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Subcellular distribution of peroxisomes and endoplasmic reticulum in hippocampal neurons

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In summary, the work described in the present thesis focused on analysis of polarized positioning of neuronal constituents in different compartments, including GABAergic synapses, CO (cisternal organelle), and POs (peroxisomes). The potential correlation between the heterogeneity of neuronal morphology and polarized distribution of subcellular compartments was discussed. The results imply that the differential distribution of inhibitory GABAergic terminals at the AIS – which are highly relevant to control of AP generation - could play a role in homeostasis of neuronal excitability potentially relevant for neuronal network function *in vivo*. The AIS-associated GABA-terminals are found in proximity to a distinct type of axonal ER – the so-called CO. The distribution of such CO does correlate with morphological variation of AIS (AcD vs. nonAcD). A tight control in the distribution of other major organelles, such as POs, is equally vital for the normal function of a neuron. Organelle contacts of POs most likely serve as a major factor in regulating their distribution and motility in distinct cell types. Hence, the newly identified PO tether ACBD5 was used to evaluate the impact of organelle contacts on the positioning of POs in hippocampal neurons. Eventually, the alteration of ACBD5 expression in neurons leads to significant redistribution and decreased motility of POs, strongly suggesting that ACBD5 plays an important role in regulating motility and distribution of neuronal POs.