Randolph F. Helfrich, M.D., Ph.D.

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Updated: October 2024

Education

2015 **Doctor of Philosophy** (Ph.D.) in Cognitive and Clinical Neurophysiology
University of Hamburg, Germany
summa cum laude (highest honors)
Award for the best thesis in Cognitive Neurobiology 2013-2016 (Hamburg)

2013 **Doctor of Medicine** (Dr. med., medical research doctorate) in Neurology
University of Tübingen, Germany
summa cum laude (highest honors)

2012 **Medical Doctor** (M.D., permanent license to practice medicine)
University of Tübingen, Germany

Academic Positions

From 07/2025 **Assistant Professor**, Yale University, New Haven, CT, USA
Department of Psychology and Department of Neurology
Affiliated Faculty Wu Tsai-Institute

2020 – now **Research Group Leader**, University Medical Center Tübingen, Germany
Hertie-Institute for Clinical Brain Research and Center for Neurology
funded by a German Research Foundation Emmy Noether Award
awarded the Ernst Jung Foundation Career Development Award in Medicine

Research Experience

2015 – 2019 **Postdoctoral Fellow**, University of California, Berkeley, CA, USA
Helen Wills Neuroscience Institute (Advisor: *Robert T. Knight, MD*)
funded by the Alexander von Humboldt Foundation

2012 – 2015 **Graduate Research Fellow** (Ph.D.), University Medical Center Hamburg, Germany
Dept. of Neurophysiology and Pathophysiology (Advisor: *Andreas K. Engel, MD, PhD)*
funded by the German National Academic Foundation

2008 – 2012 **Medical Research Doctorate** (Dr. med.), University Medical Center Tübingen, Germany
Dept. of General and Cognitive Neurology (Advisor: *Thomas Haarmeier, MD)*

Clinical Experience

2019 – 2024 **Neurology Residency** (completion expected for fall 2024), University of Tübingen, Germany
with subspecialty training in **Psychiatry (**2023-2024), **Clinical Electrophysiology** (2023)
Neurovascular diseases (2021-2022), **Epileptology/EEG Monitoring** (2020-2021)
2012 – 2014 **Dept. of Neurophysiology** University Medical Center Hamburg-Eppendorf, Germany
2012 **Internship Neurology** University of Tübingen, Germany
2011 **Internship Surgery** Tongji University, Shanghai, China
2011 **Internship Medicine** Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
2010 – 2011 **Medical school** Brown University, Providence, RI, USA
2006 – 2012 **Medical school** University of Tübingen, Germany

Research funding

Current

German Research Foundation (DFG) Emmy Noether Program 2020 – 2026
Title: *Rhythmic building blocks of human attention: How network oscillations link perception and action*
Role: PI Total: **1.465.740 EUR**

Medical Faculty Tübingen Junior Research Group Plus Program 2022 – 2026
Title: *Memory representation, transformation and pathological alteration during sleep*
Role: PI Total: **300.000 EUR**

Excellence Strategy of the German Federal and State Governments 2022 – 2025
Joint University of Tübingen and University of Nottingham, UK, Fellowship
Title: *The flexible use of human memory: High-precision imaging of subcortical-cortical networks*
Role: PI (with Nick Myers, PhD) Total: **146.800 EUR**

Hertie Foundation, Seed Funding in the Network for Excellence in Clinical Neuroscience 2024 – 2026
Title: *The rhythmicity of volitional actions: From physiologic principles of motor control to the pathophysiology movement disorders*
Role: PI (with Wolf-Julian Neumann, MD) Total: **59.165 EUR**

Ernst Jung Foundation Career Development Award in Medicine 2021 – 2024
Title: *The sleeping brain: A new perspective on the (patho-) physiology of memory systems*
Role: PI Total: **210.00 EUR**

Else-Kröner-Fresenius Foundation ClinbrAIn: Machine Learning for Clinical Brain Research 2023 – 2025
Title: *Explainable Deep Learning for the automated analysis of EEG signatures*
Role: Co-PI (with Zeynep Akata, PhD and Stefanie Liebe, MD, PhD) Total: **146.805 EUR**

Excellence Strategy of the German Federal and State Governments 2023 – 2024
Joint Program of the University of Tübingen and University of Nottingham, UK
Title: *How chaotic brain activity structures human thinking: Pioneering optically pumped magnetometers (OPM) to study working memory*
Role: PI (with Nick Myers, PhD) Total: **49.988 EUR**

Completed grants

Academic Foundation of Baden Württemberg Postdoc Fellowship 2020 – 2023
Title: *Human Intracranial Neurophysiology: Understanding the network neuroscience of predictions*
Role: PI Total: **143.240 EUR**

Hertie Foundation Network of Clinical Excellence in Neuroscience 2020 – 2024
Title: *The Pathophysiology of Memory Networks: Intracranial Recordings in the Medial Temporal Lobe*
Role: PI Total: **247.500 EUR**

German Research Foundation (DFG) Associated project, CRC1158 2022 – 2023
Title: *Spectral fingerprints of sleep deprivation induced hyperalgesia*
Role: Co-PI (with Sigrid Schuh-Hofer, MD) Total: **30.000 EUR**

German Research Foundation (DFG) Postdoctoral Fellowship 2018 – 2020
Title: *Rhythm 'n' Rules: Population coding in human and primate prefrontal cortex for cognitive flexibility*
Role: Postdoc – declined to accept group leader position Total: **~80.000 EUR**

Alexander von Humboldt-Foundation Feodor Lynen Fellowship 2015 – 2017
Title: *Cognitive rhythms: Human prefrontal cortex as a conductor in the cortical orchestra*
Role: Postdoc Total: **~70.000 EUR**

Leopoldina German National Academy of Sciences Postdoctoral Fellowship 2015 – 2017
Title: *Human prefrontal cortex as a conductor in the cortical orchestra*
Role: Postdoc – declined to accept Humboldt fellowship Total: **~70.000 EUR**

German National Academic Foundation PhD Fellowship 2012 – 2015
Merit-based award for top 0.5% of German students from all fields.
Title: *Mechanisms of multisensory perception: A combined EEG and tACS study*
Role: Ph.D. student Total: **~40.000 EUR**

Mentored grants
German Academic Exchange Service (DAAD) International Mobility Fellowship 2023 – 2025
Title: *Oscillatory and fractal dynamics: how latent stimulus features shape human working memory*
Role: Mentor (Mentored postdoc: Dr. Michael Hahn) Total: **151.800 EUR**

German Research Foundation (DFG) Walter Benjamin Fellowship 2023 – 2025
Title: *The pathophysiology of sleep-dependent memory consolidation*
Role: Mentor (Mentored postdoc: Dr. Frank van Schalkwijk) Total: **202.400 EUR**

State Postgraduate Fellowship Landesgraduiertenförderung Baden-Württemberg 2023 – 2025
Title: *Neurophysiology of Belief Updating and Integration in Visual Decisions*
Role: Mentor (mentored PhD student: Gabriela Iwama) Total: **32.400 EUR**

Medical Faculty Tübingen IZKF doctoral college 2021 – 2023
Title: *Memory representation, transformation and pathological alteration during sleep*
Role: Mentor (mentored medical student: Markus Kopf) Total: **15.843 EUR**

Fellowships, Awards and Honors

PI	2019 – 2026	Junior Research Group, Hertie Institute, Center for Neurology, Tübingen
	2021	Ernst Jung Foundation, Career Development Award in Medicine
Post-Doc	2016	Kavli Foundation Fellowship, Cognitive Neuroscience Institute
	2015	Mentee Award, German Society for Neurology
Graduate	2012 – 2015	German National Academic Foundation
	2016	Burkhard-Bromm Thesis Award
	2016	Best student paper award in the SFB936
	2015	Intramural Travel Grant, University Medical Center Hamburg
	2013	German Research Foundation (DFG): RISE Program
Undergrad	2010 – 2011	German National Academic Exchange Service (DAAD), Fellowship
	2011	Eberhard Kornbeck Foundation, Stipend
	2011	Academic Foundation of Baden Württemberg, Fellowship
	2010	University of Tübingen, Brown University Exchange Program

Journal publications (* Equal contribution, ˆ supervised trainee)

Google Scholar: https://scholar.google.com/citations?user=etB6MgYAAAAJ&hl=de&oi=sra
ORCiD: https://orcid.org/0000-0001-8045-3111

2024 Hahn MAˆ, Lendner JD, Anwander Mˆ, Slama KSJ, Knight RT, Lin JJ, **Helfrich RF**. *A tradeoff between efficiency and redundancy in the hippocampal-neocortical network during human and rodent sleep.* Prog Neurobiol. 2024 Oct 4;242:102672. doi: 10.1016/j.pneurobio.2024.102672.

2024 Lendner JD, Lin JJ, Larsson PG, **Helfrich RF**. *Multiple intrinsic timescales govern distinct brain states in human sleep*. J Neurosci. 2024 Aug 26:e0171242024. doi: 10.1523/JNEUROSCI.0171-24.2024.

2024 Kopf Mˆ, Martini Jˆ, Stier C, Ethofer S, Braun C, Li Hegner Y, Focke NK, Marquetand J, **Helfrich RF**. *Aperiodic activity indexes neural hyperexcitability in generalized epilepsy*. eNeuro. 2024 Sep 4;11(9):ENEURO.0242-24.2024. doi: 10.1523/ENEURO.0242-24.2024.

2024 Weber Jˆ, Solbakk AK, Blenkmann AO, Llorens A, Funderud I, Leske S, Larsson PG, Ivanovic J, Knight RT, Endestad T, **Helfrich RF**. *Ramping dynamics and theta oscillations reflect dissociable signatures during rule-guided human behavior*. Nature Commun. 2024 Jan 20;15(1):637. doi: 10.1038/s41467-023-44571-7.

2023 Raposo Iˆ, Szczepanski SM, Haaland KY, Endestad T, Solbakk AK, Knight RT, **Helfrich RF**. *Periodic attention deficits after frontoparietal lesions provide causal evidence for rhythmic attention sampling.* Curr Biol. 2023 Nov 20;33(22):4893-4904.e3.

2023 Lendner JD, Niethard N, Mander BA, van Schalkwijk FJˆ, Schuh-Hofer S, Schmidt H, Knight RT, Born J, Walker MP, Lin JJ, **Helfrich RF**. *Human REM sleep recalibrates neural activity in support of memory formation.* Sci Adv. 2023 Aug 25;9(34):eadj1895

2023 Weber Jˆ, Iwama Gˆ, Solbakk AK, Blenkmann AO, Larsson PG, Ivanovic J, Knight RT, Endestad T, **Helfrich RF**. *Subspace partitioning in human prefrontal cortex resolves cognitive interference*. Proc Natl Acad Sci U S A. 2023 Jul 11;120(28):e2220523120.

2023 van Schalkwijk FJˆ, Weber Jˆ, Hahn MAˆ, Lendner JD, Inostroza M, Lin JJ, **Helfrich RF**. *An evolutionary conserved division-of-labor between hippocampal and neocortical sharp-wave ripples organizes information transfer during sleep.* Prog Neurobiol. 2023 Aug;227:102485.

2022 Hahn MAˆ, Bothe K, Heib DPJ, Schabus M, **Helfrich RF**, Hoedlmoser K. *Slow oscillation-spindle coupling predicts gross-motor learning in adolescents and adults.* eLife. 2022 Feb 18;11:e66761.

2021 Kam JWY, **Helfrich RF**, Lin JJ, Solbakk, AK, Endestad T, Larsson PG, Knight RT. *Top-down Control of External and Internal Attention in Human Prefrontal Cortex.* Cereb Cortex 2021 Jan 5;31(2):873-883.

2020 Hahn MAˆ, Heib D, Schabus M, Hoedlmoser K*, **Helfrich RF***. *Slow oscillation-spindle coupling predicts enhanced memory formation from childhood to adolescence.* eLife. 2020 Jun 24;9:e53730

2020 Lendner JD, **Helfrich RF**, Mander BA, Romundstad L, Lin JJ, Walker MP, Larsson P, Knight RT. *An Electrophysiological Marker of Arousal Level in Humans.* eLife. 2020 Jul 28;9:e55092.

2019 **Helfrich RF**, Lendner JD, Mander BA, Guillen H, Paff M, Mnatsakanyan L, Vadera S, Walker MP, Lin JJ*, Knight RT*. *Bidirectional prefrontal-hippocampal dynamics organize information transfer during sleep in humans.* Nature Commun. 2019 10:3572

2019 Winer JR, Mander BA, **Helfrich RF**, Maass A, Harrison TM, Baker SL, Knight RT, Jagust WJ, Walker MP. *Sleep as a potential biomarker of tau and beta-amyloid burden in the human brain.* J Neurosci. 2019 Jun 17. pii: 0503-19.

2018 **Helfrich RF**, Fiebelkorn IC, Szczepanski SM, Lin JJ, Parvizi J, Knight RT, Kastner S. *The Neural Mechanisms of Sustained Attention are Rhythmic.* Neuron. 2018(b) Aug 22;99(4):854-865.e5.

Highlighted in VanRullen (2018) Neuron. 2018 Aug 22;99(4):632-634.

2018 **Helfrich RF**, Mander BA, Jagust WJ, Knight RT*, Walker MP*. *Old Brains Come Uncoupled in Sleep - Slow Wave-spindle Synchrony, Brain Atrophy and Forgetting*. Neuron. 2018(a) Jan 3;97(1):221-230.e4.

Highlighted in Dengler (2017) Science. doi:10.1126/science.aar7639
Highlighted in Bergmann and Born (2018) Neuron. doi:10.1016/j.neuron.2017.12.023

2017 **Helfrich RF**, Huang Mˆ, Wilson Gˆ, Knight RT. *Prefrontal Cortex Modulates Posterior Alpha Oscillations During Top-down Guided Visual Perception.* Proc Natl Acad Sci USA. 2017 Aug 29;114(35):9457-9462.

2016 **Helfrich RF***, Knepper H*, Nolte G, Sengelmann M, Koenig P, Schneider TR, Engel AK. *Spectral Fingerprints in Large-scale Cortical Networks of Ambiguous Perception.* Human Brain Mapping 2016 Nov;37(11):4099-4111.

2015 **Helfrich RF**, Herrmann CS, Engel AK*, Schneider TR*. *Different Coupling Modes Mediate Cortical Cross-Frequency Interactions.* NeuroImage 2016 Oct 15;140:76-82.

2014 **Helfrich RF**, Knepper H, Nolte G, Strueber D, Rach S, Hermann CS*, Schneider TR*, Engel AK*. *Selective Modulation of Interhemispheric Functional Connectivity by HD-tACS Shapes Perception*. PLoS Biol 12(12): e1002031.

Highlighted in Thomson (2018) Nature. 555, 20-22 doi: 10.1038/d41586-018-02391-6
Highlighted in Lewis (2015) Nat Rev Neurosci. doi:10.1038/nrn3912
Highlighted in Thut (2014) PLoS Biol. doi: 10.1371/journal.pbio.1002032

2014 **Helfrich RF**, Schneider TR, Rach S, Trautmann-Lengsfeld SA, Engel AK*, Herrmann CS* *Entrainment of Brain Oscillations by Transcranial Alternating Current Stimulation.* Curr. Biol. 2014, 24, 333–339.

2013 **Helfrich RF**, Becker HG, Haarmeier T. *Processing of Coherent Visual Motion in Topographically Organized Visual Areas in Human Cerebral Cortex.* BrainTopogr, 2013, Apr;26(2):247-63.

Reviews and perspectives

2024 Lendner JD, **Helfrich RF**. *Defining slow wave sleep without slow waves.* Trends Neurosci. 2024 Sep 25:S0166-2236(24)00174-7. doi: 10.1016/j.tins.2024.09.002.

2021 **Helfrich RF**, Lendner JD, Knight RT. *Aperiodic sleep networks promote memory consolidation.* Trends Cogn Sci. 2021 Aug;25(8):648-659.

2019 **Helfrich RF,** Breska A, Knight RT. *Neural Entrainment and Network Resonance in Support of Top-down guided Attention.* Curr Opin Psychol. 2019 Jan 2;29:82-89.

2018 **Helfrich RF**. *The Rhythmic Nature of Visual Perception.* J Neurophysiol. 2018 Apr 1;119(4):1251-1253.

2017 Slama KSJ and **Helfrich RF**. *How Does Expectation Shape Object-based Attentional Selection?* J Neurosci. 2017 Apr 26;37(17):4427-4429.

2016 **Helfrich RF** and Knight RT. *Oscillatory Dynamics of Prefrontal Cognitive Control.* Trends Cogn Sci. 2016 Dec;20(12):916-930.

2015 Herrmann CS, Strueber D, **Helfrich RF**, Engel AK. *EEG oscillations: From Correlation to Causality*. IntJPsychophys 2016 May;103:12-21

2013 **Helfrich RF** and Schneider TR. *Modulation of Cortical Network Activity by Transcranial Alternating Current Stimulation.* J Neurosci, 2013, Nov 6;33(45):17551-2.

Book chapters (Accepted versions available at www.helfrich-lab.com/publication)

2023 **Helfrich RF**, Knight RT, D'Esposito M. *Methods to study human memory.* Oxford Handbook of Human Memory (edited by M. Kahana, A. Wagner)

2023 Lendner JD, **Helfrich RF**. *How can I run sleep and anesthesia studies with intracranial EEG?* Intracranial EEG for Cognitive Neuroscientists (edited by N. Axmacher).

2023 **Helfrich RF**, Knight RT. *Neural Recordings and Time Series Analyses*. SAGE Handbook of Cognitive and Systems Neuroscience. (edited by G. Boyle)

2023 **Helfrich RF**, Knight RT. *Making Memories Last: How Sleep promotes Neuroplasticity.* Changing Brains: Essays on Neuroplasticity in Honor of Helen Neville (edited by. A. Newman, G. Grossi).

2022 **Helfrich RF**. *Human intracranial cognitive neurophysiology.* Springer protocols: Electrophysiological recording techniques (edited by R. Vertes and T. Allen) 221-245, Humana, New York, NY

2019 **Helfrich RF**, Knight RT *Cognitive Neurophysiology: Event-related Potentials.* Handb Clin Neurol. (edited by P. Chauvel) 2019;160:543-558. doi: 10.1016/B978-0-444-64032-1.00036-9.

2019 **Helfrich RF**, Knight RT *Cognitive Neurophysiology of the Prefrontal Cortex.* Handb Clin Neurol. (edited by M. D'Esposito) 2019;163:35-59. doi: 10.1016/B978-0-12-804281-6.00003-3.

Scientific outreach

2017 Ram B, **Helfrich RF** *Waves of Perception*. Front Young Minds. doi:10.3389/ frym.2017.00049

2016 Johnson EL, **Helfrich RF** *How Brain Cells Make Memories.* Front Young Minds. 4:5. doi: 10.3389/frym.2016.00005

Supervised students and trainees, including trainee honors

Postdoctoral and Clinical Research Fellows

2022 – now	Jonas Terlau	Postdoc, Clinician-Scientist, Neurology, Tübingen
2021 – now	Michael Hahn	Postdoc, University of Tübingen
		Postdoctoral Fellowship, German Academic Exchange Service
		Early Career Award, German Society of Sleep Medicine 2022
		Dissertation prize, Austrian Society of Psychology
2021 – now	Frank van	Postdoc, University of Tübingen
	Schalkwijk	*Postdoctoral Fellowship,* German Research Foundation

Ph.D. and M.D. (Dr. med., medical research doctorate) students

2023 – now	Laura Heidiri	Neuroscience Ph.D. student, University of Tübingen
		Best Poster Award, NeNa conference, Frankfurt, 2023
2023 – now	Victoria Mair	Medicine, Dr. med. candidate, University of Tübingen
2022 – now	Neha Binish	Neuroscience Ph.D. student, University of Tübingen
2022 – now	Mariana Lomeli	Psychology Ph.D. student, University of Nottingham, UK (with N. Myers)
2021 – now	Gabriela Iwama	Neuroscience M.Sc./Ph.D. student, University of Tübingen
		awarded a full Ph.D. fellowship, State Postgraduate Fellowship
		awarded an International Max Planck Research School fellowship
		Best Poster Award DGPA 2022 (shared with Jan Weber)
2020 – now	Isabel Raposo	Neuroscience Ph.D. student, University of Tübingen
		admitted to the International Max Planck Research School
		Fellowship Kavli Foundation, Cognitive Neuroscience Summer Institute
2020 – now	Markus Kopf	Medicine, Dr. med. candidate, University of Tübingen
		awarded an intramural fellowship for doctoral studies
2020 – now	Jan Martini	Neuroscience Ph.D. student, University of Tübingen
	née Weber	*admitted* to the International Max Planck Research School
		awarded SFN Trainee Professional Development Award 2024

Completed

2024	Judith Dehnen	M. Sc. rotation, Experimental/Clinical Neuroscience, University of Cologne
2024	Matthias Anwander	M.Sc. thesis, Neural Information Processing, University of Tübingen
2023	Laura Heidiri	M.Sc. thesis, Neural and Behavioral Science, University of Tübingen
2022	Matthias Anwander	M.Sc. rotation, Neural Information Processing, University of Tübingen
2022	Martin Cotrina	M.Sc. rotation, Neural and Behavioral Science, University of Tübingen
2022	Kirsti Brandes	M.Sc. rotation, Neural and Behavioral Science, University of Tübingen
2022	Tamara Kessler	M.Sc. rotation, Neural and Behavioral Science, University of Tübingen
2021	Gabriela Iwama	M.Sc. rotation and M.Sc. thesis, Neuroscience, University of Tübingen
2019	Michael Hahn	Visiting Ph.D. student (Salzburg, Austria), UC Berkeley
		published in Hahn et al. (2020) *eLife*
2018	Zachariah Cross	Visiting Ph.D. student (Australia), UC Berkeley
		preprinted on the bioRxiv: Cross et al. (2020)
2017	Julia Schipp	Visiting M.Sc. student (Freiburg, Germany)
2017	Darius Suplica	Young Minds Fellow, UC Berkeley
2017	Jacob Miller	Ph.D. lab rotation student, UC Berkeley
2016	Daniel Toker	Ph.D. lab rotation student, UC Berkeley

2016	Bhargavi Ram	Young Minds Fellow, UC Berkeley *published* in Ram and Helfrich (2017) *Front Young Minds*
2015	Melody Huang	B.Sc. Hons. Student, UC Berkeley *published* in Helfrich, Huang, Wilson and Knight (2017) *PNAS* *admitted to* Harvard Medical School
2015	Guy Wilson	B.Sc. Hons. Student, UC Berkeley *published* in Helfrich, Huang, Wilson and Knight (2017) *PNAS* *admitted to* Stanford Neuroscience Ph.D. program
2013	Christina Leduc	RiSE fellow (Canada), University Medical Center Hamburg *awarded a DFG-DAAD Rise Fellowship*

Teaching

2024 – 2024	**Lecturer Psychiatry** Bedside teaching, University of Tübingen
2019 – now	**Lecturer Clinical Neurology** Seminars and bedside teaching, University of Tübingen
2019 – now	**Faculty member**, Graduate Training Center Neuroscience, Tübingen
2015 – 2019	**Guest lecturer** Neuroscience graduate training and lectures, UC Berkeley
2013 – 2014	**Teaching assistant** in Neuro- and Pathophysiology, University of Hamburg
2007 – 2010	**Teaching assistant** in Anatomy and Neuroanatomy, University of Tübingen

Miscellaneous

Guest editor	eLife
Assoc. editor	Journal of Neuroscience
Reviewer	Nature Neuroscience, Neuron, Nature Communications, PNAS, PLoS Biology, eLife, Nature Human Behavior, Biological Psychiatry, Progress in Neurobiology, Journal of Neuroscience, Cerebral Cortex, NeuroImage, eNeuro, Human Brain Mapping, Scientific Reports, Journal of Cognitive Neuroscience, Neuropsychopharmacology, Journal of Physiology, Journal of Neurophysiology, Clinical Neurophysiology, European Journal of Neuroscience, Neuropsychologia, Cortex, Brain Stimulation, Neurobiology of Learning and Memory, Experimental Brain Research, Frontiers, International Journal of Psychophysiology, JoVE, Brain and Behavior, Brain Research, Journal of Vision, Journal of Sleep Research, Current Opinion in Psychology, Communications Biology, Sleep, Imaging Neuroscience
Grants review	Agence nationale de la recherche (ANR, France), Damp Foundation (Germany), German Research Foundation (DFG, Germany)
Academic Service	Clinician-Scientist committee member, Medical Faculty, Tübingen Faculty, Intl. Max Planck Research School, Mental Function and Dysfunction, Tübingen Faculty, Graduate Training Center, Tübingen