



FIAS Frankfurt Institute
for Advanced Studies



Work address:

Ernst Strüngmann Institut (ESI)
Deutschordenstraße 46
D-60528 Frankfurt/Main, Germany
Tel: ++49-(0)-69-96769-540

Home address:

Ginnheimer Landstr 3
D-60847 Frankfurt/Main, Germany
Cell phone ++49-(0)-176-72-198-196

hermann.neuro@gmail.com

www.treestoolbox.org/hermann/

**Research
interest**

Computational neuroscience

General goal: To understand the biophysics of neural processing as a function of the single cell and small circuits.

Positions

**Ernst Strüngmann Institute (ESI) for Neuroscience
in cooperation with Max Planck Society and
Frankfurt Institute for Advanced Studies (FIAS)**
Since August 2014: Independent group leader.

Frankfurt (Germany)

**Ernst Strüngmann Institute (ESI) for Neuroscience
in cooperation with Max Planck Society**
2011 – 2014: Guest scientist, affiliated independent
group leader at the Institute of Clinical Neuroanatomy of
the Goethe University.

Frankfurt (Germany)

University College London

2006 – 2011: Post-doc with Prof. Michael Häusser.
Research topic: Devising a theory of neuronal branching
and modeling the network dynamics in the Purkinje cell
layer of the Cerebellum.

London (UK)

Hebrew University

2004 – 2005: Post-doc with Prof. Idan Segev.
Research topic: Optimisation principles of dendritic
structure with topographically arranged input.

Jerusalem (Israel)

Education

**University of California at Berkeley (2000 - 2002)
Max Planck Institute of Neurobiology (2002 - 2004)**

2000 – 2004: Ph.D. with Prof. Alexander Borst.
Thesis title: "Input organization of motion-sensitive
interneurons in the fly" (magna cum laude).

Berkeley (US)
Munich (Germany)

**Eberhard Karls Universität Tübingen
Friedrich Miescher Laboratory (Max Planck Society)**

1994 – 2000: Diploma degree in biology with Prof.
Alexander Borst. Thesis: "Spatial distribution of
membrane parameters in fly neurons: a modeling
study".

Tübingen (Germany)

Publications **In preparation:**

1. Mazzone A, Lindén H, Cuntz H, Lansner A, Panzeri S, Einevoll GT. LFP proxies for integrate-and-fire neural networks.
2. Platschek S, Cuntz H, Vuksic M, Deller T, Jedlicka P. Homeostatic plasticity of lesion-induced dendritic retraction (CNS 2013).
3. Nedelescu H, Cuntz H, Pritchard A, Negrello M, Häusser M, Watt AJ, De Schutter E. The maturation process of a dendritic forest in the cerebellum (SfN 2012).
4. Baltruschat L, Tavosanis G, Cuntz H. A developmental stretch-and-fill process that optimises dendritic space filling (SfN 2012).
5. Schneider C, Cuntz H, Soltesz I. A three-dimensional model of the rat dentate gyrus (SfN 2013, under revision at PLoS Computational Biology).

Published (* equal contributions):

6. Cuntz H, Forstner F, Schnell B, Raghu SV, Borst A (2013). Preserving dendrite function under extreme scaling. *PLoS One* 8 (8): e71540.
7. Cuntz H, Mathy A, Häusser M (2012). A scaling law derived from optimal dendritic wiring. *PNAS* 109 (27): 11014–11018. (Press release and covered by medicalxpress and others)
8. Cuntz H (2012). The dendritic density field of a cortical pyramidal cell. Perspective article, invited submission for special issue in *Frontiers in Neuroanatomy* 6:2.
9. Cuntz H, Forstner F, Borst A, Häusser M (2011). The TREES toolbox – probing the basis of neuronal branching. *Neuroinformatics* 9(1): 91-96. News Item, invited submission, most popular download.
10. Cuntz H, Forstner F, Borst A, Häusser M (2010). One rule to grow them all: A general theory of neuronal branching and its practical application. *PLoS Computational Biology* 6(8): e1000877. (Featured image in August 2010 issue; selected by PLoS and kikim media for a prototype documentary film for the US Public Broadcasting Service; reviewed in Faculty 1000 by Prof. Olaf Sporns, ~10,000 downloads)
11. Phoka E*, Cuntz H*, Roth A, Häusser M (2010) A new approach for determining phase response curves reveals that Purkinje cells can act as perfect integrators. *PLoS Computational Biology* 6(4): e1000768.
12. Watt AJ, Cuntz H, Mori M, Nusser Z, Sjöström PJ, Häusser M (2009) Traveling waves in developing cerebellar cortex mediated by asymmetrical Purkinje cell connectivity. *Nature Neuroscience* 12:463-473. (Cover in April 2009 issue; reviewed as “exceptional” in Faculty 1000 by Prof. Marla Feller)
13. Cuntz H*, Forstner F*, Haag J, Borst A (2008) The morphological identity of insect dendrites. *PLoS Computational Biology* 4(12):e1000251. (Featured image in December 2008 issue; reviewed in Faculty 1000 by Prof. Eve Marder)
14. Weber F, Eichner H, Cuntz H, Borst A (2008) Eigenanalysis of a neural network for optic flow processing. *New Journal of Physics* 10:015013.
15. Cuntz H, Borst A, Segev I (2007) Optimization principles of dendritic structure. *Theoretical Biology and Medical Modelling* 4(1):21.
16. Cuntz H, Haag J, Forstner F, Segev I, Borst A (2007) Robust coding of flow-field parameters by axo-axonal gap junctions between fly visual interneurons. *PNAS* 104(24):10229–10233. (Press release)
17. Cuntz H, Haag J, Borst A (2003) Neural image processing by dendritic networks. *PNAS* 100 (19): 11082–11085. (Press release and covered by National geographics and others)

Book	<u>Cuntz H</u> , Remme M, Torben-Nielsen B, (Eds). The computing dendrite: from structure to function (2014). Springer Series in Computational Neuroscience, Vol 11, Springer .																		
Book chapters	<ol style="list-style-type: none"> 1. Torben-Nielsen B, <u>Cuntz H</u> (2014) Dendrite morphology and quantitative analysis. In: <i>Dendritic computations through morphology and connectivity</i>, (Eds) <u>Cuntz H</u>, Remme M, Torben-Nielsen B, Springer. 2. <u>Cuntz H</u> (2014) Modelling dendrite shape from wiring principles. In: <i>Dendritic computations through morphology and connectivity</i>, (Eds) <u>Cuntz H</u>, Remme M, Torben-Nielsen B, Springer. 3. <u>Cuntz H</u>, Haag J, Borst A (2014) Modelling the cellular mechanisms of fly optic flow. In: <i>Dendritic computations through morphology and connectivity</i>, (Eds) <u>Cuntz H</u>, Remme M, Torben-Nielsen B, Springer. 4. <u>Cuntz H</u>, (2013) Models of fly lobula plate tangential cells (LPTCs). In: <i>Encyclopedia of Computational Neuroscience</i>, (Ed) Jaeger D, Jung R; invited by Gabbiani F, Springer. 5. <u>Cuntz H</u>, (2013) TREES toolbox. In: <i>Encyclopedia of Computational Neuroscience</i>, (Ed) Jaeger D, Jung R; invited by Gleeson P, Springer. 																		
Other editorial work	<u>Cuntz H</u> , Eglén S, Krieger P (Eds). Quantitative analysis of neuronal anatomy. Frontiers in Neuroscience Research Topic.																		
Other publications	<u>Cuntz H</u> , (2013) Geburtshilfe für den Computer; Die neurowissenschaftlichen Wurzeln der Kybernetik. Gehirn und Geist (Spektrum der Wissenschaft) 3/2013: 86-87. Invited book review in German.																		
Fellowships and awards	<table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Sept 2013:</td> <td>Bernstein Award 2013 (€1,351,662.00)</td> </tr> <tr> <td>June 2013:</td> <td>DFG grant ("eigene Stelle", €257,315.00)</td> </tr> <tr> <td>Feb 2011:</td> <td>Wellcome Image Award 2011 (£200)</td> </tr> <tr> <td>May 2010:</td> <td>Guarantors of Brain, travel grant award</td> </tr> <tr> <td>April 2010:</td> <td>1st prize poster, UCL Neuroscience (£500)</td> </tr> <tr> <td>April 2008 – April 2011:</td> <td>Max Planck Fellowship</td> </tr> <tr> <td>April 2006 – March 2008:</td> <td>Alexander von Humboldt, Feodor Lynen Fellowship</td> </tr> <tr> <td>June 2004 – June 2005:</td> <td>Minerva Fellowship</td> </tr> </table>	Sept 2013:	Bernstein Award 2013 (€1,351,662.00)	June 2013:	DFG grant ("eigene Stelle", €257,315.00)	Feb 2011:	Wellcome Image Award 2011 (£200)	May 2010:	Guarantors of Brain, travel grant award	April 2010:	1 st prize poster, UCL Neuroscience (£500)	April 2008 – April 2011:	Max Planck Fellowship	April 2006 – March 2008:	Alexander von Humboldt, Feodor Lynen Fellowship	June 2004 – June 2005:	Minerva Fellowship		
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- March 2011: Interview for **BioTechniques**
 Feb 2011: **Wellcome Image Award 2011**, exhibition at the **Wellcome Collection** (24. February – 10. July)
 April 2005: Interview for **Israel21c**
 Oct 2003: Short interview for **National Geographic**

Teaching

EU advanced course in computational neuroscience (ACCN)

- Local organizer** (with Jochen Triesch at the FIAS): Frankfurt (Germany)
 Aug 2014
Course lecturer: Bedlewo (Poland)
 Aug 2013
Course tutor: *supervision of individual projects of five students for four weeks each (total ~640 hours):*
 Aug 2008 Freiburg (Germany)
 Aug 2005 and 2007 Arcachon (France)
 Aug 2004 Obidos (Portugal)

Other

- since August 20014: **Faculty member** for the Master of Interdisciplinary Neuroscience program Frankfurt (Germany)
 since March 20014: **Faculty member** of International Max-Planck Research School (IMPRS) for Neural Circuits Frankfurt (Germany)
 Oct 2013: **Guest lecturer**, Computational Neuroscience Basel (Switzerland)
 Summer Semester 2011: **Lecturer**, Human Anatomy Frankfurt (Germany)
 Dec 2006: **Course tutor**, “Dendritic patching workshop” London (UK)
 May 2006: **Guest lecturer**, “Theoretical Neuroscience II”, at the Gatsby Computational Neuroscience Unit London (UK)

Selected invited talks

- Nov 2014: Invited talk at Symposium “Principles of Brain Wiring” Bochum (Germany)
 Sept 2013: Bernstein Award Lecture at the Bernstein Conference 2013 Tübingen (Germany)
 Sept 2013: Centre de Regulació Genòmica; invited by Prof. Mara Dierssen Barcelona (Spain)
 June 2013: Philipps Universität Marburg; invited by Prof. Uwe Homberg Marburg (Germany)
 May 2013: Invited talk at Dutch INCF meeting on “predictive modeling” Nijmegen (Netherlands)
 April 2013: Donders Institute Nijmegen, invited by Prof. Paul Tiesinga Nijmegen (Netherlands)
 *Feb 2013: Philipps Universität Marburg; invited by Prof. Anna Schubö Marburg (Germany)
 Dec 2012: Frankfurt Institute for Advanced Studies (FIAS); invited by Prof. Jochen Triesch Frankfurt (Germany)
 April 2012: Max Planck Institute (MPI) for Brain Research; invited by Prof. Gilles Laurent Frankfurt (Germany)
 *Dec 2011: Imperial College London; invited by Prof. Ross Ethier London (UK)

July 2011: Helmholtz Research Center; invited by Prof. Markus Diesmann	Jülich (Germany)
July 2011: MRC Laboratory of Molecular Biology (LMB); invited by Dr. Gregory Jefferis	Cambridge (UK)
July 2011: Microsoft Research; invited by Prof. Stephen Emmott	Cambridge (UK)
July 2011: Friedrich Miescher Institute (FMI); invited by Dr. Karl Farrow and Dr. Botond Roska	Basel (Switzerland)
May 2011: Hertie-Institut für klinische Hirnforschung; invited by Dr. Fahad Sultan	Tübingen (Germany)
March 2011: Invited talk at 2nd NeuroML workshop by Padraig Gleeson	London (UK)
Nov 2010: Brain Corporation, Qualcomm; invited by Dr. Eugene Izhikevich	San Diego (US)
July 2010: Invited talk at FENS 2010 satellite meeting "Morphology and computations of single neurons"	Amsterdam (Holland)
March 2010: Massachusetts Institute of Technology (MIT); invited by Prof. Sebastian Seung	Boston (US)
Jan 2010: Ernst Strüngmann Institute (ESI) for Neuroscience; invited by Prof. Pascal Fries & Prof. Wolf Singer	Frankfurt (Germany)
*Jan 2010: Neurosciences Institute; invited by Prof. Gerald Edelman	San Diego (US)
*July 2009: Goethe Center for Scientific Computing; invited by Prof. Gabriel Wittum	Frankfurt (Germany)
June 2009: Goethe University, Clinical Neuroanatomy; invited by Prof. Thomas Deller	Frankfurt (Germany)
March 2009: Okinawa Institute of Science and Technology; invited stay for three weeks with Prof. Erik de Schutter, incl. invited talk	Okinawa (Japan)
May 2008: Invited talk at 47 th Tutzing Symposium "Modelling and engineering of complex systems - from molecular assemblies to biological networks"	Tutzing (Germany)
Feb 2008: Invited talk at Joint meeting of Gatsby Computational Neuroscience Unit and Columbia University Center for Theoretical Neuroscience	New York (US)
Jan 2004: Max Planck Institute for Mathematics in the Sciences "neural networks and cognitive systems" seminar series; invited by Prof. Jürgen Jost	Leipzig (Germany)
June 2003: FU Berlin Neurobiology department; invited by Prof. Bernd Grünwald and Prof. Randolf Menzel	Berlin (Germany)
(* shortlisted for faculty position)	
Organised scientific events	
July 2013: Official workshop of CNS*2013, "Dendrite function and wiring" with Dr. Michiel Remme and Dr. Ben Torben-Nielsen	Paris (France)
October 2012: Computational Neuroscience Social at SfN*2012. Invited chairman and organizer, approximate attendance 350.	New Orleans (US)

July 2011: Official workshop of CNS*2011, “Dendrite function and wiring: experiments and theory” with Dr. Stockholm (Sweden)
 Michiel Remme, Dr. Ben Torben-Nielsen and Prof. Jaap van Pelt

Selected conference attendance

International

SfN: New Orleans 2012*, Washington 2011*, San Diego 2010*, Washington 2008*, New Orleans 2003*, Miami Beach 1999
FENS: Amsterdam 2010, Lisbon 2004*
CNS: Paris 2013*; Stockholm 2011*, Berlin 2009, Edinburgh 2006, Chicago 2002*, Bruges 2000*;
Cosyne: Salt Lake City 2010*, 2008*
Invertebrate Vision: Lund 2001*

Local

Bernstein Conference: Tübingen 2013*, Göttingen 2014
Rhine Main Neuroscience Network Biennial Meeting in Oberwesel 2014*
Meeting of the Dutch INCF (Neuroinformatics) in Nijmegen 2013*
Annual meeting of the German anatomical society in Frankfurt 2012*
Morphology and computations of single neurons in Amsterdam 2010*
Dendrites, Neurones and Networks in Warwick 2010*
UCL Neuroscience Symposium 2010*
Mathematical Neuroscience Meeting in Warwick 2007
Ein Gedi Meeting in Israel 2004, 2005*
Meeting of the Israel Society of Neuroscience in Eilat 2004*
Meeting of the German Neuroscience Society in Göttingen 1999, 2003*
 (* poster or oral presentation)

Summer schools

Otto Loewi International Course in Eilat 2005
 School of dendrites in Jerusalem 2005

Supervision

PhD thesis

Since 2012: Calvin Schneider. *With Prof. Ivan Soltesz.*

MD thesis

Since 2012: Steffen Platschek. *With Dr. Peter Jedlicka and Prof. Thomas Deller.*

PhD thesis

Since 2012: Marcel Beining. *With Dr. Stephan Schwarzacher, Dr. Peter Jedlicka and Prof. Thomas Deller.*

PhD thesis

Since 2010: Hermina Nedeltescu. *With Prof. Erik de Schutter and Prof. Alanna Watt.*

Master thesis

2010 – 2011: Lothar Baltruschat. *With Prof. Gaia Tavosanis.*

Master thesis

2006 – 2007: Elena Phoka. Title of thesis: “The Phase response curves of cerebellar Purkinje cells”. *With Prof. Michael Häusser.*

Diploma thesis and PhD thesis

2005 – 2011: Friedrich Förstner. Title of Diploma thesis: “Modeling the neuroanatomy of interneurons in the visual system of the fly *calliphora vicina*”. Title of PhD thesis: “The morphological identity of insect dendrites”. *With Prof. Alexander Borst.*

Review editor for

PNAS, Current Biology, PLoS Computational Biology, PLoS One, Frontiers in Neuroscience, Biological Cybernetics, Cerebral Cortex, Neuroinformatics, Scientific Reports, Journal of Neurophysiology, Neuroscience, Neuroscience

Letters, Journal of Computational Neuroscience
ERA-Net of the European Union, Air Force Office of Scientific Research, Dutch
Research Council (NWO)
EU advanced course in computational neuroscience, CNS*2012, CNS*2013

Other Brains for Brains Award selection committee

Languages English, French, German, basic Dutch

Service work 2002: McKinsey award “start social” for a project to München (Germany)
build an international house in München.

1993 – 1994: Terre des Hommes – Civil Service in a Wiesbaden (Germany)
children’s home.

Other activities Opera singing (student of Cilla Grossmeyer and Zvi Semel), Piano, Painting.