QUANTITATIVE SUPER-RESOLUTION IMAGING OF ACTIVE ZONE STATES

Nadine Ehmann, Sebastian van de Linde, Amit Alon, Dmitrij Ljaschenko, Xi Zhen Keung, Thorge Holm, Annika Rings, Aaron DiAntonio, Stefan Hallermann, Xi Zhen Keung, Thorge Holm, Annika Rings, Aaron DiAntonio, Stefan Hallermann, Uri Ashery, Manfred Heckmann, Markus Sauer, Robert J. Kittel

1Institute of Physiology, Department of Neurophysiology, University of Würzburg, 97070 Würzburg, Germany. 2Department of Biotechnology & Biophysics, University of Würzburg, 97074 Würzburg, Germany. 3European Neuroscience Institute, University Medical Center Göttingen, 37077 Göttingen, Germany. 4Department of Developmental Biology, Washington University School of Medicine, Saint Louis, MO 63110, USA. 5Department of Neurobiology, Wise Faculty of Life Sciences, and 6Sagol School of Neuroscience, Tel Aviv University, Tel Aviv, Israel

E-mail: vdlinde@uni-wuerzburg.de

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ABSTRACT

The precise molecular architecture of synaptic active zones (AZs) gives rise to different structural and functional AZ states, which fundamentally shape chemical neurotransmission. However, elucidating the nanoscopic protein organization at AZs is impeded by the diffraction-limited resolution of conventional light microscopy. Here, we introduce new approaches to quantify endogenous proteins at single-molecule resolution in situ with super-resolution imaging by direct Stochastic Optical Reconstruction Microscopy (dSTORM, [1]). Focusing on Bruchpilot (BRP), a key player at presynaptic AZs of Drosophila melanogaster [2], we tested for a quantitative relationship between CAZ (cytoskeletal matrix associated with the AZ) ultrastructure and neurotransmitter release properties by engaging Drosophila mutants and electrophysiology. Our results demonstrate that the precise nanoscopic organization of BRP distinguishes different AZ states and links functional diversification to a heretofore unrecognised neuronal gradient of the CAZ ultrastructure.
