lobe (*summa cum laude*)** — 2019–2022
  University of Freiburg, Faculty of Biology, Freiburg, Germany
  In the framework of the international PhD program of the Spemann Graduate School of Biology and Medicine (SGBM)
  Supervisor: Prof. Dr. Andreas Schulze-Bonhage
- **MD (Dr. med.). Thesis: Investigation of grid cell–based representations of the entorhinal cortex in adults at genetic risk for Alzheimer's disease (*summa cum laude*)** — 2013–2017
  University of Bonn, Faculty of Medicine, Bonn, Germany
  Supervisors: Prof. Dr. Nikolai Axmacher, PD Dr. Jürgen Fell
- **Human medicine (state examination)** — 2010–2017
  University of Bonn, Bonn, Germany. Final grade: "Very good."
- **Philosophy and German studies (B.A.)** — 2011–2018
  University of Bonn, Bonn, Germany. Final grade: "Very good."

Publications (peer reviewed)

25. Guth TA, Brandt A, Reinacher PC, Schulze-Bonhage A, Jacobs J, **Kunz L**† (2025). Theta-phase locking of single neurons during human spatial memory. Nature Communications; 16, 7402.

24. Nett L, Guth TA, Büchel PK, Rungratsameetaweemana N, **Kunz L**† (2025). Behavioral investigation of allocentric and egocentric cognitive maps in human spatial memory. Neuropsychologia; 271, 109230.

23. Colmant L, Quenon L, Huyghe L, Ivanoiu A, Gérard T, Lhommel R, Coppens P, Salman Y, Malotaux V, Dricot L, **Kunz L**, Axmacher N, Lefèvre P, Hanseeuw B (2025). Rotation errors in path integration are associated with Alzheimer's disease tau pathology: a cross-sectional study. Alzheimer's Research & Therapy; 17, 34.

22. Estefan DP, Fellner MC, **Kunz L**, Zhang H, Reinacher P, Roy C, Brandt A, Schulze-Bonhage A, Yang L, Wang S, Liu J, Xue G, Axmacher N (2024). Maintenance and transformation of representational formats during working memory prioritization. Nature Communications; 15, 8234.

21. Bin Khalid I, Reifenstein ET, Auer N, **Kunz L****†, Kempter R** (2024). Quantitative modeling of the emergence of macroscopic grid-like representations. eLife; 13, e85742.

20. Boecker H, Daamen M, **Kunz L**, Geiß M, Müller M, Neuss T, Henschel L, Stirnberg R, Upadhyay N, Scheef L, Martin JA, Stöcker T, Radbruch A, Attenberger U, Axmacher N, Maurer A (2024). Hippocampal subfield plasticity is associated with improved spatial memory. Communications Biology; 7, 271.

19. **Kunz L**†, Staresina BP, Reinacher PC, Brandt A, Guth TA, Schulze-Bonhage A, Jacobs J (2024). Ripple-locked coactivity of stimulus-specific neurons and human associative memory. Nature Neuroscience; 27, 587–599.

18. Colmant L, Bierbrauer A, Bellaali Y, **Kunz L**, Van Dongen J, Sleegers K, Axmacher N, Lefevre P, Hanseeuw B (2023). Dissociating effects of aging and genetic risk of sporadic Alzheimer's disease on path integration. Neurobiology of Aging; 131, 170–181.

17. Liu J, Chen D, Xiao X, Zhang H, Zhou W, Liang S, **Kunz L**, Schulze-Bonhage A, Axmacher N, Wang L (2023). Multi-scale goal distance representations in human hippocampus during virtual spatial navigation. Current Biology; 33, 2024–2033.e3.

16. Herweg NA, **Kunz L**, Schonhaut D, Brandt A, Wanda PA, Sharan AD, Sperling MR, Schulze-Bonhage A, Kahana MJ (2023). A learned map for places and concepts in the human medial temporal lobe. Journal of Neuroscience; 43, 3538–3547.

15. Han CZ, Donoghue T, Cao R, **Kunz L**, Wang S, Jacobs J (2023). Using multi-task experiments to test principles of hippocampal function. Hippocampus; 33, 646–657.

14. Akan O, Bierbrauer A, **Kunz L**, Gajewski PD, Getzmann S, Hengstler JG, Wascher E, Axmacher N, Wolf OT (2023). Chronic stress is associated with specific path integration deficits. Behavioral Brain Research; 442, 114305.

13. Costa M, Lozano-Soldevilla D, Gil-Nagel A, Toledano R, Oehrn CR, **Kunz L**, Yebra M, Mendez-Bertolo C, Stieglitz L, Sarnthein J, Axmacher N, Moratti S, Strange BA (2022). Aversive memory formation in humans involves an amygdala-hippocampus phase code. Nature Communications; 13, 6403.

12. Chen D, **Kunz L**, Lv P, Zhang H, Zhou W, Liang S, Axmacher N, Wang L (2021). Theta oscillations coordinate grid-like representations between ventromedial prefrontal and entorhinal cortex. Science Advances; 7, eabj0200.

11. Guth TA, **Kunz L**, Brandt A, Dümpelmann M, Klotz KA, Reinacher PC, Schulze-Bonhage A, Jacobs J, Schönberger J (2021). Interictal spikes with and without high-frequency oscillation have different single-neuron correlates. Brain; 144, 3078–3088.

10. **Kunz L**†, Brandt A, Reinacher PC, Staresina BP, Reifenstein ET, Weidemann CT, Herweg NA, Patel A, Tsitsiklis M, Kempter R, Kahana MJ, Schulze-Bonhage A, Jacobs J (2021). A neural code for egocentric spatial maps in the human medial temporal lobe. Neuron; 109, 2781–2796.e10.

9. Lachner-Piza D, **Kunz L**, Brandt A, Dümpelmann M, Thomschewski A, Schulze-Bonhage A (2021). Effects of spatial memory processing on hippocampal ripples. Frontiers in Neurology; 12, 620670.

8. Manzouri F, Meisel C, **Kunz L**, Dümpelmann M, Stieglitz T, Schulze-Bonhage A (2021). Low-frequency electrical stimulation reduces cortical excitability in the human brain. NeuroImage: Clinical; 31, 102778.

7. Bierbrauer A*, **Kunz L***†, Gomes CA*, Luhmann M, Deuker L, Getzmann S, Wascher E, Gajewski PD, Hengstler JG, Fernandez-Alvarez M, Atienza M, Cammisuli DM, Bonatti F, Pruneti C, Percesepe A, Bellaali Y, Hanseeuw B, Strange BA, Cantero JL, Axmacher N (2020). Unmasking selective path integration deficits in Alzheimer's disease risk carriers. Science Advances; 6, eaba1394.

6. **Kunz L**†, Wang L, Lachner-Piza D, Zhang H, Brandt A, Dümpelmann M, Reinacher PC, Coenen VA, Chen D, Wang W, Zhou W, Liang S, Grewe P, Bien CG, Bierbrauer A, Schröder TN, Schulze-Bonhage A, Axmacher N (2019). Hippocampal theta phases organize the reactivation of large-scale electrophysiological representations during goal-directed navigation. Science Advances; 5, eaav8192.

5. **Kunz L***†, Maidenbaum S*, Chen D*, Wang L, Jacobs J, Axmacher N (2019). Mesoscopic neural representations in spatial navigation. Trends in Cognitive Sciences; 23, 615–630.

4. Chen D*, **Kunz L***, Wang W, Zhang H, Wang W, Schulze-Bonhage A, Reinacher PC, Zhou W, Liang S, Axmacher N, Wang L (2018). Hexadirectional modulation of theta power in human entorhinal cortex during spatial navigation. Current Biology; 28, 3310–3315.e4.

3. **Kunz L**†, Reuter M, Axmacher N, Montag C (2017). Conscientiousness is negatively associated with grey matter volume in young APOE ε4-carriers. Journal of Alzheimer's Disease; 56, 1135–1144.

2. **Kunz L**, Schröder TN, Lee H, Montag C, Lachmann B, Sariyska R, Reuter M, Stirnberg R, Stöcker T, Messing-Floeter PC, Fell J, Doeller CF, Axmacher N (2015). Reduced grid-cell–like representations in adults at genetic risk for Alzheimer's disease. Science; 350, 430–433.

1. Montag C, **Kunz L**, Axmacher N, Sariyska R, Lachmann B, Reuter M (2014). Common genetic variation of the APOE gene and personality. BMC Neuroscience; 15, 1–5.

* *denotes shared first authorship;* ** *denotes shared last authorship*; † *denotes corresponding author.*

Publications (other)

6. **Kunz L** (2024). Searching for the cellular basis of spatial navigation in humans. Neuroforum: Organ der Neurowissenschaftlichen Gesellschaft; 30, 12–18.

5. **Kunz L**† (2023). Orientation: Neuroscientific insights into mechanisms, impairments, and relevance. Book chapter for the exhibition *Building to Heal. New Architecture for Hospitals* at the modern art museum *Pinakothek der Moderne* in Munich (exhibition period, 2023/07/12–2024/01/21).

4. Qasim SE, **Kunz L**† (2023). How is single-neuron activity related to LFP oscillations? Book chapter in *Intracranial EEG. A Guide for Cognitive Neuroscientists* (pp. 703–718); Springer.

3. **Kunz L** (2022). Neural mechanisms underlying spatial navigation in the human medial temporal lobe. Dissertation. Albert-Ludwigs-Universität Freiburg im Breisgau.

2. **Kunz L**†, Deuker L, Zhang H, Axmacher N (2018). Tracking human engrams using multivariate analysis techniques. Book chapter in *Handbook of Behavioral Neuroscience* (vol. 28, pp. 481–508); Elsevier.

1. **Kunz L** (2017). Untersuchung von „grid cell"-basierten Repräsentationen des entorhinalen Kortex in Erwachsenen mit genetisch erhöhtem Risiko für Morbus Alzheimer. Dissertation. Universitäts- und Landesbibliothek Bonn.

† *denotes corresponding author.*

Preprints

4. Khazali MF, Brandt A, Reinacher PC, Kahana MJ, Jacobs J, Schulze-Bonhage A, **Kunz L**† (2024). A preserved neural code for temporal order between memory formation and recall in the human medial temporal lobe. Preprint at *bioRxiv*.

3. Treu S, Barcia JA, Torres C, Bierbrauer A, Gonzalez-Rosa JJ, Nombela C, Pineda-Pardo JA, Torres D, **Kunz L**, Hellerstedt R, Avecillas-Chasin JM, Lara M, Navas M, Vallejo AG, García-Albea J, Oliviero A, Seijo F, Horn A, Li N, Axmacher N, Canals S, Reneses B, Strange BA (2023). Deep-brain stimulation of the human nucleus accumbens-medial septum enhances memory formation. Preprint at *Research Square*.

2. Qasim SE, Reinacher PC, Brandt A, Schulze-Bonhage A, **Kunz L**† (2023). Neurons in the human entorhinal cortex map abstract emotion space. Preprint at *bioRxiv*.

1. Yebra M, Jensen O, **Kunz L**, Moratti S, Axmacher N, Strange B (2021). A gradient of electrophysiological novelty responses along the human hippocampal long axis. Preprint at *bioRxiv*.

† *denotes corresponding author.*

Open Science

2025 Public GitHub release of all analysis code related to Guth et al., Nature Communications, 2025: https://github.com/BonnSpatialMemoryLab/GuthPhaseLocking2025

2025 Public GitHub release of all analysis code and data related to Nett et al., Neuropsychologia, 2025: https://github.com/BonnSpatialMemoryLab/NettGardenGameBehavior2025 and https://github.com/BonnSpatialMemoryLab/GardenGameTask.

2024 Public GitHub release of all analysis code related to Kunz et al., Nature Neuroscience, 2024: https://github.com/NeuroLuke/KunzNatureNeuroscience2024.

2024 Public GitHub release of analysis code related to Boecker et al., Communications Biology, 2024: https://github.com/NeuroLuke/BoeckerCommunicationsBiology2024.

2021 Public GitHub release of all analysis code related Kunz et al., Neuron, 2021: https://github.com/NeuroLuke/KunzNeuron2021.

Editorial activity

2025 Guest Editor for the Special Issue "Maps in the Brain: from Definitions to Measurement and Applications" in the journal Neuropsychologia. *Link*.

Funding as principal investigator

Cumulative funding: 1,674,239 EUR

- Collaborative Research in Computational Neuroscience (CRCNS) grant by the Federal Ministry of Education and Research (BMBF, 01GQ2402A) for studying the single-neuron basis of allocentric and egocentric cognitive maps in humans. **324,275 EUR** for personnel and non-personnel costs for a period of 3 years. 11/2024–10/2027
- Return program of the State of North Rhine-Westphalia (NRW Rückkehrprogramm) to establish and lead an independent junior research group at the University Hospital Bonn, Bonn, Germany. **1,249,964 EUR** for personnel and non-personnel costs for a period of 5 years. 5/2023–4/2028
- Walter Benjamin Programme (WBP) Return Stipend of the German Research Foundation (DFG). **4,000 EUR** for personnel for a period of 2 months. 3/2023–4/2023
- Walter Benjamin Programme (WBP) Stipend of the German Research Foundation (DFG). **96,000 EUR** for personnel for a period of 2 years. 3/2021–2/2023

Awards and Scholarships

- Schilling Research Award of the German Neuroscience Society. 2025
- Junior Researcher Award for Clinical Neurophysiology of the German Society of Neurophysiology and Functional Imaging, Jena, Germany. 2023
- Boehringer Ingelheim Fonds travel grant for a 3-month research stay at Columbia University, New York, USA. 2019–2020
- Poster Award of the Center for Basics in NeuroModulation of the University of Freiburg, Freiburg, Germany. 2019
- Trainee Professional Development Award (TPDA) for the Annual Meeting of the Society of Neuroscience (SfN), San Diego, USA. 2018
- Travel Award for the Grid Cell Meeting 2018 of the University College London, London, UK. 2018

- BONFOR Research Prize of the BONFOR Research Commission of the Medical Faculty of the University of Bonn, Bonn, Germany. 2016
- 2-year BONFOR Scholarship of the Medical Faculty of the University of Bonn, Bonn, Germany. 2013–2015
- 7-year Scholarship of the German Academic Scholarship Foundation (Studienstiftung des deutschen Volkes). 2011–2017

Work as a reviewer for international journals

Nature; Neuron; Nature Human Behaviour; Nature Communications; Science Advances; Current Biology; Nature Scientific Data; Neuropsychopharmacology; Acta Physiologica; Neuroscience and Biobehavioral Reviews; Imaging Neuroscience; Communications Biology; NeuroImage; Journal of Neuroscience; Cerebral Cortex; Journal of the Neurological Sciences; eNeuro; European Journal of Neuroscience; Frontiers in Human Neuroscience; Neuropsychologia; Brain Research; eLife.

Work as a reviewer for research agencies

- German Research Foundation (DFG). 2024–present
- National Science Foundation (NSF). 2024–present
- Swiss National Science Foundation (SNSF). 2024–present
- Fondation pour la Recherche Médicale (FRM). 2024–present
- French National Research Agency (ANR). 2023–present

Society membership

- Society for Neuroscience (SfN). 2018–present
- Federation of European Neuroscience Societies (FENS). 2019–present
- German Neuroscience Society (NWG). 2019–present
- ALBA Network for diversity and equity in brain sciences. 2021–present
- German Academic International Network (GAIN). 2021–present
- Verein zur Förderung der Epilepsieforschung e.V. 2023–present