

Publications**I) Peer-reviewed Original papers:**

- 1) **Schneggenburger, R.**, López-Barneo, J. & Konnerth, A. (1992). Excitatory and inhibitory synaptic currents and receptors in rat medial septal neurones. *J. Physiology* 445, 261-276.
- 2) **Schneggenburger, R.** & López-Barneo, J. (1992). Patch-clamp analysis of voltage-gated currents in intermediate lobe cells from rat pituitary thin slices. *Pflügers Archiv* 420, 302-312.
- 3) **Schneggenburger, R.** & Konnerth, A. (1992). GABA-mediated synaptic transmission in neuroendocrine cells: a patch-clamp study in a pituitary slice preparation. *Pflügers Archiv* 421, 364-373.
- 4) **Schneggenburger, R.**, Zhou, Z., Konnerth, A. & Neher, E. (1993). Fractional contribution of calcium to the cation current through glutamate receptor channels. *Neuron* 11, 133-143.
- 5) **Schneggenburger, R.**, Tempia, F. & Konnerth, A. (1993). Glutamate- and AMPA-mediated Calcium influx through glutamate receptor channels in medial septal neurons. *Neuropharmacology* 32, 1221-1228.
- 6) Kano, M., **Schneggenburger, R.**, Verkhratsky, A. & Konnerth, A. (1995). Depolarization-induced calcium signals in the somata of cerebellar Purkinje neurons. *Neuroscience Research* 24, 87-95.
- 7) Tempia, F., Kano, M., **Schneggenburger, R.**, Schirra, C., Garaschuk, O., Plant, T. & Konnerth, A. (1996). Fractional calcium current through neuronal AMPA-receptor channels with a low calcium permeability. *J. Neuroscience* 16, 456-466.
- 8) Garaschuk, O., **Schneggenburger, R.**, Schirra, C. Tempia, F. & Konnerth, A. (1996). Fractional calcium currents through somatic and dendritic glutamate receptor channels of rat hippocampal CA1 neurones. *J. Physiology* 491, 757-772.
- 9) **Schneggenburger, R.** (1996). Simultaneous measurement of Ca²⁺-influx and reversal potentials in recombinant N-methyl-D-aspartate receptor channels. *Biophysical Journal* 70, 2165-2174.
- 10) **Schneggenburger, R.** & Ascher, P. (1997). Coupling of permeation and gating in an NMDA-channel pore mutant. *Neuron* 18, 167-177.
- 11) v. Gersdorff, H., **Schneggenburger, R.**, Weis, S. & Neher, E. (1997). Presynaptic depression at a calyx synapse: The small contribution of metabotropic glutamate receptors. *J. Neuroscience* 17, 8137-8146.
- 12) **Schneggenburger, R.** (1998). Altered voltage dependence of fractional Ca²⁺ current in N-methyl-D-aspartate channel pore mutants with a decreased Ca²⁺-permeability. *Biophysical Journal* 74, 1790-1794.
- 13) Döring, F., Derst, C., Wischmeyer, E., Karschin, C., **Schneggenburger, R.**, Daut, J. & Karschin, A. (1998) The epithelial inward rectifier channel Kir7.1 displays unusual permeation properties. (1998) *J. Neuroscience* 18, 8625-8636.
- 14) **Schneggenburger, R.**, Meyer, A.C. & Neher, E. (1999) Released fraction and total size of a pool of immediately available transmitter quanta at a calyx synapse. *Neuron* 23, 399-409.
- 15) Weis, S., **Schneggenburger, R.** & Neher, E. (1999) Properties of a model of Ca⁺⁺-dependent vesicle pool dynamics and short-term synaptic depression. *Biophysical Journal* 77, 2418-2429.
- 16) **Schneggenburger, R.** & Neher, E. (2000) Intracellular calcium dependence of transmitter release rates at a fast central synapse. *Nature* 406, 889 – 893.

- 17) Meyer, A. C., Neher, E. & **Schneggenburger, R.** (2001) Estimation of quantal size and number of functional active zones at the calyx of Held synapse by nonstationary EPSC variance analysis. *J. Neuroscience* 21, 7889-7900.
- 18) Scheuss, V., **Schneggenburger, R.** & Neher, E. (2002) Separation of pre- and postsynaptic contributions to depression by covariance analysis of successive EPCs at the calyx of Held synapse. *J. Neuroscience* 22, 728-739.
- 19) Felmy, F., Neher, E., **Schneggenburger, R.** (2003) Probing the intracellular Calcium sensitivity of transmitter release during synaptic facilitation. *Neuron* 37, 801 – 811.
- 20) Trommershäuser, J., **Schneggenburger, R.**, Zippelius, A., Neher, E. (2003) Heterogenous presynaptic release-probabilities: functional relevance for short-term plasticity. *Biophysical Journal* 84, 1563-1579.
- 21) Wölfel, M., **Schneggenburger, R.** (2003) Presynaptic capacitance measurements and Ca^{2+} uncaging reveal sub-millisecond exocytosis kinetics and characterize the Ca^{2+} affinity of vesicle pool depletion at a fast CNS synapse. *J. Neuroscience* 23, 7059-7068.
- 22) Felmy, F., Neher, E., **Schneggenburger, R.** (2003) The time course of phasic transmitter release is Ca^{2+} dependent and lacks a direct influence of the presynaptic membrane potential. *Proc. Natl. Acad. Sci. USA* 100, 15200-15205.
- 23) Fernández-Chácon, R. Wölfel, M., Nishimune, H., Tabares, L., Schmitz, F., Castellano-Muñoz, M., Rosenmund, C., Montesinos, M.L., Sanes, J.R., **Schneggenburger, R.**, Südhof, T. (2004) The synaptic vesicle protein CSP α prevents presynaptic degeneration. *Neuron* 42, 237-251.
- 24) Felmy, F., **Schneggenburger, R.** (2004) Developmental expression of the Ca^{2+} -binding proteins Calretinin and Parvalbumin at the calyx of Held of rats and mice. *European Journal of Neuroscience* 20, 1473-1482.
- 25) Korogod, N., Lou, X., **Schneggenburger, R.** (2005) Presynaptic Ca^{2+} requirements and developmental regulation of post-tetanic potentiation at the calyx of Held. *J. Neuroscience* 25: 5127-5137.
- 26) Lou, X., Scheuss, V. & **Schneggenburger, R.** (2005) Allosteric modulation of the presynaptic Ca^{2+} sensor for vesicle fusion. *Nature* 435: 497-501.
- 27) Kim, M.-H., Korogod, N., **Schneggenburger, R.**, Ho, W.-K. & Lee, S-H. (2005) Interplay between $\text{Na}^+/\text{Ca}^{2+}$ exchangers and mitochondria in Ca^{2+} clearance at the calyx of Held. *J. Neuroscience* 25: 6057-6065.
- 28) Dulubova, I., Lou, X. Lu, J., Huryeva, I., Alam, A. **Schneggenburger, R.** , Südhof, T.C. & Rizo, J. (2005) A munc13/RIM/rab3 tripartite complex: from priming to plasticity? *EMBO J.* 24: 2839 - 2850.
- 29) Müller, M., Felmy, F., Schwaller, B., **Schneggenburger, R.** (2007) Parvalbumin is a mobile presynaptic Ca^{2+} buffer in the calyx of Held that accelerates the decay of Ca^{2+} and short-term facilitation. *J. Neuroscience* 27 : 2261-2271.
- 30) Wölfel, M., Lou, X., **Schneggenburger, R.** (2007) A mechanism intrinsic to the vesicle fusion machinery determines fast and slow transmitter release at a large CNS synapse *J. Neuroscience* 27: 3198-3210.
- 31) Korogod, N., Lou, X., **Schneggenburger, R.** (2007) Posttetanic potentiation critically depends on an enhanced Ca^{2+} sensitivity of vesicle fusion mediated by presynaptic PKC. *Proc. Natl. Acad. Sci. USA* 104: 15923-15928.

- 32) Lou, X., Korogod, N., Brose, N., **Schneggenburger, R.** (2008) Phorbol esters modulate spontaneous and Ca^{2+} -evoked transmitter release via acting on both Munc13 and protein kinase C. *J. Neuroscience* 28: 8257 - 8267.
- 33) Müller, M., Felmy, F., **Schneggenburger, R.** (2008) A limited contribution of Ca^{2+} current facilitation to paired-pulse facilitation of transmitter release at the rat calyx of Held. *J. Physiology* 586: 5503 - 5520.
- 34) Kochubey, A., Han, Y., **Schneggenburger, R.** (2009) Developmental regulation of the intracellular Ca^{2+} sensitivity of vesicle fusion and Ca^{2+} - secretion coupling at the rat calyx of Held *J. Physiology*, 587: 3009 - 3023.
- 35) Müller, M., Goutman, J., Kochubey O., **Schneggenburger R.** (2010) Interaction between facilitation and depression at a large CNS synapse reveals mechanisms of short-term plasticity. *J. Neuroscience*, 30: 2007 - 2016.
- 36) Xiao L., Han Y., Runne H., Murray H., Kochubey O., Lüthi-Carter R. **Schneggenburger R.** (2010) Developmental expression of Synaptotagmin isoforms in single calyx of Held-generating neurons. *Mol Cell Neurosci* 44: 374 - 385.
- 37) Beurg, M., Michalski, N., Safieddine, S., Bouleau, Y., **Schneggenburger, R.**, Chapman, E. R., Petit, C., and Dulon, D. (2010). Control of exocytosis by synaptotagmins and otoferlin in auditory hair cells. *J. Neuroscience* 30, 13281-13290.
- 38) Han, Y., Kaeser, P. S., Südhof, T. C., **Schneggenburger, R.** (2011). RIM determines Ca^{2+} channel density and vesicle docking at the presynaptic active zone. *Neuron* 69, 304-316.
See also: Preview by Pernía-Andrade & Jonas, *Neuron* 69: 185-187.
- 39) Kochubey, O., **Schneggenburger, R.** (2011). Synaptotagmin increases the dynamic range of synapses by driving Ca^{2+} - evoked release and by clamping a near-linear remaining Ca^{2+} sensor. *Neuron* 69: 736 - 748.
- 40) Gaugler M.N., Genç O., Bobela W., Mohanna S., Ardah M.T., El-Agnaf O.M., Cantoni M., Bensadoun J.C., **Schneggenburger R.**, Knott G.W., Aebischer P., Schneider B.L. (2012) Nigrostriatal overabundance of α -synuclein leads to decreased vesicle density and deficits in dopamine release that correlate with reduced motor activity. *Acta Neuropathologica* 123:653-69.
- 41) Michalski, N., Babai, N., Renier, N., Perkel, D., Chédotal, A., **Schneggenburger, R.** (2013). Robo3-dependent axon midline crossing conditions functional maturation of a large commissural synapse. *Neuron* 78, 855 - 868.
See also: Preview by Scheiffele, *Neuron* 78: 751-752
- 42) Xiao, L., Michalski, N., Kronander, E., Gjoni, E., Genoud C., Knott, G., **Schneggenburger, R.** (2013). BMP-signaling specifies the development of a large and fast CNS synapse. *Nature Neuroscience* 16: 856 - 864.
- 43) Genc, Ö., Kochubey, O., Toonen, R., Verhage, M. and **Schneggenburger, R.** (2014). Munc18-1 is a dynamically regulated PKC target during short-term enhancement of transmitter release. *eLife*, 3:e01715.
- 44) Babai, N., Kochubey, O., Keller, D., **Schneggenburger, R.** (2014) An alien divalent ion reveals a major role for Ca^{2+} buffering in controlling slow transmitter release. *J. Neuroscience* 34:12622 - 12635
- 45) Han, Y., Babai, N., Kaeser P., Südhof T.C., **Schneggenburger, R.** (2015) RIM1 and RIM2 redundantly determine Ca^{2+} channel density and readily-releasable pool size at a large hindbrain synapse. *J. Neurophysiology* 113: 255-263.

- 46) Keller, D., Babai, N., Han, Y., Kochubey, O., Markram H., Schürmann, F. **Schneggenburger R.** (2015) An exclusion zone for Ca²⁺ channels around docked vesicles explains release control by multiple channels at a CNS synapse. *Plos Comp. Biol.* 11(5) e1004253.
- 47) Kochubey, O., Babai, N., **Schneggenburger R.** (2016) A Synaptotagmin isoform switch during the development of an identified CNS synapse. *Neuron* 90: 984 - 999.
- 48) Kronander, E., Michalski, N., Lebrand, C., Hornung, J.P., and **Schneggenburger, R.** (2017). An organotypic slice culture to study the formation of calyx of Held synapses *in-vitro*. *PLoS One* 12, e0175964.
- 49) Bouhours, B., Gjoni, E., Kochubey, O., **Schneggenburger, R.** (2017). Synaptotagmin2 (Syt2) drives fast release redundantly with Syt1 at the output synapses of Parvalbumin-expressing inhibitory neurons. *J Neuroscience* 37, 4604-4617.
- 50) Gjoni, E., Zenke, F., Bouhours, B., **Schneggenburger, R.** (2018). Specific synaptic input strengths determine the computational properties of excitation - inhibition integration in a sound localization circuit *J. Physiology*, 596.20, 4945-4967.
- 51) Gjoni, E., Aguet, C., Sahlender, D.A., Knott, G., **Schneggenburger, R.** (2018). Ultrastructural basis of strong unitary inhibition in a binaural neuron. *J. Physiology* 596.20, 4969-4982.
See also: Perspective by T. Sakaba, *J. Physiology* 596.20, 4807–4808.
- 52) Vickers, E.D., Clark, C., Osypenko, D., Fratzl, A., Kochubey, O. Bettler, B., **Schneggenburger R.** (2018) Parvalbumin-interneuron output synapses show spike-timing dependent plasticity that contributes to auditory map remodeling. *Neuron* 99, 720 - 735.
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doi: 10.1002/dneu.22661.
Recommended in F1000 by K. Cramer and G. Milinkeviciute, DOI 10.3410/f.734635836.793558525
- Berret, E., Kintscher, M., Palchadhuri, S., Tang, W., Osypenko, D., Kochubey, O., and **Schneggenburger, R.** (2019). Insular cortex processes aversive somatosensory information and is crucial for threat learning. *Science* 364. doi: 10.1126/science.aaw0474
We have retracted the paper, when we found that the first author had manipulated data in Figures 1, 3 and 6. See the retraction note (Berret et al. *Science*, Dec. 2019; doi: 10.1126/science.aba2173).
- Berret, E., Kintscher, M., Palchadhuri, S., Tang, W., Osypenko, D., Kochubey, O., and **Schneggenburger, R.** (2019) Retraction. *Science*. 366(6472):1460. doi: 10.1126/science.aba2173.
- 54) Tang, W., Kochubey, O., Kintscher, M., **Schneggenburger, R.** (2020) A VTA to basal amygdala dopamine projection contributes to signal salient somatosensory events during fear learning. *J. Neuroscience*, 40(20):3969 - 3980.
Highlighted in: "This week in the Journal" (<https://doi.org/10.1523/JNEUROSCI.twij.40.20.2020>)
Discussed by: "Journal Club" by Cardozo Pinto et al. *J. Neuroscience* 40(40):7590–7592
- 55) Vickers, E.D., Osypenko, D., Clark, C., Okur, Z., Scheiffele, P., **Schneggenburger, R.** (2020) LTP of inhibition at PV-interneuron output synapses requires developmental BMP signaling. *Scientific Reports* 10:10047 ; doi.org/10.1038/s41598-020-66862-5
- 56) Lozano-Montes L., Dimanico M., Mazloum R., Li W., Nair J., Kintscher M., **Schneggenburger R.**, Harvey M., Rainer G. (2020) Optogenetic stimulation of basal forebrain Parvalbumin neurons activates the default mode network and associated behaviors. *Cell Reports* 33(6):108359.
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- 57) Baleisyte A., **Schneggenburger R.**, Kochubey O. (2022). Stimulation of medial amygdala GABA neurons with kinetically different channelrhodopsins yields opposite behavioral outcomes. *Cell Reports* 39(8):110850. doi:10.1016/j.celrep.2022.110850.
- 58) Kintscher M., Kochubey O., Schneggenburger R. (2023). A striatal circuit balances learned fear in the presence and absence of sensory cues. *eLife* 12:e75703. doi:10.7554/eLife.75703
- 59) Mombelli E, Osypenko D, Palchadhuri S, Sourmpis C, Brea J, Kochubey O and Schneggenburger R (2024). Auditory stimuli suppress contextual fear responses in safety learning independent of a possible safety meaning. *Front Behav Neurosci* 18:1415047. doi:10.3389/fnbeh.2024.1415047

II) Peer-reviewed reviews:

- 1) **Schneggenburger, R.**, Sakaba, T. & Neher, E. (2002). Vesicle pools and short-term synaptic depression: Lessons from a large synapse. *Trends in Neurosciences* 25: 206-212.
- 2) Sakaba, T., **Schneggenburger, R.** & Neher, E (2002). Estimation of quantal parameters at the calyx of Held synapse. *Neuroscience Research* 44: 343 - 356
- 3) **Schneggenburger, R.** & Neher, E. (2005). Presynaptic Calcium and control of vesicle fusion. *Curr. Op. Neurobiol.* 44: 266 - 274.
- 4) **Schneggenburger, R.** and Forsythe, I.F. (2006) The calyx of Held. *Cell Tissue Res.* 326: 311-337.
- 5) Kochubey, O., Lou, X., and **Schneggenburger, R.** (2011). Regulation of transmitter release by Ca²⁺ and synaptotagmin: insights from a large CNS synapse. *Trends in Neurosciences* 34: 237-246.
- 6) **Schneggenburger, R.**, Han, Y., Kochubey, O. (2012). Ca²⁺ channels and transmitter release at the active zone. *Cell Calcium* 52: 199 - 207.
- 7) **Schneggenburger, R.**, Rosenmund C. (2015) Molecular mechanisms governing the Ca²⁺ regulation of evoked and spontaneous transmitter release. *Nat. Neuroscience* 18: 935 - 941.
- 8) Palchadhuri, S., Osypenko, D., **Schneggenburger, R.** (2022) Fear Learning: An Evolving Picture for Plasticity at Synaptic Afferents to the Amygdala. *The Neuroscientist*. July 2022.

III) Book chapters

- 1) Eilers, J., **Schneggenburger, R.** & Konnerth, A. (1995). Patch clamp and Calcium imaging in brain slices. In: *Single Channel Recording, Second edition*, ed. by B. Sakmann und E. Neher.
- 2) **Schneggenburger, R.** (2005) Ca²⁺ uncaging in nerve terminals. In: *Imaging in Neuroscience and Development*; ed. by Rafael Yuste and Arthur Konnerth.

- 3) **Schneggenburger, R.** (2006) Short-term plasticity: facilitation and post-tetanic potentiation *In: Textbook of Neural repair and rehabilitation*, ed. by M.E. Selzer, S. Clarke, L. Cohen, P.W. Duncan and F.H. Gage.
- 4) **Schneggenburger, R.** (2008) "Exocytosis: Ca²⁺-sensitivity". *The New Encyclopedia of Neuroscience*, edited by Larry Squire et al., 2008.
- 5) Kochubey O., **Schneggenburger, R.** (2011) Ca²⁺ uncaging in nerve terminals. *In: Optical Imaging in Neuroscience: A Laboratory Manual*; ed. by Fritjof Helmchen and Arthur Konnerth., pp 151 - 160.
- 6) Kochubey, O., **Schneggenburger, R.** (2014) "Ca²⁺ sensitivity of vesicle fusion". Reference Module in Biomedical research (note: updated second edition of an earlier version: "*Exocytosis: Ca²⁺-sensitivity*". *The New Encyclopedia of Neuroscience*, edited by Larry Squire et al., 2008).
- 7) Kochubey, O., and **Schneggenburger, R.** (2015). Ca²⁺ Uncaging in Nerve Terminals: A Three-Point Calibration Procedure. *Cold Spring Harbor Protocols* 2015, 761-768. (note: adapted and updated from the 2011 book chapter of the same authors: "Ca²⁺ uncaging in nerve terminals").