Bernstein Netzwerk
Computational Neuroscience

PhD Positions in Theoretical Systems Neuroscience – Lab of Christian Leibold

www.neurotheory.uni-freiburg.de

The Lab of Christian Leibold is inviting applications for **PhD student positions**. The projects focus on **computational modelling and data analysis of hippocampal sequences**, with the overarching goal of advancing our understanding of memory and navigation.

The hippocampus is one of the most extensively studied brain regions, uniquely suited to linking neural microcircuit dynamics to behavior and cognition. With increasingly large-scale simultaneous recordings of neuronal populations now available, modern theoretical and machine learning approaches can be applied in complex behavioral contexts. Our specific interest lies in how hippocampal activity patterns during locomotion support learning, memory retrieval, and navigation, and in the neural circuit mechanisms underlying these computations.

PhD candidates will:

- Analyze large data sets from collaborating experimental labs,
- Develop biologically inspired neural network models of the hippocampal formation,
- Develop theoretical methods and conceptual frameworks that bridge neurophysiological mechanisms and computation.

We are seeking applicants with a background in the **quantitative sciences** (e.g. Physics, Mathematics, Computational Neuroscience, Computer Science, Machine Learning, and related fields) who are eager to engage with both neurobiological and computational perspectives. Projects can be tailored to the candidate's expertise and interests.

Our international group offers a truly interdisciplinary research environment, ranging from cellular biophysics to NeuroAI. We are based at the **Bernstein Center Freiburg** (www.bcf.uni-freiburg.de), a founding node of the **Bernstein Network Computational Neuroscience** (https://bernstein-network.de/), and embedded in the vibrant **Freiburg Neuroscience Community** (www.neuro.uni-freiburg.de), with close ties to experimental collaborators.

- **Employment**: Positions are funded according to the German public pay scale (TV-L).
- **Diversity**: Applications from women and candidates from underrepresented groups are strongly encouraged and will be prioritized in case of equal qualification.
- **Application**: Please send your **CV, transcripts, and two letters of recommendation** to *raphaela.straub@biologie.uni-freiburg.de*.
- **Deadline**: Applications received by **November 1, 2025** will receive full consideration.

Hippocampus-related papers of the lab since 2020:

Yuan M, Cazala A, Goedeke S, Leibold C, Sauer JF, Bartos M. Predictive goal coding by dentate gyrus somatostatin-expressing interneurons in male mice. Nat Commun. 2025 Jun 25;16(1):5382. doi: 10.1038/s41467-025-60841-y.

Ahmadi S, Sasaki T, Sabariego M, Leibold C, Leutgeb S, Leutgeb JK. Distinct roles of dentate gyrus and medial entorhinal cortex inputs for phase precession and temporal correlations in the hippocampal CA3 area. Nat Commun. 2025 Jan 2;16(1):13. doi: 10.1038/s41467-024-54943-2.

Athanasiadis M, Masserini S, Yuan L, Fetterhoff D, Leutgeb JK, Leutgeb S, Leibold C. Low rate hippocampal delay period activity encodes behavioral experience. Hippocampus. 2024 Aug;34(8):422-437. doi: 10.1002/hipo.23619.

Diester I, Bartos M, Bödecker J, Kortylewski A, Leibold C, Letzkus J, Nour MM, Schönauer M, Straw A, Valada A, Vlachos A, Brox T. Internal world models in humans, animals, and AI. Neuron. 2024 Jul 17;112(14):2265-2268. doi: 10.1016/j.neuron.2024.06.019.

Huang X, Schlesiger MI, Barriuso-Ortega I, Leibold C, MacLaren DAA, Bieber N, Monyer H. Distinct spatial maps and multiple object codes in the lateral entorhinal cortex. Neuron. 2023 Oct 4;111(19):3068-3083.e7. doi: 10.1016/j.neuron.2023.06.020.

Yiu YH, Leibold C. A theory of hippocampal theta correlations accounting for extrinsic and intrinsic sequences. Elife. 2023 Oct 4;12. doi: 10.7554/eLife.86837.

Leibold C. Neural kernels for recursive support vector regression as a model for episodic memory. Biol Cybern. 2022 Jun;116(3):377-386. doi: 10.1007/s00422-022-00926-9.

Yiu YH, Leutgeb JK, Leibold C. Directional Tuning of Phase Precession Properties in the Hippocampus. J Neurosci. 2022 Mar 16;42(11):2282-2297. doi: 10.1523/JNEUROSCI.1569-21.2021. Epub 2022 Feb 2. PubMed PMID: 35110389; PubMed Central PMCID: PMC8936609.

Fetterhoff D, Sobolev A, Leibold C. Graded remapping of hippocampal ensembles under sensory conflicts. Cell Rep. 2021 Sep 14;36(11):109661. doi: 10.1016/j.celrep.2021.109661.

Beed P, de Filippo R, Holman C, Johenning FW, Leibold C, Caputi A, Monyer H, Schmitz D. Layer 3 Pyramidal Cells in the Medial Entorhinal Cortex Orchestrate Up-Down States and Entrain the Deep Layers Differentially. Cell Rep. 2020 Dec 8;33(10):108470. doi: 10.1016/j.celrep.2020.108470.

Leibold C. A model for navigation in unknown environments based on a reservoir of hippocampal sequences. Neural Netw. 2020 Apr;124:328-342. doi: 10.1016/j.neunet.2020.01.014.

Monsalve-Mercado MM, Leibold C. Effect of boundaries on grid cell patterns. Phys. Rev. Research 2, 043137 2020 DOI: https://doi.org/10.1103/PhysRevResearch.2.043137