Prof. Dr. Andreas V.M. Herz

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Faculty of Biology
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Research Interests

I am interested in neuronal dynamics and computation. Using methods from information theory and dynamical systems, we test our hypotheses by analyzing neurophysiological data from local and international collaboration partners. Current topics include the neuronal basis of spatial navigation and collective properties of large neural networks. I have also worked on acoustic communication, auditory coding and sexual selection, olfactory learning, and some problems in applied mathematics, statistical physics, game theory and theoretical immunology.

Curriculum Vitae

Faculty Positions

since 2007	Full Professor for Computational Neuroscience Ludwig-Maximilians-Universität München
1996-2007	Full Professor for Theory of Neural Systems, Humboldt-Universität zu Berlin
1996-1997	Associate Professor for Theoretical Biophysics, University of Bremen

Postdoctoral Training

1994-1996	Research Fellow, University of Oxford (with Robert May)
1993-1994	Beckmann Fellow, UIUC, Urbana-Champaign (with Klaus Schulten)
1990-1993	Postdoctoral Fellow, Caltech, Pasadena (with John J. Hopfield)

Academic Education

1987-1990	PhD in Theoretical Physics, University of Heidelberg (with J Leo van Hemmen)
1983-1984	MSc in Physics, Georgia Institute of Technology, Atlanta
1980-1987	Diploma in Physics, LMU München

Honours and Awards

1994-1996	Research Fellowship (Human Capital and Mobility, EU)
1993-1994	Beckman Institute Fellowship, University of Illinois at Urbana-Champaign
1991-1993	Postdoc Fellowship, DFG
1990	Dr.rer.nat. (PhD) with honors (summa cum laude), Heidelberg University
1988-1990	Ph.D.-Scholarship, Studienstiftung des Deutschen Volkes
1983-1984	Student Scholarship, Fulbright Commission
1980-1987	Bavarian Student Excellence Scholarship

Professional Activities

2010-2018	Spokesperson, National Network for Computational Neuroscience
since 2008	Member, Munich Center for NeuroSciences (MCN^{LMU})
since 2008	Faculty Member, Graduate School of Systemic Neurosciences (GSN^{LMU})
since 2008	Coordinator, Bernstein Center for Computational Neuroscience Munich
since 2008	Coordinator, German National Neuroinformatics Node (hosted by LMU)
2007	Founding Member, NeuroCure Research Cluster (Berlin)
2006	Founding Member, Berlin School for Mind and Brain
2004-2007	Coordinator, Bernstein Center for Computational Neuroscience Berlin
2003	Founding Member, MD/PhD Program in Medical Neurosciences (Charité)
2000	Founding Member, Center for Biophysics and Bioinformatics (HU Berlin)
1999-2003	German Delegate for the Working Group on Neuroinformatics of the OECD Global Science Forum (jointly with Klaus-Peter Hoffmann, Bochum)
1996	Founding Member, Institute for Theoretical Biology (HU Berlin)

Selected Publications

Eberhardt F, Bushong EA, Phan S, Peltier S, Monteagudo-Mesas P, Weinkauf T, Herz AVM, Stemmler MB, Ellisman M
A uniform and isotropic cytoskeletal tiling fills dendritic spines. *eNeuro* 9, 1-19 (2022)

Csordas DÉ, Fischer C, Nagele J, Stemmler MB, Herz AVM
Spike afterpotentials shape the *in vivo* burst activity of principal cells in medial entorhinal cortex. *J Neurosci* 40, 4512-4524 (2020)

Zirkelbach J, Stemmler MB, Herz AVM
Anticipatory neural activity improves the decoding accuracy for dynamic head-direction signals. *J Neurosci* 39, 2847-2859 (2019)

Eberhardt F, Herz AVM, Häusler S
Tuft dendrites of pyramidal neurons contain feedback-modulated functional subunits. *PLoS Computational Biology* e1006756 (2019)

Stemmler MB, Mathis A, Herz AVM
Connecting multiple spatial scales to decode the population activity of grid cells. *Sci Adv* 1: e1500816. DOI: 10.1126/science.1500816 (2015)

Mathis A, Stemmler MB, Herz AVM
Probable nature of higher-dimensional symmetries underlying mammalian grid-cell activity pattern. *eLife*, Elife 4. doi: 10.7554/eLife.05979 (2015)

Loebel A, Le Bé J-V, Richardson MJE, Markram H, Herz AVM
Matched pre- and post-synaptic changes underlie synaptic plasticity over long time scales. *J Neurosci*, 33, 6257-6266 (2013)

Reifenstein E, Kempter R, Schreiber S, Stemmler MB, Herz AVM
Grid cells in rat entorhinal cortex encode physical space with independent firing fields and phase. precession at the single-trial level. *Proc Natl Acad Sci USA* 109**,** 6301-6306 (2012)

Herz AVM, Gollisch T, Machens CK, Jaeger D
Modeling single-neuron dynamics and computations: a balance of detail and abstraction. *Science*, 314, 80-85 (2006)

Gollisch T, Herz AVM
Disentangling sub-millisecond processes within an auditory transduction chain. *PLoS Bio* 3, e8 (2005)

Machens CK, Gollisch T, Kolesnikova O, Herz AVM
Testing the efficiency of sensory coding with optimal stimulus ensembles. *Neuron*, 47, 447-456 (2005)

Benda J, Herz AVM
A universal model for spike-frequency adaptation. *Neural Computation* 15, 2523-2564 (2004)

Erchova I, Kreck G, Heinemann U, Herz AVM
Dynamics of rat entorhinal cortex layer II/III cells: characteristics of membrane potential resonance at rest predict oscillation properties near threshold. *J Physiol* 560, 89-110 (2004)

Galan RF, Sachse S, Galizia CG, Herz AVM
Odor-driven attractor dynamics in the antennal lobe allow for simple and rapid odor classification. *Neural Computation* 16, 999-1012 (2004)

Machens CK, Schütze H, Franz A, Kolesnikova O, Stemmler MB, Ronacher B, Herz AVM
Single auditory neurons rapidly discriminate conspecific communication signals. *Nature Neuroscience*, 6, 341-342 (2003)

Herz AVM, Bonhoeffer S, Anderson RM, May RM, Nowak MA
Viral dynamics in vivo: Limitations on estimates of intracellular delay and virus decay. *Proc Natl Acad Sci, USA* 93, 7247-7251 (1996)

Herz AVM
Solutions of dx(t)/dt=-g(x(t-1)) approach the Kaplan-Yorke orbits for odd sigmoid g. *Journal of Differential Equations* 118, 36-53 (1995)

Herz AVM, Hopfield JJ
Earthquake cycles and neural reverberations: Collective oscillations in systems with pulse-coupled threshold elements. *Physical Review Letters* 75, 1222-1225 (1995)

Herz AVM
Collective phenomena in spatially extended evolutionary games. *Journal of Theoretical Biology* 169, 65-87 (1994)

Herz AVM, Sulzer B, Kühn R, van Hemmen JL
Hebbian learning reconsidered: representation of static and dynamic objects in associative neural nets. *Biological Cybernetics* 60, 457-467 (1989)