



# Dr. Oliver Barnstedt

POSTDOCTORAL RESEARCHER

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Born on 18.08.1987 in Tübingen, Germany | Father of two sons (3 & 7 y.o.)

## Professional Experience

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### Leibniz Institute for Neurobiology

Magdeburg, Germany

POSTDOCTORAL RESEARCHER

05/2022 – present

- Advisor: Prof. Stefan Remy
- Coordinated the establishment of a new “Behavioural Imaging Facility” encompassing five two-photon microscopes, three head-mounted miniature microscopes and multiple behavioural assays.
- Co-organiser of bi-annual two-week summer school “LINdroscope: Advanced Optical Imaging and Data Analysis in Systems Neuroscience”, funded by Volkswagen Foundation and EMBO, September 2021/3.
- Collaborating with Prof. Bertram Gerber to conduct two-photon calcium imaging in *Drosophila*.

### German Center for Neurodegenerative Diseases DZNE

Bonn, Germany

POSTDOCTORAL RESEARCHER

11/2017 – present

- Advisor: Prof. Stefan Remy
- Main project: Characterising the role of the subiculum in spatial reward learning using *in vivo* two-photon calcium imaging.
- Established a head-fixed spatial reward learning task with multi-angle high-speed camera tracking in mice.
- Established a versatile Python-based processing pipeline for automated image processing, behavioural motion analysis, and interactive data inspection.
- Parental leave from 04/2020 – 12/2020.

## Education

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### University of Oxford

Oxford, UK

DOCTOR OF PHILOSOPHY

09/2013 – 08/2017

- DPhil award date: 12 May 2018
- Advisor: Prof. Scott Waddell
- Thesis committee: Prof. David Bannerman, Prof. André Fiala
- Thesis title: “Neural circuit mechanisms of memory coding in the *Drosophila* mushroom body”
- Funded by the UK Medical Research Council and University College Oxford
- DPhil work identified the *Drosophila* mushroom body neurotransmitter (Barnstedt et al., 2016, *Neuron*) and resulted in 6 peer-reviewed articles (see List of Publications).

### University of Oxford

Oxford, UK

MASTER OF SCIENCE, NEUROSCIENCE

09/2012 – 08/2013

- Passed with Distinction
- Advisors: Profs. Scott Waddell and Andrew King
- Project with Scott Waddell: “The regulation and function of retrotransposition in the adult *Drosophila* brain.”
- Project with Andrew King: “Tonotopic organisation in the mouse dorsal cortex of the inferior colliculus and its connection to the auditory cortex.”, published as Barnstedt et al., 2015, *J.Neurosci.*
- Funded by German Academic Scholarship Foundation (Studienstiftung des deutschen Volkes)

### Jacobs University

Bremen, Germany

BACHELOR OF SCIENCE, NEUROSCIENCE AND COGNITIVE PSYCHOLOGY

09/2009 – 06/2012

- Advisor: Prof. Arvid Kappas
- Final GPA: 1.26
- Thesis title: “Testing vicarious extinction of conditioned fears based on skin conductance response”, graded 1.00
- Developed a vicarious fear extinction paradigm, tested in human subjects and mice (in collaboration with Dr Magdalena Sauvage at Ruhr-University Bochum).
- Recipient of Jacobs University scholarship and 3-times recipient of President’s Award

## Further Research Experience

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### **Laboratorio de Circuitos Neuronales, Instituto Cajal**

Madrid, Spain

ADVISOR: DR. LISET MENENDEZ DE LA PRIDA

June 2012

Two-week research stay, funded by German National Academic Foundation, to learn *in vivo* electrophysiological recordings in rodent hippocampus.

### **Mercator Research Group “Functional Architecture of Memory Unit”, Ruhr-University**

Bochum, Germany

ADVISOR: DR. MAGDALENA SAUVAGE

May 2012

Brief research stay to collect pilot data testing vicarious fear extinction in mice for BSc Thesis.

### **Institute of Behavioural Neuroscience, University College London**

London, UK

ADVISOR: DR. HUGO SPIERS

06/2011 - 08/2011

Internship in which I developed and piloted a novel maze for rats to distinguish between hippocampal coding of Euclidean and path distance towards a goal.

### **Division of Neuropsychology, Hertie-Institute of Clinical Brain Research**

Tübingen, Germany

ADVISOR: PROF. HANS-OTTO KARNATH

06/2010 - 08/2010

Internship in which I recruited and tested participants for a spatial attention task, analysed fMRI data sets, and tested stroke patients for neuropsychological defects.

## Awards, Fellowships, & Grants

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2023	Travel Award for SfN Washington, FENS	€2,000
2023	Practical Course funding, EMBO	€41,630
2021	Grant to organize a Summer School, Volkswagen Foundation	€21,300
2019	Winner, Young Investigator Talk, BonnBrain	
2016	Goodger and Schorstein Fellowship, University of Oxford Medical Sciences Div.	£8,100
2016	Old Members' Trust Travel Grant, University College Oxford	£350
2015	Guarantors of Brain Travel Grant, Guarantors of Brain	£600
2014	Guarantors of Brain Travel Grant, Guarantors of Brain	£770
2014	Old Members' Trust Travel Grant, University College Oxford	£350
2013	War Memorial Studentship, University College Oxford	£41,178
2013	MRC Scholarship, Medical Research Council	£34,980
2011	Mercator Award, Mercator Foundation	€5,000
2011	Fellowship, German Academic Scholarship Foundation (Studienstiftung d. d. V.)	€20,000
2009–12	President's List, Jacobs University	
2009–12	Scholarship, Jacobs University	€27,000

## Selected Presentations

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### INVITED TALKS

06/2024	<b>FENS Forum</b> , A hippocampus-accumbens code guides goal-directed appetitive behavior. As speaker and organiser of accepted symposium “Hippocampal coding of reward and novelty”, chaired by Attila Losonczy and Charlotte Boccara.	Vienna, Austria
10/2023	<b>CRC1436 General Assembly</b> , The fate of the memory trace: Hippocampus-accumbens projections mediate spatial reward memories.	Magdeburg, Germany
05/2023	<b>Spring Hippocampal Research Conference</b> , A hippocampus-accumbens code guides goal-directed appetitive behavior.	Verona, Italy
09/2022	<b>DZNE Mini-Symposium “Information Flow”</b> , Projection-specific conjunctive coding of space, velocity, and appetitive behaviors by dorsal hippocampus neurons.	Bonn, Germany





09/2022	<b>LIN Retreat</b> , Projection-specific conjunctive coding of space, velocity, and appetitive behaviors by dorsal hippocampus neurons.	Magdeburg, Germany
03/2019	<b>BonnBrain Conference</b> , Proximal Subiculum Anticipates Reward Locations. Winner, Young Investigator Talk.	Bonn, Germany
05/2017	<b>South West Fly Meeting</b> , Memory-relevant mushroom body output synapses are cholinergic.	Bristol, UK
02/2016	<b>Imperial College</b> , Memory-relevant mushroom body output synapses are cholinergic.	London, UK
06/2012	<b>Instituto Cajal</b> , Vicarious fear extinction. A rat maze to distinguish between hippocampal coding of Euclidean and path distance towards a goal.	Madrid, Spain

## POSTER PRESENTATIONS

11/2023	<b>SfN Neuroscience 2023</b> , A hippocampus-accumbens code guides goal-directed appetitive behaviour.	Washington D.C., USA
09/2023	<b>Bernstein Conference</b> , MouseFlow: a Python toolbox for quantifying facial and body movements in head-fixed mice.	Berlin, Germany
08/2023	<b>BonnBrain Conference</b> , A hippocampus-accumbens code guides goal-directed appetitive behaviour.	Bonn, Germany
02/2023	<b>EPFL Brain-Mind Symposium – What is memory?</b> , A hippocampus-accumbens code guides goal-directed appetitive behaviour.	Lausanne, Switzerland
04/2022	<b>International Winter Neuroscience Conference</b> , Spatial and reward coding of dorsal hippocampus projection neurons to the nucleus accumbens.	Sölden, Austria
03/2018	<b>BonnBrain Conference</b> , Afferent projections of the dorsal subiculum.	Bonn, Germany
09/2016	<b>Neurofly Meeting</b> , Memory-relevant mushroom body output synapses are cholinergic.	Crete, Greece
10/2015	<b>Cold Spring Harbor Drosophila Neurobiology Meeting</b> , Acetylcholine is a neurotransmitter of mushroom body neurons.	Cold Spring Harbor, USA
07/2014	<b>FENS Forum</b> , Functional Division of the Mouse Inferior Colliculus studied with Two-Photon Calcium Imaging.	Milan, Italy
02/2014	<b>39th Annual Midwinter Meeting of the Association for Research in Otolaryngology</b> , Tonotopy in the Dorsal Cortex of the Mouse Inferior Colliculus: a Two-Photon Calcium Imaging study.	San Diego, USA
04/2013	<b>BNA Festival of Neuroscience</b> , A role for de novo transposition in Drosophila learning and memory.	London, UK

## Code contributions

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	<b>MouseFlow</b> , Main developer of this Python toolbox to quantify facial and bodily movement in headfixed mice using machine learning and computer vision algorithms.	Python, Jupyter notebook
	<b>LINDoscope 2023</b> , Course content for the 2023 EMBO technical workshop. Main contributor for interactive calcium imaging processing, behavioural data analysis using DeepLabCut and computer vision, and bridging neural and behavioural data using information theoretical approaches and CEBRA. Further contributors: Mackenzie Mathis (EPFL) & Eric Thomson (Flatiron Institute).	Jupyter notebook
	<b>LINDoscope 2021</b> , Course content for the 2021 technical workshop. Contributed calcium imaging processing and interactive visualisation tools, and computer vision-based behaviour analysis.	Jupyter notebook
	<b>CalmAn tools</b> , Notebooks to interactively visualise and set quality thresholds for CalmAn-extracted spatiotemporal components.	Jupyter notebook

## Mentoring

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2022 to date	<b>Fatima Amin</b> , mentoring 2P imaging project on locomotion-to-valence circuitry in <i>Drosophila</i>	<i>LIN Magdeburg</i>
2023	<b>Kevin Luxem</b> , mentored PhD thesis writing “ <i>Measuring the hidden structure of animal motion</i> ”	<i>Magdeburg University</i>
2023	<b>Petra Mocellin</b> , mentored PhD thesis writing “ <i>A basal forebrain to midbrain circuit drives exploratory locomotion</i> ”	<i>Bonn University</i>
2020	<b>Felix Ludwig</b> , mentored PhD thesis writing “ <i>Locus coeruleus modulates locomotor activity via the medial septum and the diagonal band of Broca</i> ”	<i>Bonn University</i>

## Teaching Experience

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WiSe 2023	<b>Neuroethology (MSc Integrative Neuroscience)</b> , Lecturer “Mechanisms of navigation across species”	<i>University Magdeburg</i>
09/2023	<b>EMBO Practical Course: LINdoscope – Neuroimaging and data analysis</b> , Co-organiser and instructor	<i>LIN Magdeburg</i>
SuSe 2023	<b>Learning and Memory (MSc Integrative Neuroscience)</b> , Lecturer “Spatial memory”	<i>University Magdeburg</i>
WiSe 2021-3	<b>Introduction to Nervous Systems (BSc Philosophy - Neuroscience - Cognition)</b> , Lecturer for 3-4 lectures on basic neuroscience topics	<i>University Magdeburg</i>
09/2021	<b>LINdoscope: Advanced Optical Imaging and Data Analysis in Systems Neuroscience</b> , Co-organiser and instructor	<i>LIN Magdeburg</i>
SuSe 2018-9	<b>BIGS Neuroscience Summer School Practical</b> , Co-instructor	<i>BIGS Bonn</i>
WiSe 2011	<b>Learning and Memory</b> , Teaching assistant	<i>Jacobs University</i>
SuSe 2011	<b>Sensation and Perception</b> , Teaching assistant	<i>Jacobs University</i>

## Outreach & Professional Development

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### SERVICE AND OUTREACH

2023–	<b>Calcium imaging data analysis group</b> , Organiser	<i>Bonn, Germany</i>
2013–2015	<b>Cortex Club</b> , IT Secretary	<i>Oxford, UK</i>
2012–2013	<b>St Peter’s College Middle Common Room</b> , Secretary	<i>Oxford, UK</i>
2011–2012	<b>Jacobs Society for Neuroscience</b> , Founder and President	<i>Jacobs University</i>
2009–2012	<b>Pulse of the world (student newspaper)</b> , Executive Board Member	<i>Jacobs University</i>

### DEVELOPMENT

05/2021	<b>Grant Writing for Early Career Researchers Workshop</b> , Full-day workshop for ECRs from Scriptorium Training & Consulting on improving grant writing skills.	<i>DZNE, Germany</i>
04/2021	<b>Laser safety officer for technical laser applications</b> , Full-day online training course according to the German OStrV.	<i>Bayerisches Laserzentrum</i>
09/2014	<b>Personal Licence (UK Home Office)</b> , Licence to carry out regulated procedures on living animals (amphibians, ferrets, mice, rats) – equiv. to FELASA B.	<i>Oxford, UK</i>
09/2011	<b>European Campus of Excellence: The Fate of the Memory Trace</b> , Three-week fully funded summer school about the neuroscience of learning and memory, including lectures and practicals.	<i>RU Bochum, Germany</i>
03/2011	<b>Formal Models in Cognitive Neuroscience and Experimental Psychology</b> , Two-week funded ERASMUS workshop on computational models of learning and memory, and decision-making, with lectures and practicals.	<i>Schoorl, Netherlands</i>

## PEER REVIEW

Neuron  
DZNE-internal manuscripts

## PROFESSIONAL MEMBERSHIPS

British Neuroscience Association (2013–2017)  
German Neuroscience Society (NWG) (2022–)  
Bernstein Network (2023–)  
Society for Neuroscience (SfN) (2023–)

## References

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### **Prof. Dr. Stefan Remy**

POSTDOCTORAL SUPERVISOR (2017–)  
Scientific director  
Leibniz Institute for Neurobiology  
Center for Learning and Memory Research  
Brenneckestr. 6  
39118 Magdeburg  
Germany  
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Email: stefan.remy@lin-magdeburg.de

### **Prof. Dr. Bertram Gerber**

COLLABORATOR AND CO-LECTURER (2021–)  
Head of Department  
Department Genetics of Learning and Memory  
Leibniz Institute for Neurobiology  
Brenneckestr. 6  
39118 Magdeburg  
Germany  
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### **Prof. Dr. Scott Waddell**

MSc & DPHIL SUPERVISOR (2013–2017)  
Professor of Neurobiology  
Centre for Neural Circuits and Behaviour  
University of Oxford  
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Mansfield Road  
Oxford, OX1 3SR  
United Kingdom  
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### **Prof. Dr. Arvid Kappas**

BSc ADVISOR (2010–2012)  
Dean  
Professor of Psychology  
Psychology & Methods  
Constructor University Bremen gGmbH  
Campus Ring 1  
28759 Bremen  
Germany  
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Email: akappas@constructor.university

## List of Publications

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### HIGHLIGHTED PUBLICATIONS

1. **Barnstedt, O**, Mocellin P, Remy S. 2023. A hippocampus-accumbens code guides goal-directed appetitive behavior. **BioRxiv**, 2023.03.09.531869. doi.org/10.1101/2023.03.09.531869. *In revision*.  
In the **top 5%** of all research outputs scored by Altmetric; highlighted by Simons Foundation on May 16, 2023.  
*The dorsal hippocampus (dHPC) is a major centre for processing spatial memories, but the role of its downstream pathways remains unclear. We have used dual-colour 2-photon imaging and optogenetics to show special coding characteristics of nucleus accumbens-projecting neurons that allow mice to engage in goal-directed behaviour upon approach of a learned reward zone.*
2. **Barnstedt O**, Oswald D, Felsenberg J, Brain R, Moszynski J, Talbot CB, Perrat P, Waddell S. 2016. Memory-Relevant Mushroom Body Output Synapses Are Cholinergic. **Neuron**, 89(6): 1237–1247. doi.org/10.1016/j.neuron.2016.02.015.  
JIF: 18.7, Citations: **171**.  
*The mushroom body (MB) is the main learning and memory centre of invertebrate brains, but its main neurotransmitter has remained a mystery before this publication. Using a combination of histological, behavioural, optogenetic, and 1P/2P calcium imaging methods, we conclusively demonstrate acetylcholine as the main MB transmitter used for communication with MB output neurons. This shows that structural plasticity at a cholinergic synapse underlies olfactory associative learning in Drosophila.*
3. **Barnstedt O**, Keating P, Weissenberger Y, King AJ, Dahmen JC. 2015. Functional Microarchitecture of the Mouse Dorsal Inferior Colliculus Revealed through In Vivo Two-Photon Calcium Imaging. **Journal of Neuroscience**, 35(31): 10927–10939. doi.org/10.1523/jneurosci.0103-15.2015.  
JIF: 6.7, Citations: **66**.  
*This work represents the first 2-photon calcium imaging study of the mammalian midbrain, and describes tonotopic responses in somata of inferior colliculus neurons as well as in axonal projections from auditory cortex.*

### OTHER PEER-REVIEWED ORIGINAL RESEARCH ARTICLES

4. Felsenberg J, Jacob PF, Walker T, **Barnstedt O**, Edmondson-Stait AJ, Pleijzier MW, Otto N, Schlegel P, Sharifi N, Perisse E, Smith CS, Lauritzen JS, Costa M, Jefferis GSXE, Bock DD, Waddell S. 2018. Integration of parallel opposing memories underlies memory extinction. **Cell**, 175 (3): 709-722. doi.org/10.1016/j.cell.2018.08.021.  
JIF: 66.9, Citations: **160**.
5. Felsenberg J, **Barnstedt O**, Cognigni P, Lin S, Waddell S. 2017. Re-evaluation of learned information in *Drosophila*. **Nature**, 544(7649): 240-244. doi.org/10.1038/nature21716.  
JIF: 69.5, Citations: **119**.
6. Žurauskas M, **Barnstedt O**, Frade-Rodriguez M, Waddell S, Booth MJ. 2017. Rapid adaptive remote focusing microscope for sensing of volumetric neural activity. **Biomedical optics express**, 8(10): 4369-4379. doi.org/10.1364/boe.8.004369.  
JIF: 3.6, Citations: **54**.
7. Perisse E\*, Oswald D\*, **Barnstedt O**, Talbot CB, Huetteroth W, Waddell S. 2016. Aversive Learning and Appetitive Motivation Toggle Feed-Forward Inhibition in the *Drosophila* Mushroom Body. **Neuron**, 90(5): 1086-1099. doi.org/10.1016/j.neuron.2016.04.034.  
JIF: 18.7, Citations: **159**.

### REVIEW ARTICLES

8. Waddell S, **Barnstedt O**, Treiber C. 2014. Neural Transposition in the *Drosophila* Brain: Is It All Bad News? **Advances in Genetics**, 86(65). Epigenetic Shaping of Sociosexual Interactions: From Plants to Humans. doi.org/10.1016/B978-0-12-800222-3.00004-8.

### OTHER MANUSCRIPTS

9. Mocellin P, **Barnstedt O**, Luxem K, Kaneko H, Mikulovic S, Remy S. A septal-VTA circuit drives exploratory behavior. *In revision*.
10. **Barnstedt O**, Mocellin P, Pakan J, Musall S, Remy S. MouseFlow: A Python toolbox for automated facial and bodily movement detection in head-fixed mice. *In preparation*.