Curriculum vitae

Contact

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Professional

2023–present	**Assistant Professor (W1–W2 Tenure Track) and Research Group Leader: Neural mechanisms of navigation and memory in human health and disease.** University of Bonn, Bonn, Germany Faculty of Medicine
2021–2023	**Postdoctoral fellow: Neuronal mechanisms of associative memory formation in the human medial temporal lobe.** Columbia University, New York City, NY, USA Department of Biomedical Engineering (PI, Joshua Jacobs)
2018–2021	**Postdoctoral researcher: The roles of grid and place cells and phase precession in human episodic memory.** University of Freiburg, Freiburg, Germany Epilepsy Center (PI, Andreas Schulze-Bonhage)

Education

2019–2022	**PhD (Dr. rer. nat.). Thesis: Neural mechanisms underlying spatial navigation in the human medial temporal lobe (*summa cum laude*).** 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, Andreas Schulze-Bonhage.
2013–2017	**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*).** University of Bonn, Faculty of Medicine, Bonn, Germany. Supervisors, Nikolai Axmacher and Jürgen Fell.
2011–2018	**Philosophy and German studies (B.A.)** University of Bonn, Bonn, Germany.
2010–2017	**Human medicine (state examination).** University of Bonn, Bonn, Germany.

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.

*Notes: * 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 in *Building to Heal. New Architecture for Hospitals* (eds. Tanja C. Vollmer, Andres Lepik, Lisa Luksch); ***ArchiTangle***.

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***.

Notes: † denotes corresponding author.

Preprints

5. Patai EZ, Stawarczyk D, Herweg N, Gomes CA, Zhang H, Schulze-Bonhage A, **Kunz L**, Axmacher N. It's All In The Journey: Putative Strategies Extracted from Navigation Paths Predict Spatial Memory and Hippocampal Recruitment. Preprint at *bioRxiv*.

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*.

Notes: † denotes corresponding author.

Open Science (publication of code and data)

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

5. 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.

4. Public GitHub release of all analysis code related to Bin Khalid et al., eLife, 2024: https://github.com/ikhwankhalid/grid_bold.

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

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

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

Funding as principal investigator

2024–2027 Federal Ministry of Research, Technology and Space (BMFTR): Collaborative Research in Computational Neuroscience (CRCNS). Title: Neural circuits for egocentric and allocentric cognitive maps in humans. **324,275 EUR** for personnel and non-personnel costs for a period of 3 years.

2023–2028 Ministry of Culture and Science of the German state of North Rhine-Westphalia: Return Program (NRW Rückkehrprogramm). Title: Neural mechanisms of navigation and memory in human health and disease. **1,249,964 EUR** for personnel and non-personnel costs for a period of 5 years.

Fellowships and scholarships

2021–2023 Walter Benjamin Programme, German Research Foundation (DFG).

2013–2015 BONFOR Scholarship, Medical Faculty, University of Bonn, Bonn, Germany.

2011–2017 Scholarship, German Academic Scholarship Foundation (Studienstiftung des deutschen Volkes).

Awards and prizes

2025 Schilling Research Award, German Neuroscience Society.

2023 Junior Researcher Award for Clinical Neurophysiology, German Society of Neurophysiology and Functional Imaging (DGKN).

2019–2020 Travel grant, Boehringer Ingelheim Fonds.

2019 Poster Award, Center for Basics in NeuroModulation, University of Freiburg, Freiburg, Germany.

2018 Trainee Professional Development Award, Society for Neuroscience (SfN).

2018 Travel Award, Grid Cell Meeting 2018 at University College London, London, UK.

2016 BONFOR Research Prize, Medical Faculty, University of Bonn, Bonn, Germany.

Editorial activity

2024–present Guest Editor for the Special Issue "Maps in the Brain: from Definitions to Measurement and Applications" in the journal ***Neuropsychologia***. *Link*.

Reviewing activity for international journals

Science; Nature; Nature Neuroscience; Neuron; Nature Human Behaviour; Nature Communications; Science Advances; Current Biology; Nature Scientific Data; Neuropsychopharmacology; Acta Physiologica; Neuroscience and Biobehavioral Reviews; Imaging Neuroscience; PLOS Biology; 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.

Reviewing activity for research agencies

2025	National Science Foundation (NSF, USA): Cognitive Neuroscience (CogNeuro), PD 24-1699. Ad-hoc reviewer.
2025	German Research Foundation (DFG, Germany): Emmy Noether Programme. Ad-hoc reviewer.
2025	German Research Foundation (DFG, Germany): Individual Research Grant. Ad-hoc reviewer.
2024	Swiss National Science Foundation (SNSF, Switzerland): Project Funding. Ad-hoc reviewer.
2024	National Science Foundation (NSF, USA): Cognitive Neuroscience (CogNeuro), PD 24-1699. Ad-hoc reviewer.
2024	German Research Foundation (DFG, Germany): ANR-DFG 2024 NLE. Ad-hoc reviewer.
2024	Fondation pour la Recherche Médicale (FRM, France): Call for proposals Equipes FRM 2024. Ad-hoc reviewer.
2021	French National Research Agency (ANR, France): CE16 - Neurosciences moléculaires et cellulaires - Neurobiologie du développement. Ad-hoc reviewer.

Society membership

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