

# Janne Kristian Lappalainen

Shanahan Foundation Postdoctoral Fellow

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## Research interests

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How do organisms compute and learn? My research combines data (such as from connectomics) with machine learning techniques (such as deep learning and simulation-based inference) to build mechanistic neural-network models that integrate rich biological measurements and yield testable predictions about neural function. The aim is to understand how constraints such as anatomical structure influence computation, working toward accurate whole-brain and organism-level models that support neuroscientific discovery.

## Education

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- 10/2020 – 01/2026 **Dr. rer. nat., Machine Learning in Science**, University of Tübingen and Max Planck Research School for Intelligent Systems, Supervisor: Prof. Dr. Jakob H. Macke  
Thesis submitted 16 July 2025; defended 16 January 2026 with overall designation *summa cum laude*. Thesis reports by Prof. Dr. Jakob H. Macke, Prof. Dr. Julijana Gjorgjieva, and Prof. Dr. H. Sebastian Seung. Oral examination committee: Prof. Dr. Jakob H. Macke, Prof. Dr. Julijana Gjorgjieva, Prof. Dr. Georg Martius, and Prof. Dr. Matthias Bethge.
- 10/2017 – 03/2020 **M.Sc. Neuroengineering**, Technical University of Munich, High Distinction
- 10/2013 – 07/2017 **B.Sc. Physics**, University of Göttingen, Distinction; Erasmus semester at Universidad de La Laguna

## Academic appointments

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- since 01/2026 **Shanahan Foundation Postdoctoral Fellow**, Allen Institute and University of Washington, Seattle, Advisors: Dr. Forrest Collman and Prof. Adrienne Fairhall  
Start date: 26 January 2026.
- 10/2020 – 10/2025 **Doctoral Researcher, Machine Learning in Science**, University of Tübingen and Max Planck Institute for Intelligent Systems, Advisor: Prof. Dr. Jakob H. Macke  
In collaboration with HHMI Janelia Research Campus (Dr. Srinivas C. Turaga).
- 04/2019 – 10/2020 **Visiting Researcher (M.Sc. thesis and remote collaboration)**, HHMI Janelia Research Campus, Ashburn, VA, USA, Host: Dr. Srinivas C. Turaga  
M.Sc. thesis: *Task-performance optimization of a connectome-based neural network model of the Drosophila visual system*.
- 2017 – 2019 **Earlier research projects (M.Sc. Neuroengineering, TU Munich)**  
U-net nerve segmentation from ultrasound imaging (Prof. Nießner, Prof. Leal-Taixé); GANs for multi-agent pedestrian trajectory prediction (Prof. Leal-Taixé); representational dissimilarity between human medial temporal lobe and deep networks (Prof. Macke); machine-learning internship at Celonis SE, Munich.

## Honors and awards

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- 2026 Shanahan Foundation Postdoctoral Fellowship in Computational Neuroscience, Allen Institute and University of Washington.
- 2025 Aspirational Neuroscience Award.
- 2024 Leadership Talent Academy scholarship, Karl Schlecht Stiftung (KSG).
- 2017 Elite Network of Bavaria membership.
- 2016 Erasmus+ EU Grant.

## Contributions to grants and funding

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- 2024 **Contributor** (discussions, review, editing, poster). CRC 1233 *Robust Vision – Inference Principles and Neural Mechanisms* (PIs: Prof. Bethge, Prof. Macke, Prof. Franke). *Awarded*.

- 2022 **Lead scientific contributor.** ERC Starting Grant *DeepCoMechTome: Using deep learning to understand computations in neural circuits with connectome-constrained mechanistic models* (PI: Prof. Macke). *Awarded.*
- 2021 **Lead author.** *Optical flow calculations with biologically realistic neural networks.* Vector Stiftung MINT Innovationen (J. Lappalainen with Prof. Macke). *Shortlisted.*
- 2020 Research and writing contributor. *Dissociating neuronal representations along the ventral visual processing stream in the human temporal lobe* (DFG SFB *Synaptic microcircuits in health and disease*, Prof. Macke, Co-PI). *Awarded.*

## Publications

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### Doctoral thesis

- 2026 **Lappalainen J. K.** From Connectome to Computation: Predicting Neural Function with Machine Learning. Doctoral dissertation, University of Tübingen, Faculty of Mathematics and Natural Sciences. Submitted 16 July 2025; defended 16 January 2026; published 9 March 2026. [doi:10.15496/publikation-117772](https://doi.org/10.15496/publikation-117772)

### Peer-reviewed journal articles

- 2025 Deistler M., Kadhim K. L., Beck J., Pals M., Huang Z., Gloeckler M., **Lappalainen J. K.**, Schröder C., Berens P., Gonçalves P. J., Macke J. H. JAXLEY: Differentiable simulation enables large-scale training of detailed biophysical models of neural dynamics. *Nature Methods. Contributions: software, investigation, reviewing and editing writing.* [Link](#), [Code1](#), [Code2](#)
- 2024 **Lappalainen J. K.**, Tschopp F. D., Prakhya S., McGill M., Nern A., Shinomiya K., Takemura S., Gruntman E., Macke J. H., Turaga S. C. Connectome-constrained networks predict neural activity across the fly visual system. *Nature* 634, 1132–1140. [Link](#), [Code](#)
- 2019 **Lappalainen J. K.**, Herpich J., Tetzlaff C. A theoretical framework to derive simple, firing-rate-dependent mathematical models of synaptic plasticity. *Frontiers in Computational Neuroscience* 13, 26. [Link](#), [Code](#)

### Peer-reviewed conference articles and preprints

- 2026 Garcia-Duran A., Rodriguez-Garcia A., Molano-Mazon M., Hyafil A., Ramaswamy S., **Lappalainen J. K.** Measuring Robustness and Efficiency in a Connectome-Constrained Fly Visual System Model on a Collision-Detection Task. *Under review.*
- 2026 Allier C., **Lappalainen J. K.**, Kumar V., Saalfeld S. Graph neural networks recover interpretable circuit models from neural activity. *Under review.*
- 2025 Deistler M., Boelts J., Steinbach P., Moss G., Moreau T., Gloeckler M., Rodrigues P. L. C., Linhart J., **Lappalainen J. K.**, Miller B. K., Gonçalves P. J., Lueckmann J.-M., Schröder C., Macke J. H. Simulation-Based Inference: A Practical Guide. arXiv; submitted to *JMLR*. [Link](#)
- 2024 Alphabetically ordered author list including **Lappalainen J. K.** and twenty others A practical guide to sample-based statistical distances for evaluating generative models in science. *Transactions on Machine Learning Research* 2835–8856. *Contributions: concept, software, writing, visualization.* [Link](#), [Code](#)
- 2024 Boelts J., Deistler M., Gloeckler M., Tejero-Cantero Á., Lueckmann J.-M., Moss G., Steinbach P., Moreau T., Muratore F., Linhart J., Durkan C., Vetter J., Miller B. K., Herold M., Ziaemehr A., Pals M., Gruner T., Bischoff S., Krouglova N., Gao R., **Lappalainen J. K.**, Mucsányi B., Pei F., Schulz A., Stefanidi Z., Rodrigues P., Schröder C., Abu Zaid F., Beck J., Kapoor J., Greenberg D. S., Gonçalves P. J., Macke J. H. sbi reloaded: a toolkit for simulation-based inference workflows. arXiv preprint arXiv:2411.17337. *Contributions during hackathons.* [Link](#), [Code](#)

## Invited talks

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- 04/2026 Computational Neuroscience Center seminar, University of Washington, Seattle.
- 11/2024 Princeton Neuroscience Institute (hosts: Prof. Murthy and Prof. Seung).
- 09/2024 Bernstein Conference Frankfurt, *Computation across scales in brain and beyond.*
- 07/2024 Gerstner lab seminar, EPFL.

10/2021

Champalimaud Research Symposium, Lisbon, *Dialogues on Neural and Machine Intelligence*.

Full list available on request.

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## Poster presentations

Approximately 15 posters at Cosyne (2020, 2024, 2026), Bernstein Conference (2022, 2024, 2025), SfN 2022, Connectomics Meeting Berlin (2022, 2024), and CoNectome 2026 (UW), 2020–2026. Full list available on request.

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## Teaching

2025	Instructor, CAJAL Advanced Neuroscience Training Programme – NeuroAI – Neuroscience and AI, Lisbon, Portugal. <a href="#">Link</a>
2020–2025	Teaching assistant, University of Tübingen (Macke lab). Probabilistic Machine Learning; Computational Connectomics Seminar (lead lecturer); Data Literacy; Machine Learning Seminar. <a href="#">Probabilistic ML</a> ; <a href="#">Comp. Connectomics</a> ; <a href="#">Data Literacy</a> .
2019	Teaching assistant, TU Munich (Macke lab). Statistics and Probability Theory; Large-scale Modeling and Large-scale Data Analysis.
2016–2017	Teaching assistant, University of Göttingen. Classical Mechanics (Prof. Volkert); Classical Electrodynamics (Prof. Salditt).

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## Student supervision

Supervised eight Master's and Bachelor's students, research interns, and lab rotations (2021–2025); two (L. Ulmer, I. Omolayo) are now PhD students in the Macke lab. Full list available on request.

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## Academic service

	Peer review
2026	Reviewer, NeurIPS 2026.
2025	Reviewer, <i>PLOS Computational Biology</i> .
2024–2025	Co-reviewer with Prof. Macke for one journal manuscript.
	Outreach and community engagement
2023–2024	Healthy Minds – mental-health in academia workshop and talk series. Initiator and organizer with N. Effenberger. Financially supported by the Excellence Cluster Machine Learning and the Tübingen AI Center. <a href="#">Series page</a> , <a href="#">Materials</a>
2022–2026	KI macht Schule – volunteer, Tübingen chapter. <a href="#">Link</a>

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## Example open-source contributions

- *flyvis* – PyTorch framework for task-optimizing connectome-constrained neural networks of the fly visual system. [docs](#)
- *datamate* – Lightweight data management for computational science. [docs](#)
- *cbsp* – Numba code for simulating neurons with calcium-based synaptic plasticity and learning of plasticity rules.
- *dnnvsbrain* – Representational similarity analysis between deep networks and brain activity.
- *jaxley* – Differentiable biophysical simulator (JAX). Software, investigation, reviewing/editing.
- *sbi* – Simulation-based inference toolkit. Hackathon contributions.
- *flyvis-gnn* – Graph neural networks for recovering interpretable circuit models from neural activity.

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## References

References available upon request.