
Supplementary information

A large-scale nanoscopy and biochemistry analysis of postsynaptic dendritic spines

In the format provided by the
authors and unedited

Protein name (Synonyms, Genename, Uniprot ID)

Known function: determined from literature

Known organization: determined from literature

Known Interactions: Only interactions with other proteins from this dataset are considered.

Rat hippocampal cultures were immunostained for the he protein of interest (red, STED) , the PSD marker Homer1 (blue, confocal), and the membrane was stained using DiO (green, confocal). Representative images for both classes are shown. The heatmap represents the average distribution of the protein of interest, obtained by aligning and averaging many spines of each class. The used colormap is inferno. The green outline represents the average membrane border of the spine, the blue circle the average position of the PSD. Scale bar is 500 nm for all images

The average distribution of the protein of interest is shown as a heatmap, obtained by aligning and averaging many spines of each class. The colormap is inferno, the green outline represents the average membrane border of the spine, the blue circle the average position of the PSD. Scale bar is 500 nm.

To quantify the protein localization and to make it comparable between the two classes, we defined corresponding functional zones (see Fig. S5). The fluorescence intensity was summed for each zone and normalized to the size of the zone. Then the fold difference to an average protein localization was calculated. The average protein localization was obtained using all proteins in this study.

Rat hippocampal were immunostained against the protein of interest (red) and the PSD marker Homer1 (blue), and imaged in epifluorescence to obtain the proportion of protein located in dendritic spines. A representative image is shown. Scale bar is 5 μ m.

Whole cell copy number	Mean \pm SEM	
Spine copy number	Mean \pm SEM	
Function	Determined from literature	
	Mushroom	Stubby
Spine copy number	Mean \pm SEM	Mean \pm SEM
% of total protein	Mean \pm SEM	Mean \pm SEM
Molarity (μ M)	Mean \pm SEM	Mean \pm SEM
PSD copy number	Mean \pm SEM	Mean \pm SEM
% in PSD	Mean \pm SEM	Mean \pm SEM

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	Mean ± SEM	Mean ± SEM	Mean ± SEM	Mean ± SEM
Stubby	Mean ± SEM	Mean ± SEM	Mean ± SEM	Mean ± SEM

Molecular structure of the protein of interest

Model of the average mushroom spine indicating the spatial organization of the protein of interest. The PSD is highlighted in red.

A zoom into the PSD of the mushroom model, which is highlighted in red.

A zoom into the neck of the mushroom model.

Several parameters were measured for each individual spine. The distribution is presented as a violin plot, the thick line indicates the median, the dotted lines upper and lower quartiles.

Enrichment head: The fluorescence signal within the head is calculated and compared to the fluorescence signal in the shaft.

Enrichment PSD: The fluorescence signal in the PSD was calculated and compared to the fluorescence signal in the shaft.

Nearest neighbor: For each protein spot the closest distance to the next spot of the protein of interest.

Distance to PSD: The shortest distance of every spot to the PSD.

Eccentricity: The position of all spots in the head is determined on the top-bottom axis and normalized. The top of the head is 1, the bottom is -1.

Laterality: The position of all spots in the head is determined on the lateral/center axis is determined. The center of the spine is 0, 1 is most left/right position.

For each spine class the correlation between the protein of interest signal with Homer1 signal was calculated. The color intensity represents the value. A solid border indicates a significant correlation, a grey border is non-significant. See also Fig. 5.

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	Mean ± SEM	Mean ± SEM	Mean ± SEM	Mean ± SEM
Stubby	Mean ± SEM	Mean ± SEM	Mean ± SEM	Mean ± SEM

Molecular structure of the protein of interest

Model of the average stubby spine indicating the spatial organization of the protein of interest. The PSD is highlighted in red.

A zoom into the PSD of the stubby model, which is highlighted in red.

A zoom into the interior of the mushroom model. The organelle on the left is the ER.

References

List of primary antibodies used for this protein. **PDB Identifier:** Used to extract the protein structure

Literature:

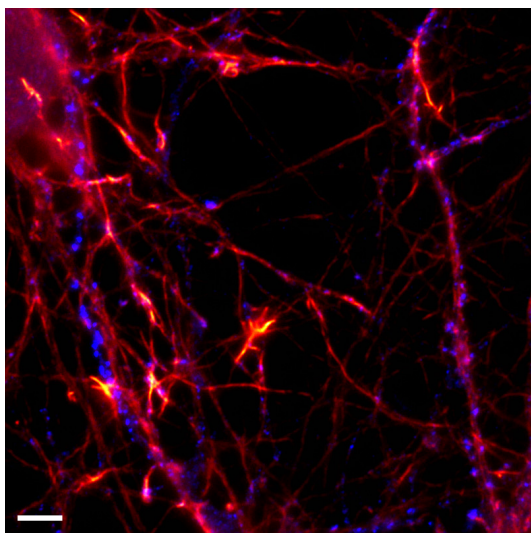
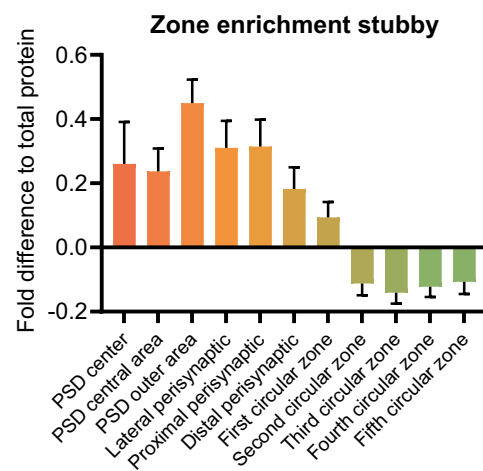
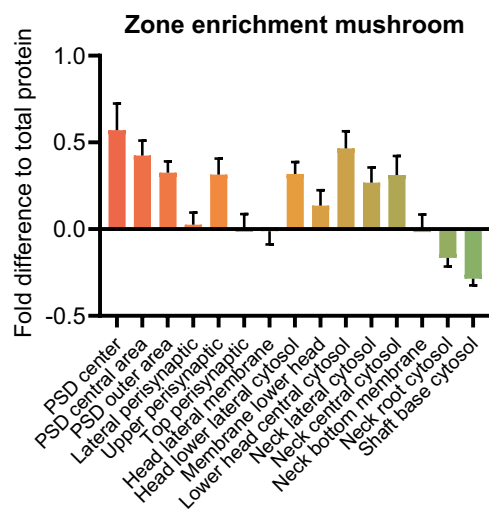
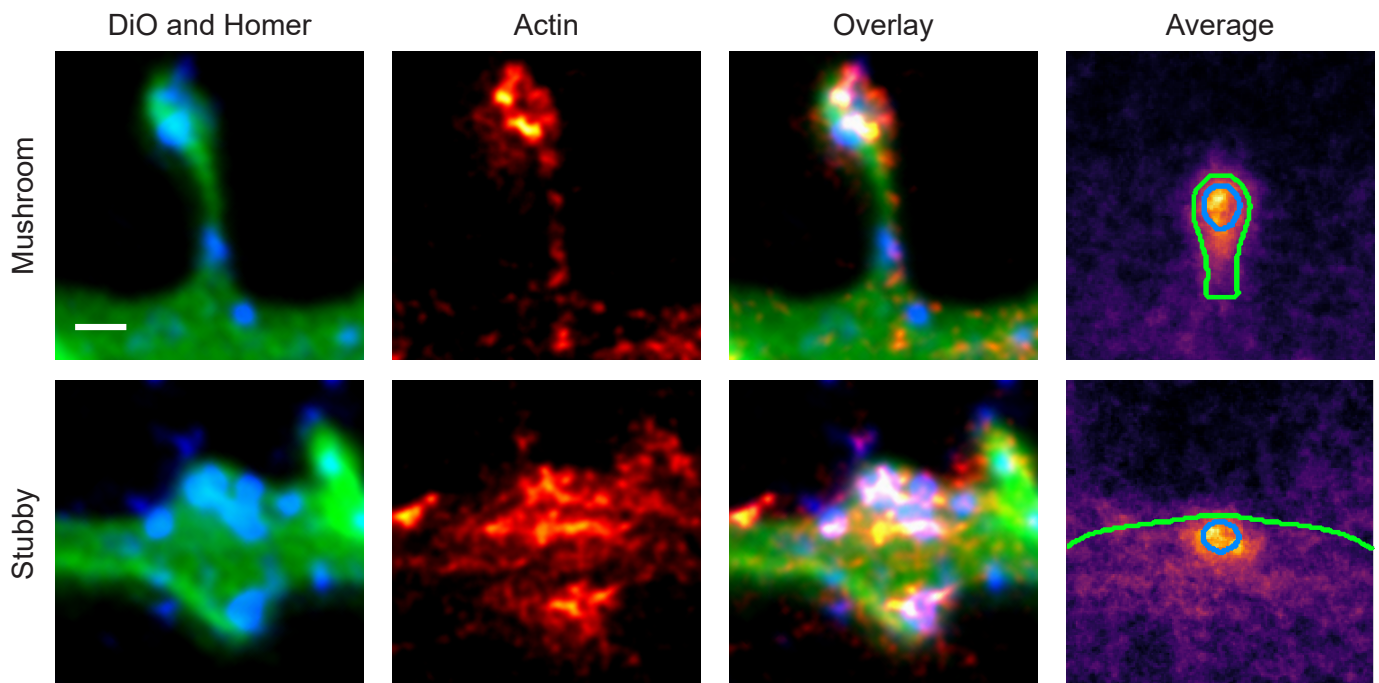
A list of references used to additionally determine the appropriate organization, localization and function of the protein of interest.

Actin (Genes: Actg1, Actb, Actc1, Uniprot ID: P63259, P60711, P68035)

Known function: Shapes spine morphology, serves as scaffold for transport

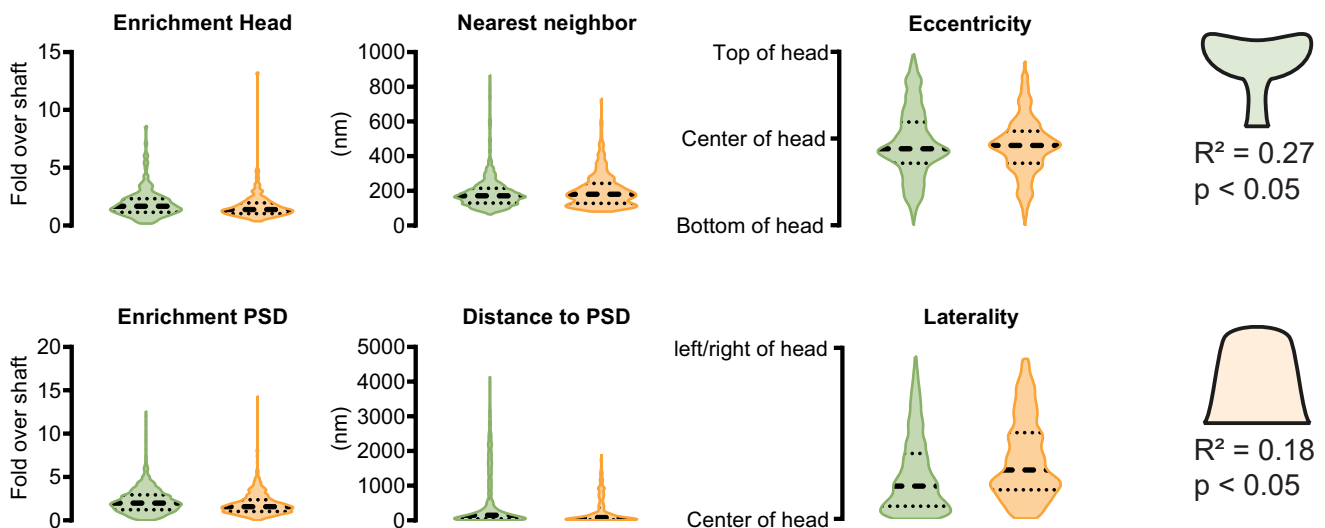
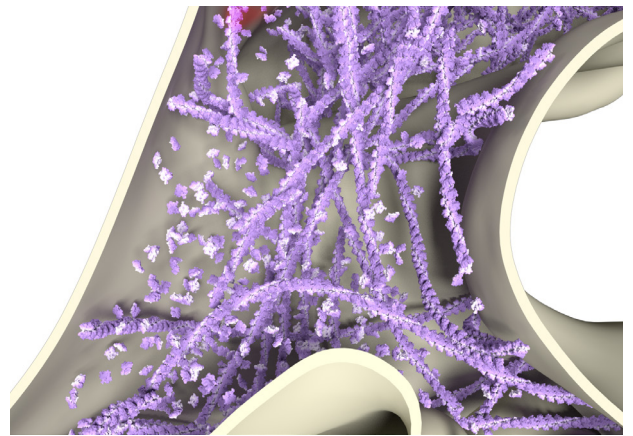
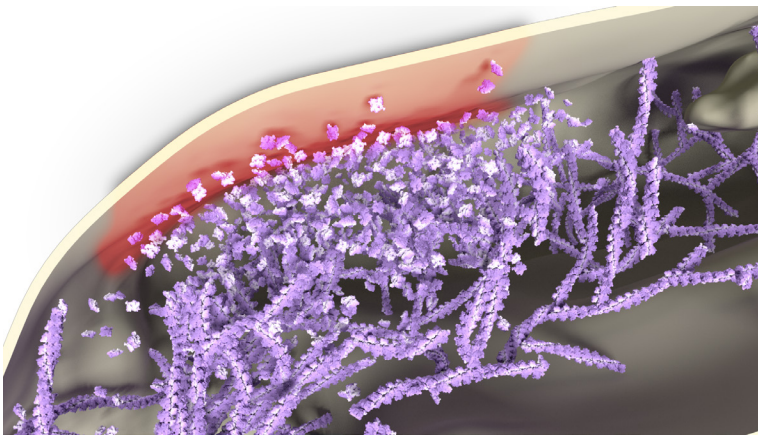
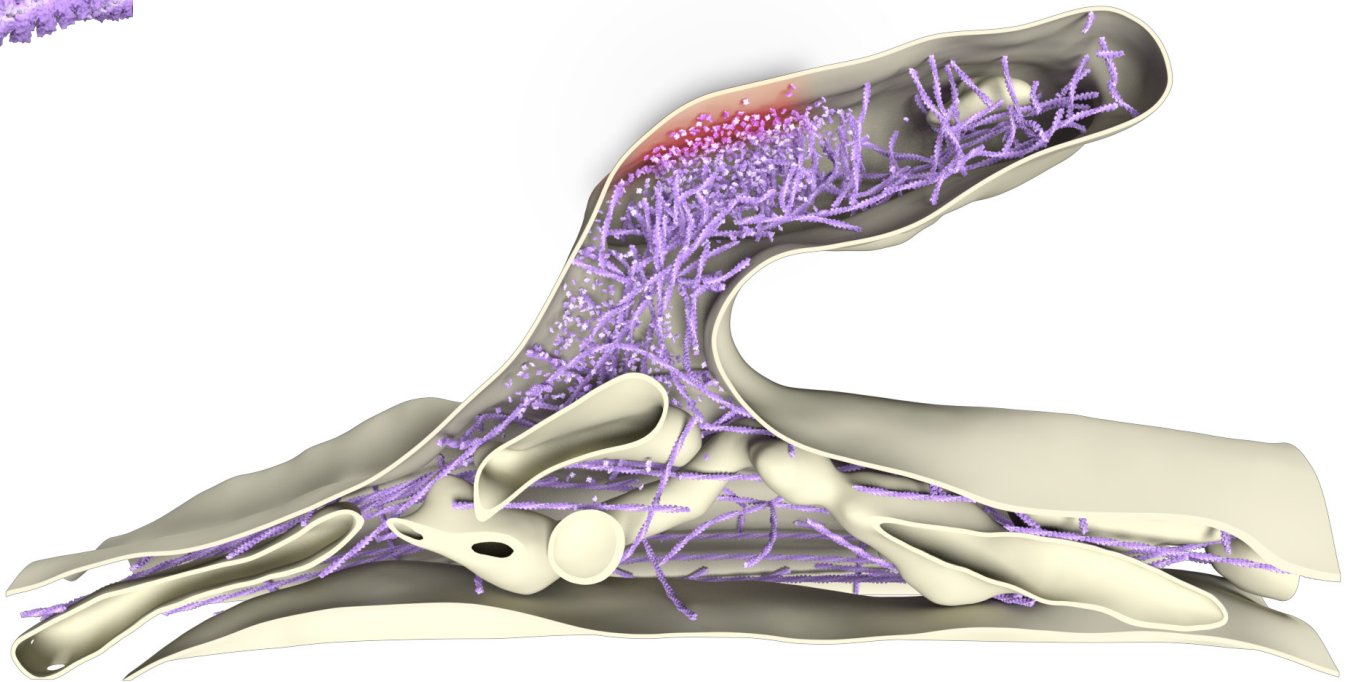
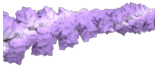
Known organization: Cytosolic, forms filaments, rings in neck and shaft

Known Interactions: β -2-spectrin

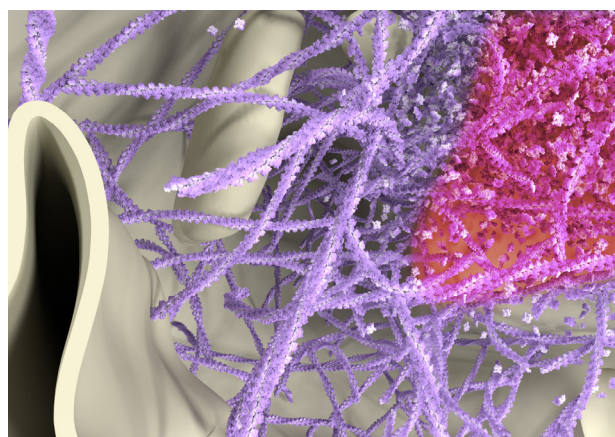
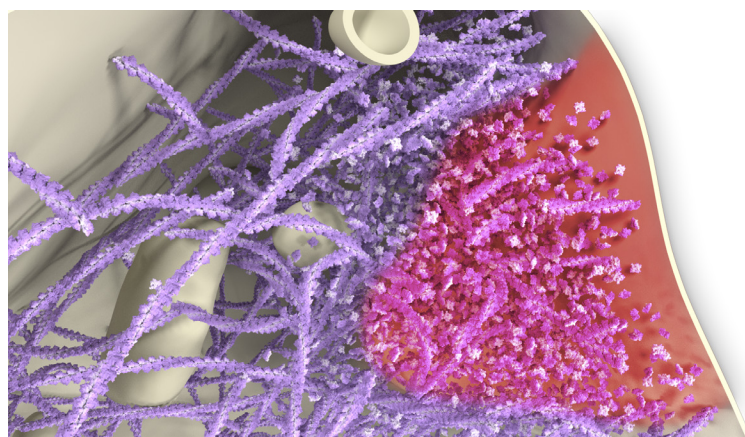
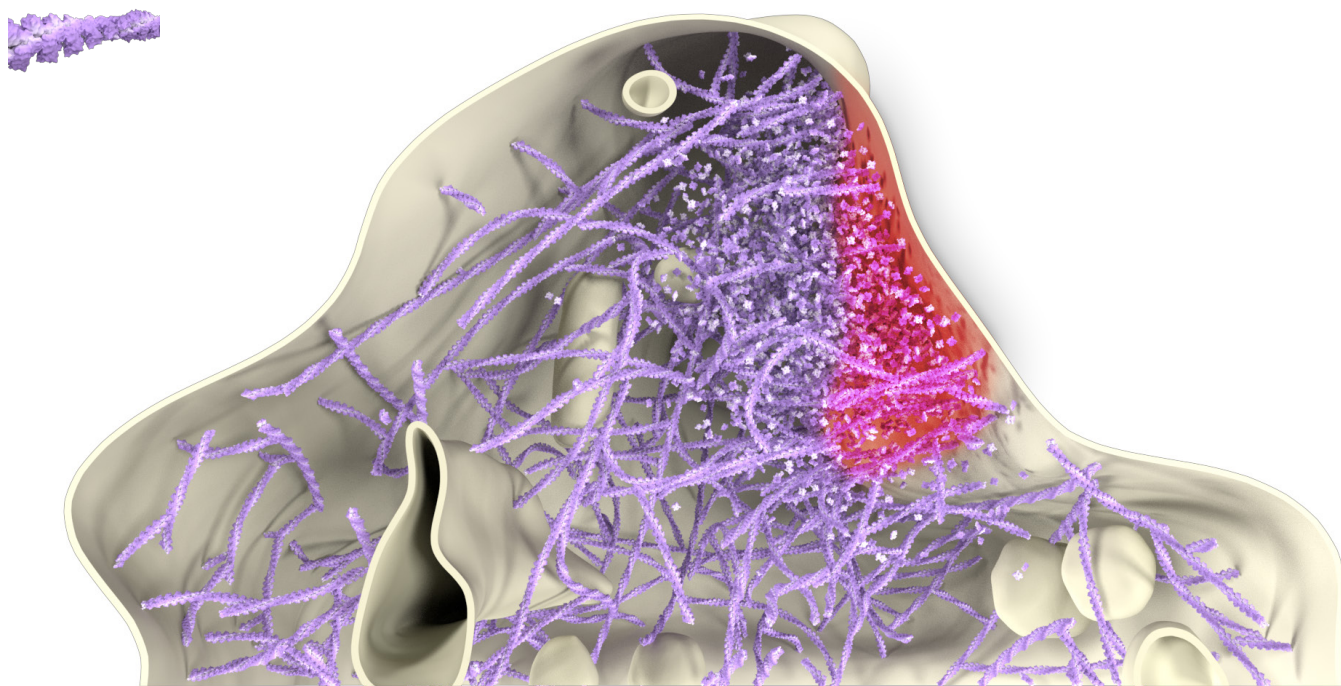


Whole cell copy number	481057719.6 ± 45433802.4	
Spine copy number	213638.4 ± 331711.4	
Function	Cytoskeleton	
	Mushroom	Stubby
Spine copy number	241916.1 ± 35908.8	185822.6 ± 27582.6
% of total protein	49.3 ± 7.3%	32.6 ± 4.8%
Molarity (μM)	3072.4 ± 456.0	1756.2 ± 260.7
PSD copy number	95755 ± 14213.4	69304 ± 10287.1
% in PSD	39.6 ± 5.9%	37.3 ± 37.3

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	241916.1 ± 35908.8	$49.3 \pm 7.3\%$	3072.4 ± 456.0	95755 ± 14213.4
Stubby	185822.6 ± 27582.6	$32.6 \pm 4.8\%$	1756.2 ± 260.7	69304 ± 10287.1



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Stubby	185822.6 ± 27582.6	$32.6 \pm 4.8\%$	1756.2 ± 260.7	69304 ± 10287.1



References

Phalloidin Sigma Aldrich 65906

PDB Identifier: 1j6z

Literature:

Bär et al., 2016, Sci. Rep.

Burette et al., 2012, J. Comp. Neurol.

Chaezeau et al., 2014, Cell. Mol. Life Sci.

D'Este et al., 2015, Cell Rep.

D'Este et al., 2016, Sci. Rep.

Korobova and Svitkina, 2010, Mol. Biol. Cell

Sidenstein et al., 2016, Sci. Rep.

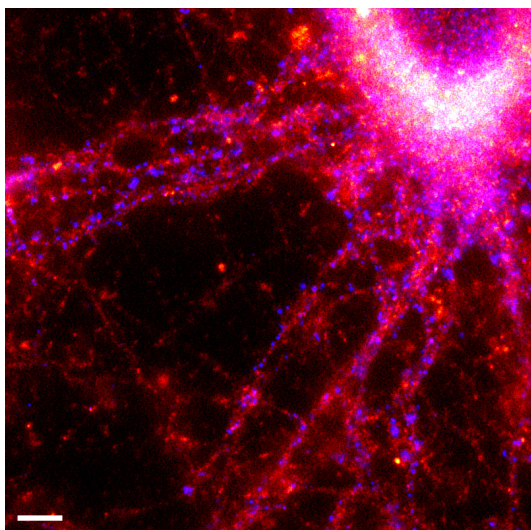
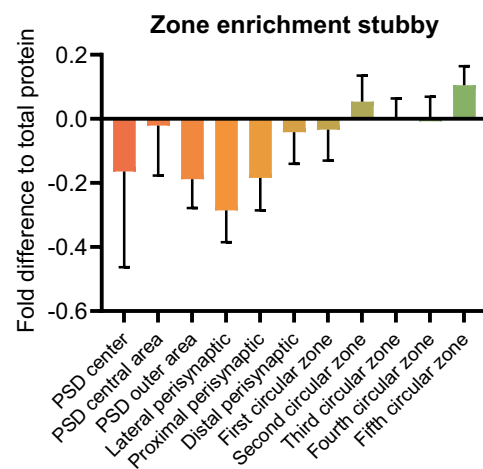
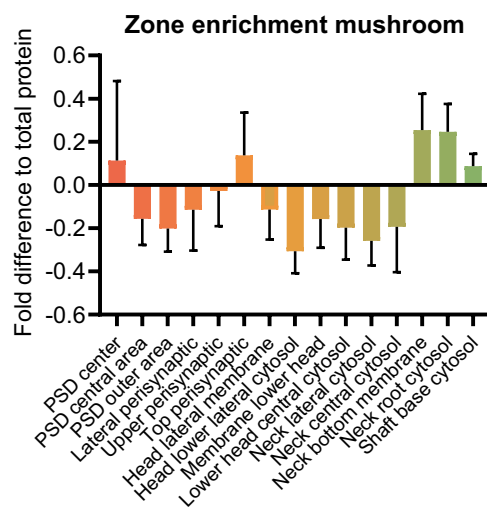
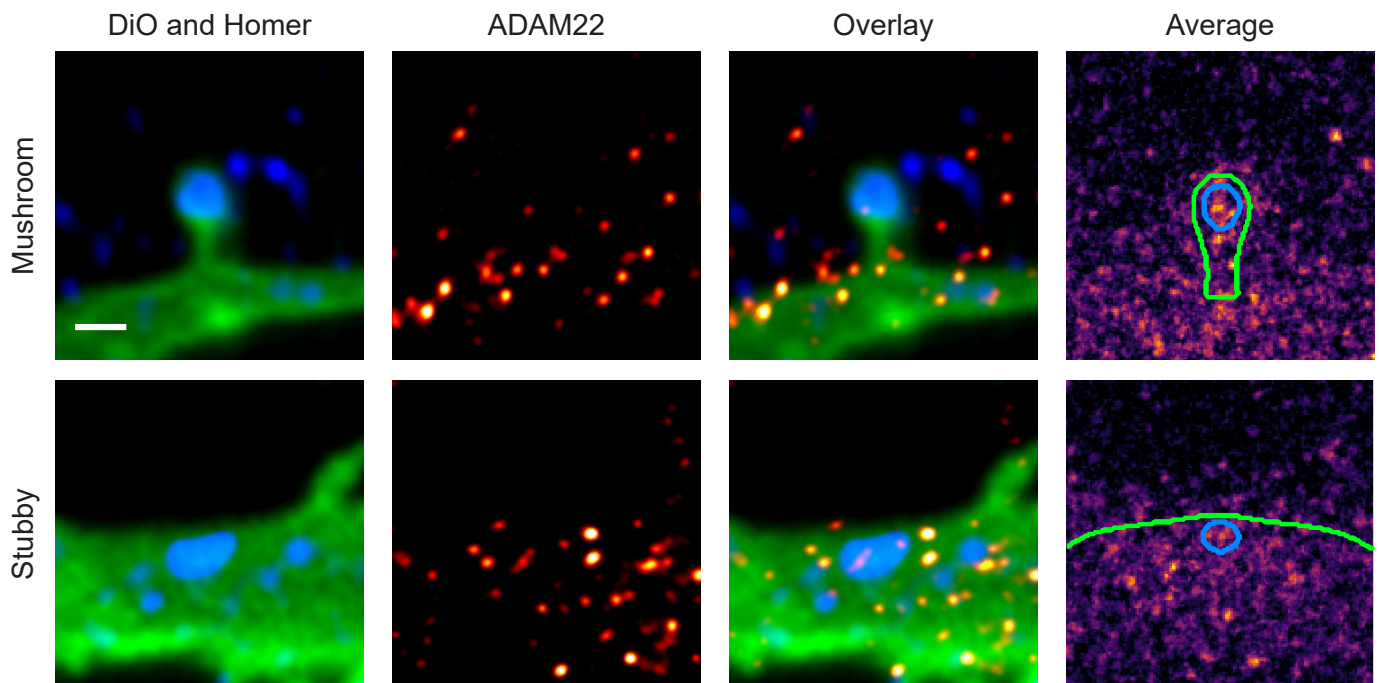
Xu et al., 2013, Science

ADAM22 (Gene: Adam22, Uniprot ID: M0R5P8)

Known function: Catalytically inactive metalloprotease, Involved in cell adhesion, Regulation of AMPAR, K_v1 channels and PSD95

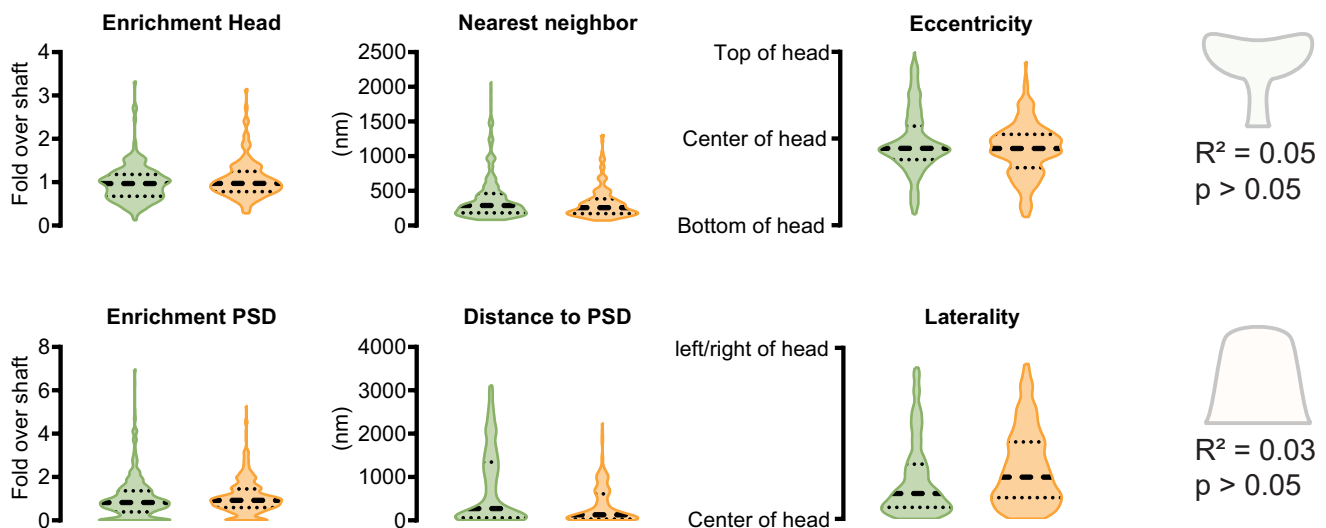
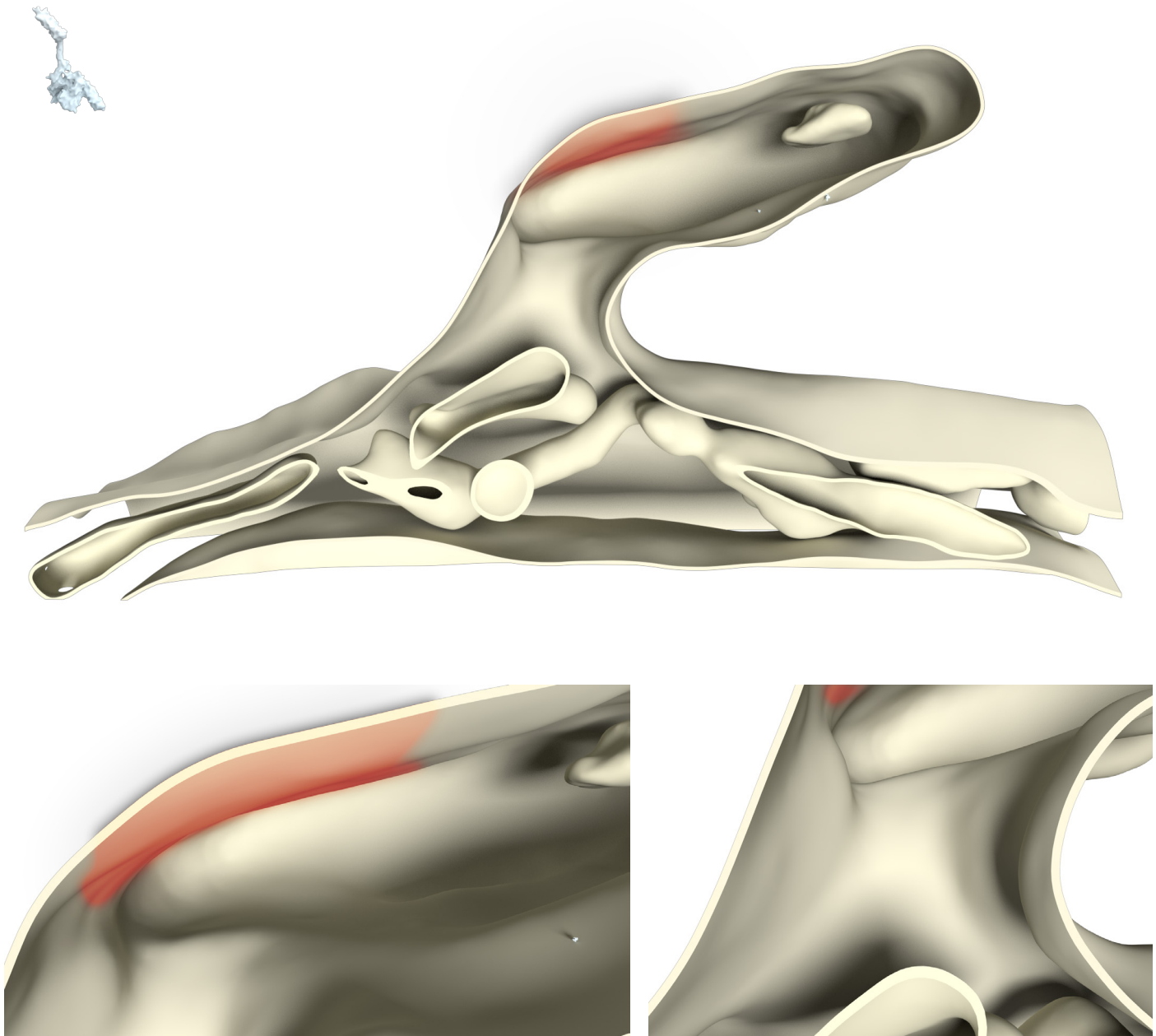
Known organization: Transmembrane protein, On PM

Known Interactions: K_v1.1, PSD95, AMPA receptors

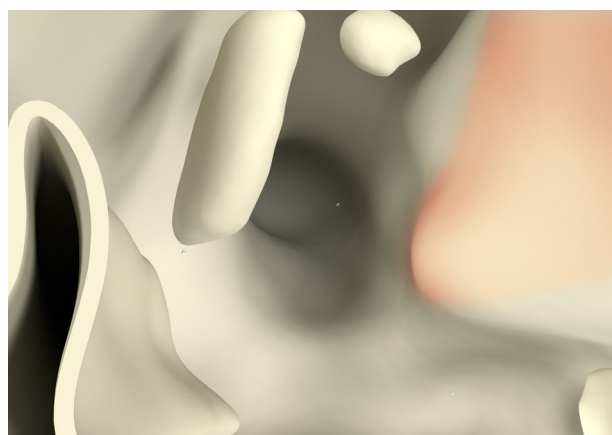
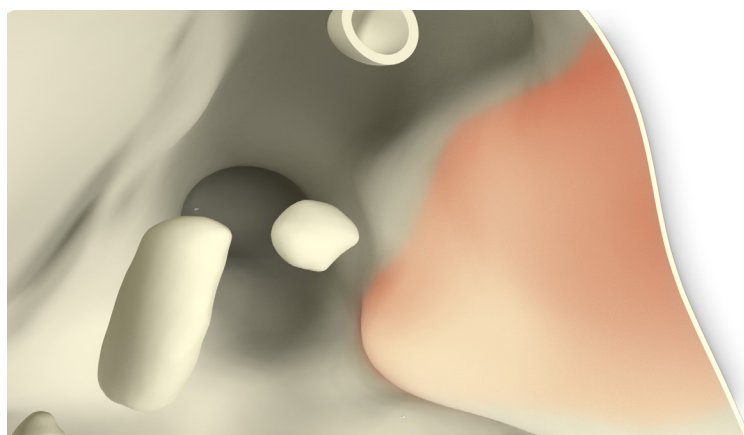
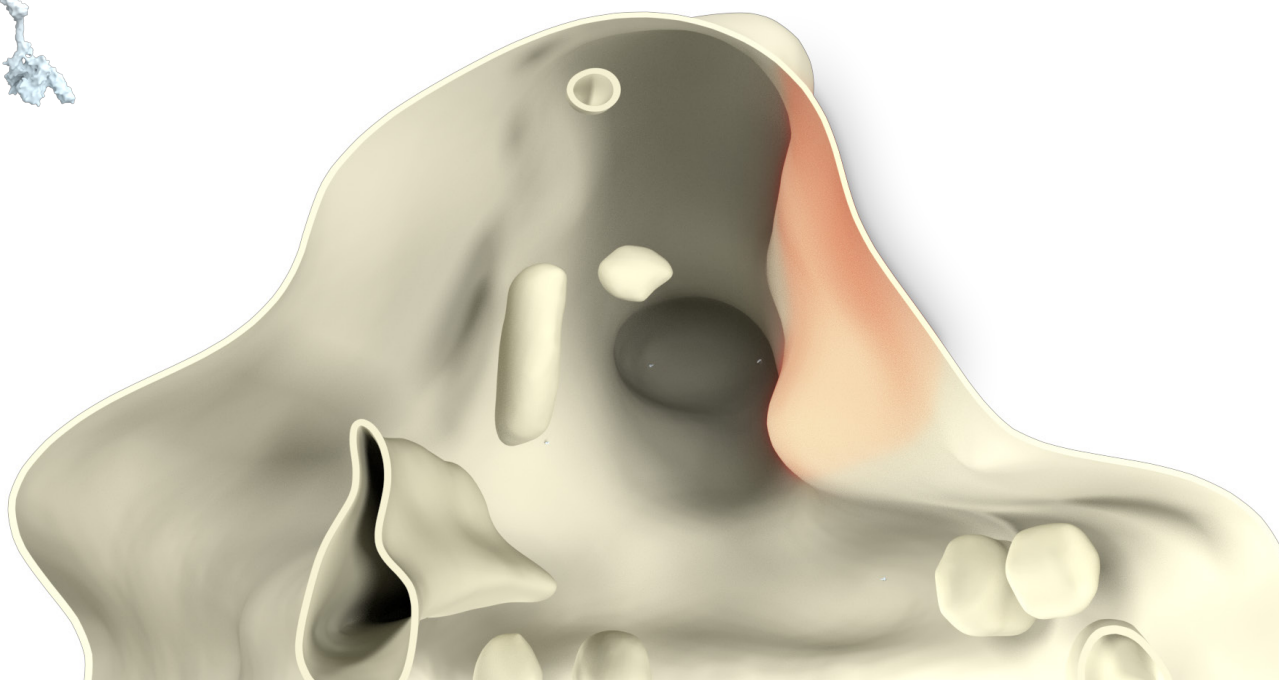


Whole cell copy number	89590.0 ± 18537.6	
Spine copy number	6.1 ± 2.8	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	5.2 ± 2.4	7.5 ± 3.4
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.1 ± 0.0	0.1 ± 0.0
PSD copy number	1 ± 0.5	0 ± 0.0
% in PSD	19.1 ± 8.7%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	5.2 ± 2.4	$0.0 \pm 0.0\%$	0.1 ± 0.0	1 ± 0.5
Stubby	7.5 ± 3.4	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	5.2 ± 2.4	$0.0 \pm 0.0\%$	0.1 ± 0.0	1 ± 0.5
Stubby	7.5 ± 3.4	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



References

Antibody: Novus Biologicals NBP2-22425

PDB Identifier: 5y2z

Literature:

D'Abaco et al., 2006, Neurosurgery

Fukata et al., 2006, Science

Lovero et al., 2015, PNAS

Ogawa et al., 2010, J. Neurosci.

Poindexter et al., 1999, Gene

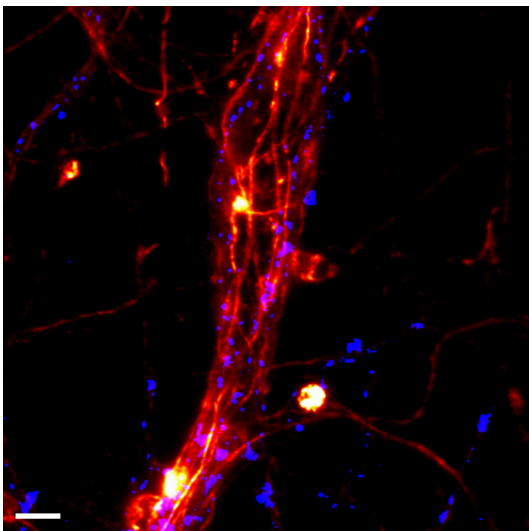
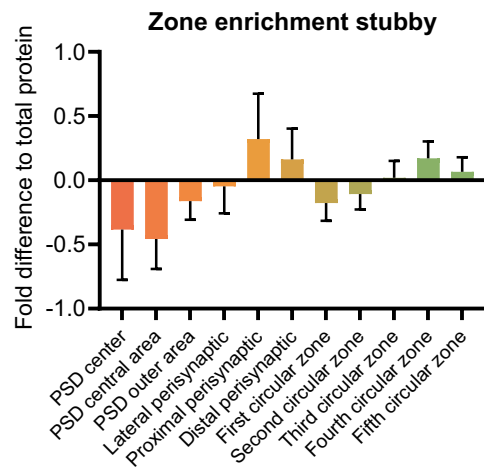
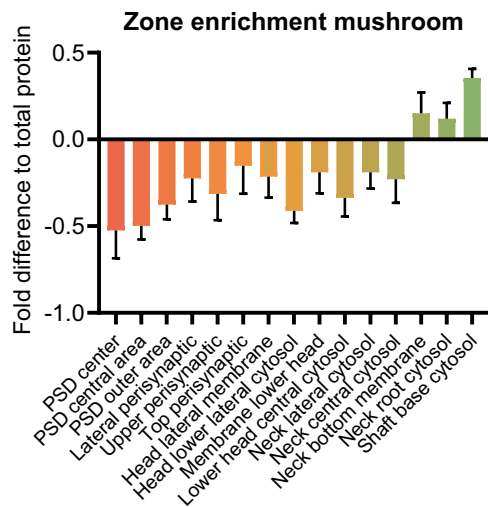
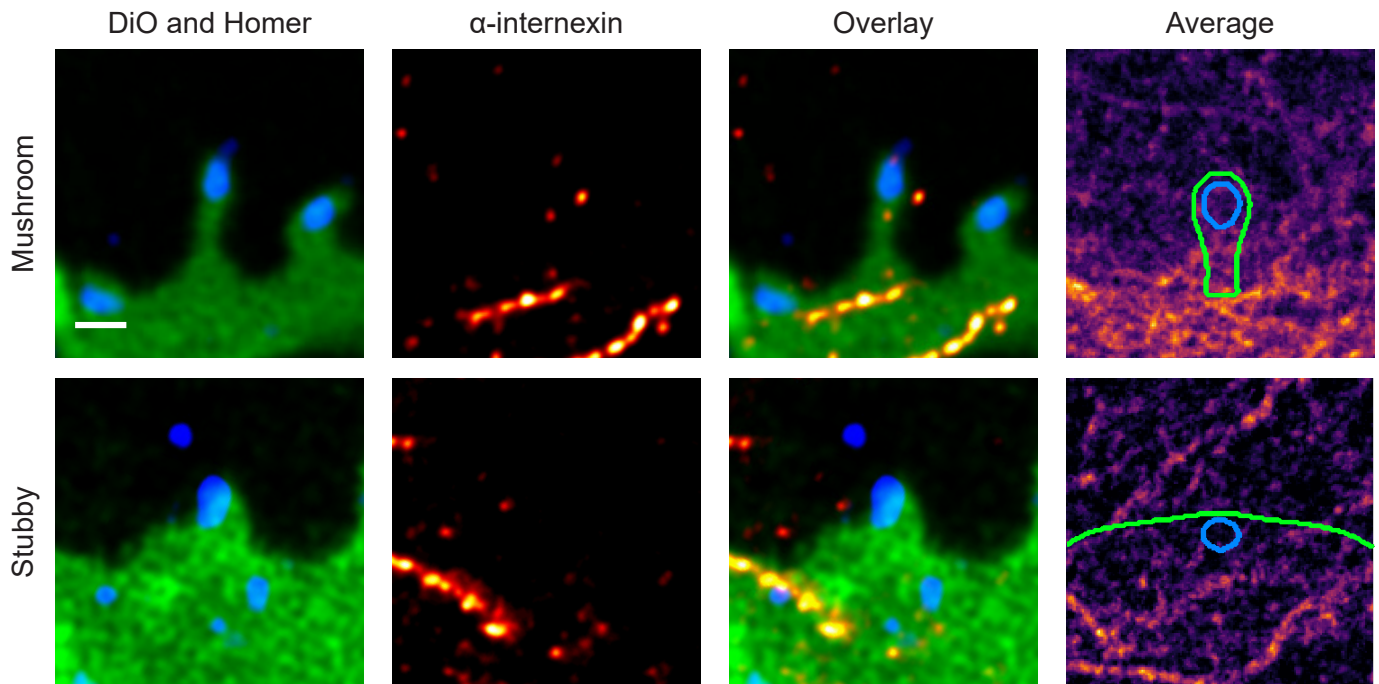
Sagane et al., 1998, Biochem. J.

α -Internexin (Gene: Ina , Uniprot ID: P23565)

Known function: Part of the neurofilament filament

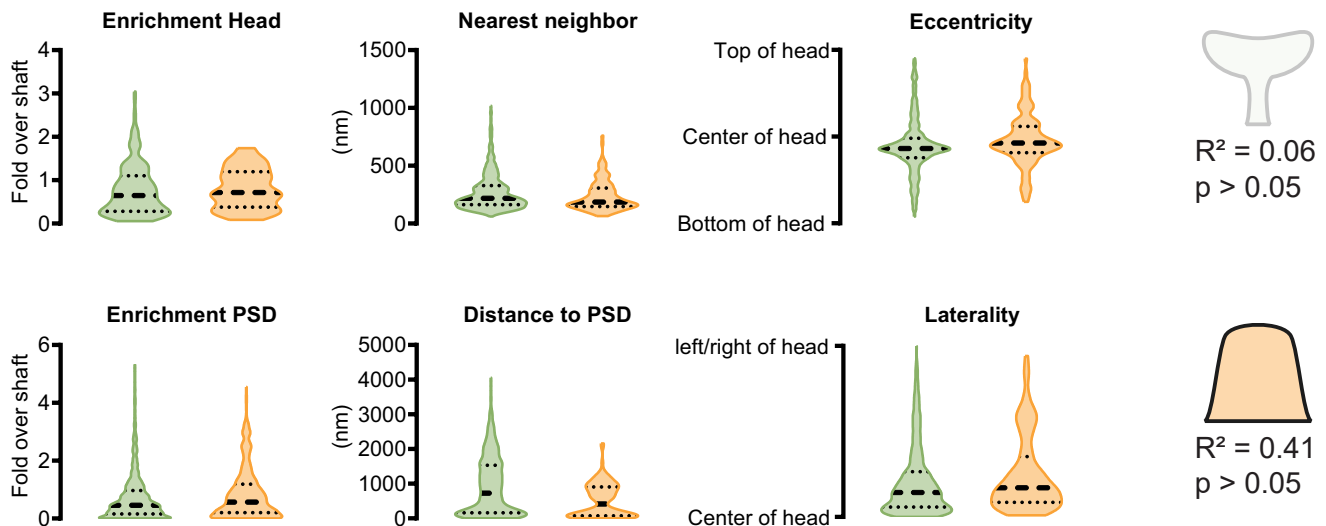
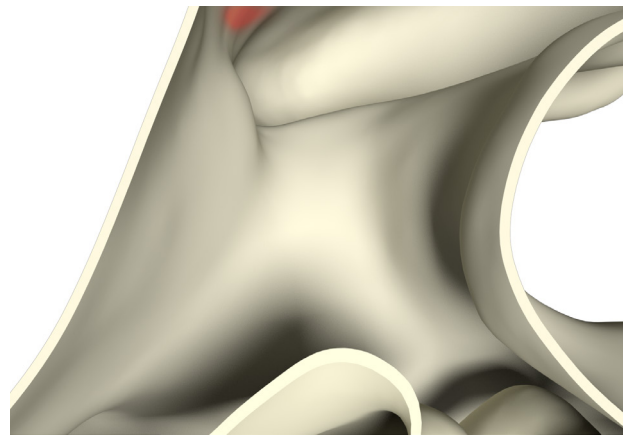
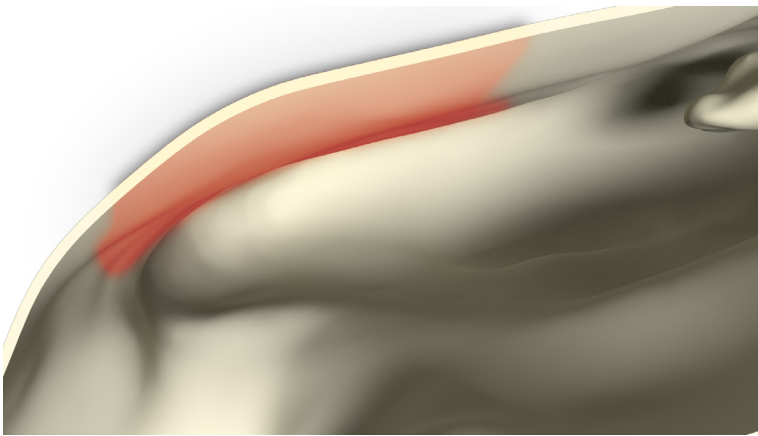
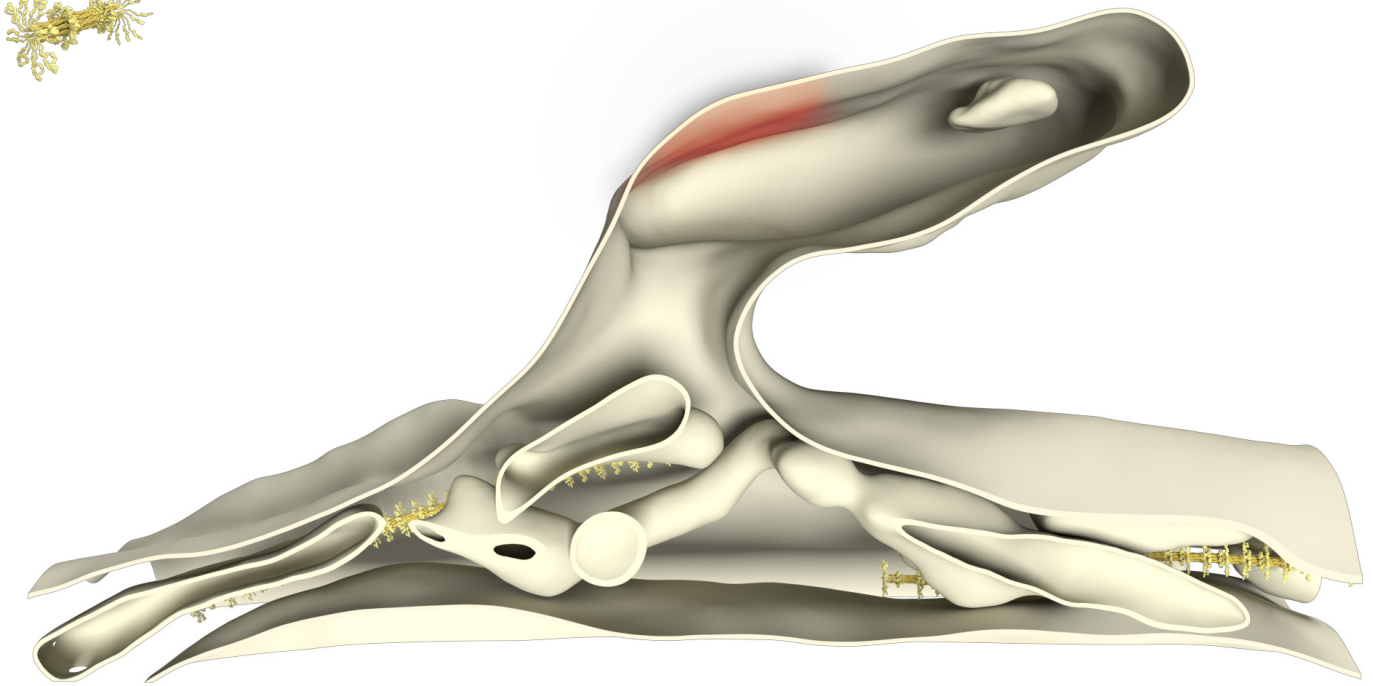
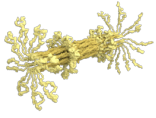
Known organization: Cytosolic

Known Interactions: Neurofilaments, Tubulins

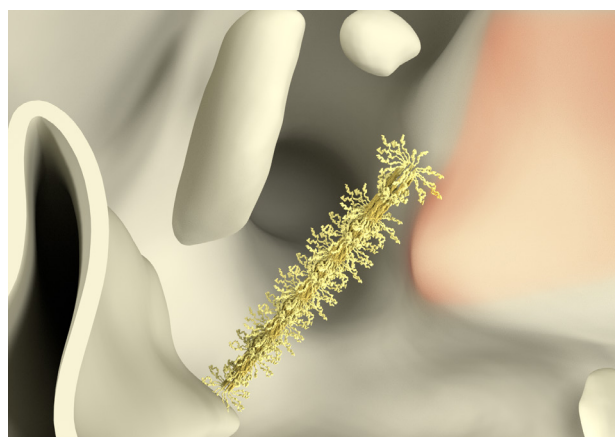
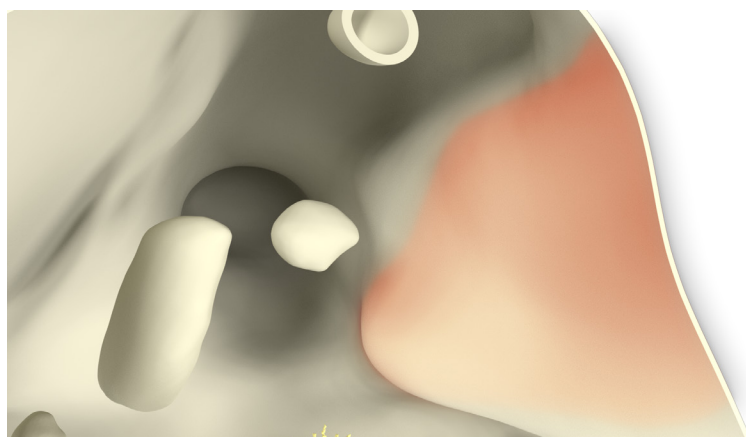
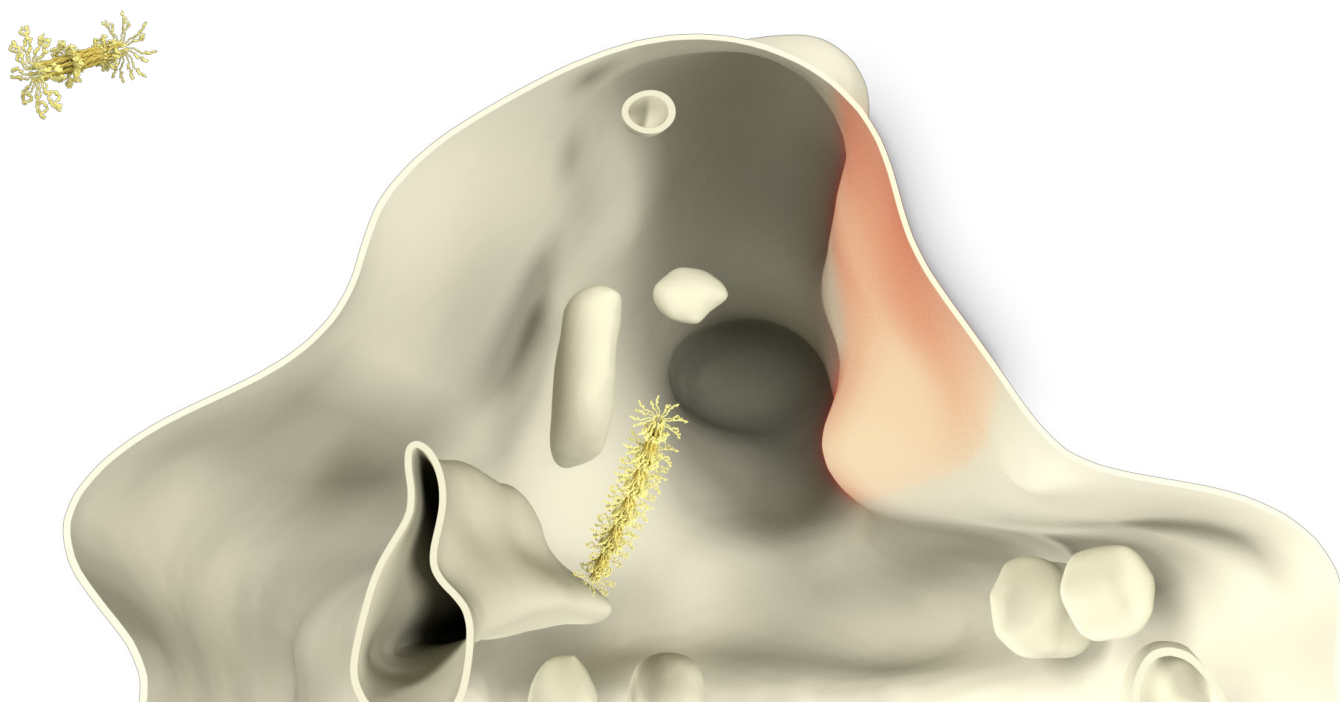


Whole cell copy number	12483426.0 \pm 1142313.6	
Spine copy number	648.1 \pm 722.3	
Function	Cytoskeleton	
	Mushroom	Stubby
Spine copy number	660.1 \pm 735.6	469.1 \pm 522.8
% of total protein	0.2 \pm 0.2%	0.1 \pm 0.1%
Molarity (μ M)	8.4 \pm 9.3	4.4 \pm 4.9
PSD copy number	34 \pm 37.9	18 \pm 20.1
% in PSD	5.2 \pm 5.7%	3.8 \pm 3.8%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	660.1 ± 735.6	$0.2 \pm 0.2\%$	8.4 ± 9.3	34 ± 37.9
Stubby	469.1 ± 522.8	$0.1 \pm 0.1\%$	4.4 ± 4.9	18 ± 20.1



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	660.1 ± 735.6	$0.2 \pm 0.2\%$	8.4 ± 9.3	34 ± 37.9
Stubby	469.1 ± 522.8	$0.1 \pm 0.1\%$	4.4 ± 4.9	18 ± 20.1



References

Antibody: LS Bio LS-B10413

PDB Identifier: modified NF-H

Literature:

Suzuki et al., 1997, Brain Res.

Suzuki et al., 2018, J. Neurochem.

Yuan et al., 2006, J. Neurosci.

Yuan et al., 2015a, Mol. Psychiatry

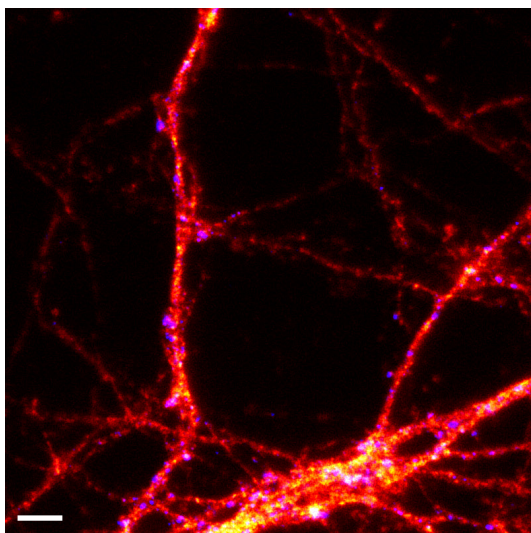
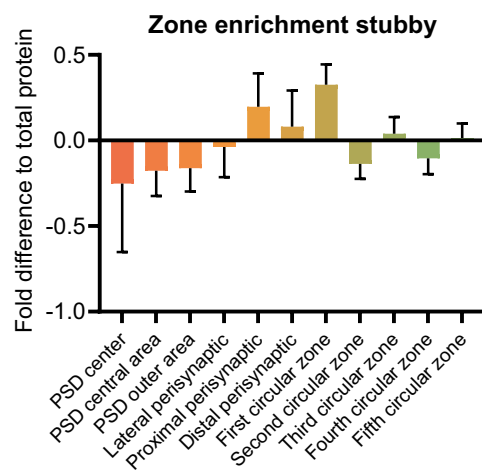
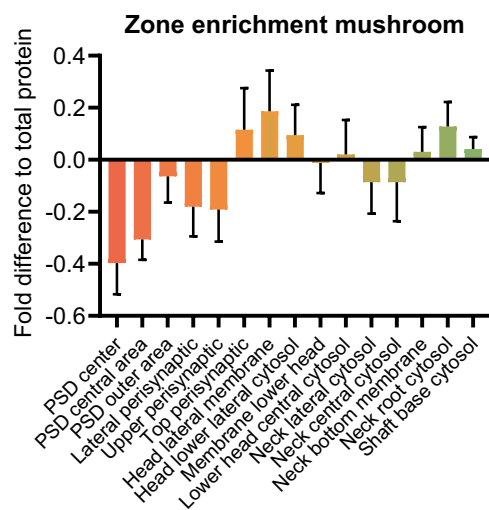
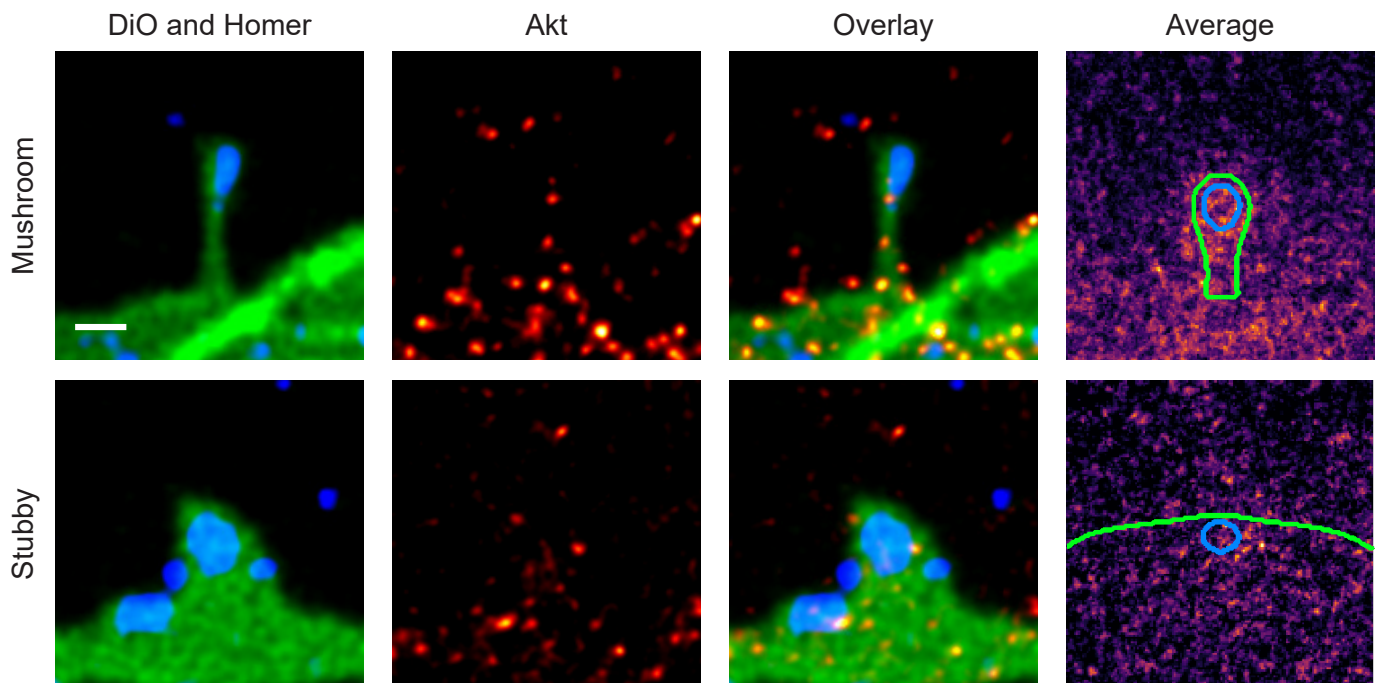
Yuan et al., 2015b, Mol. Psychiatry

pan-Akt (PKB, Genes: Akt1, Akt2, Akt3, Uniprot ID: P47196, P47196, P47196)

Known function: Mediates PI3-K signaling, Activates nNOS, Regulates AMPAR expression, Is activated by NMDA receptors

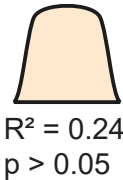
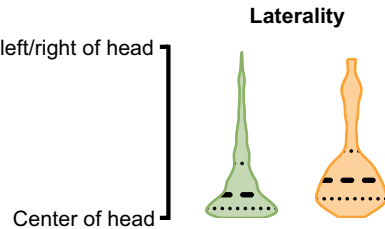
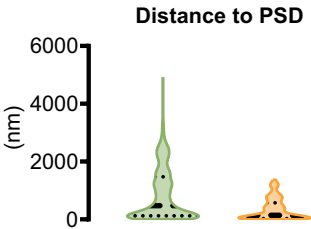
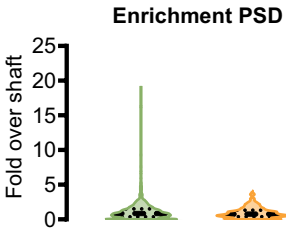
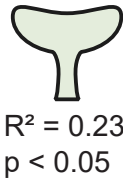
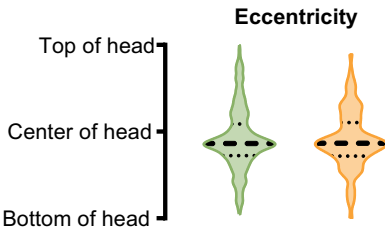
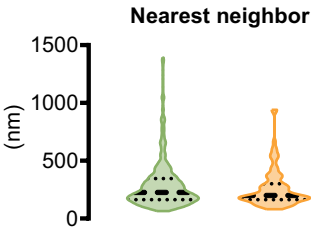
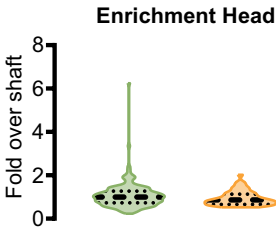
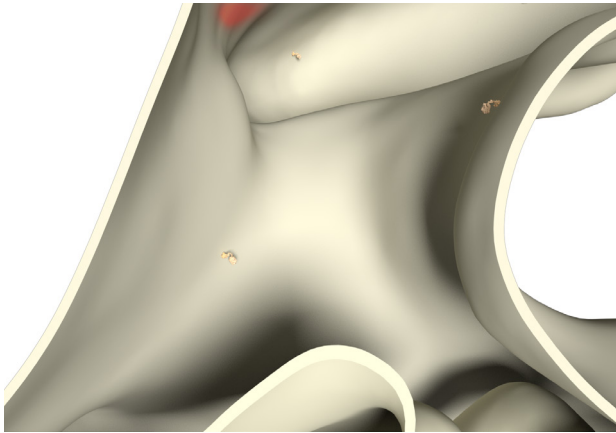
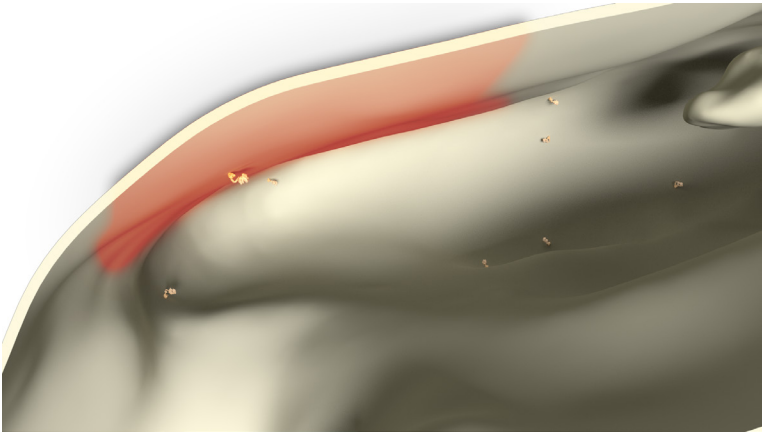
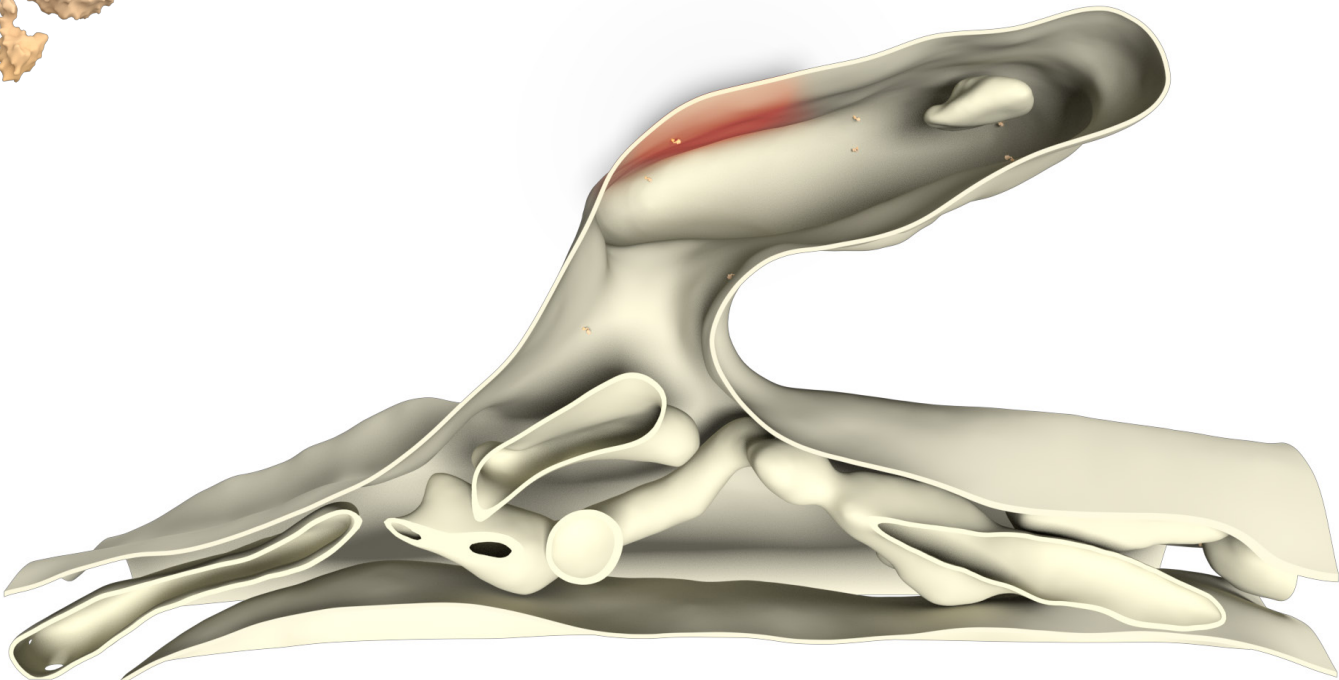
Known organization: Cytosolic

Known Interactions: nNOS

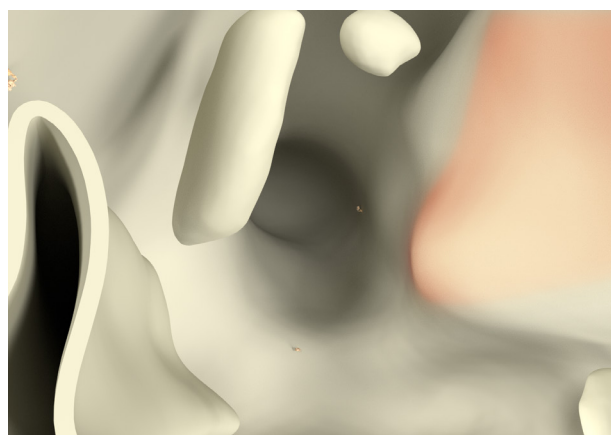
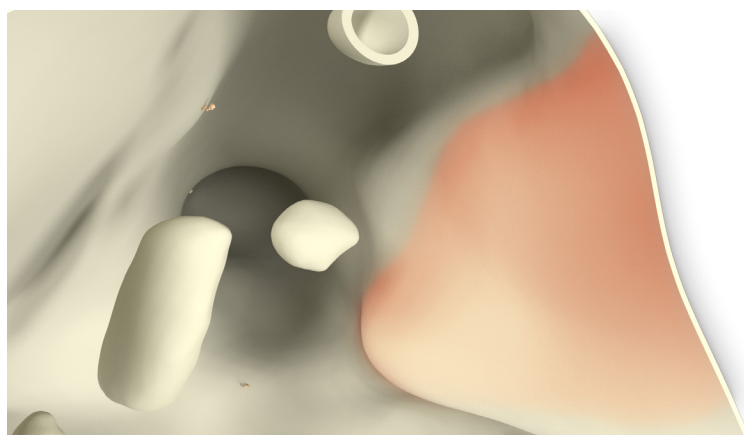
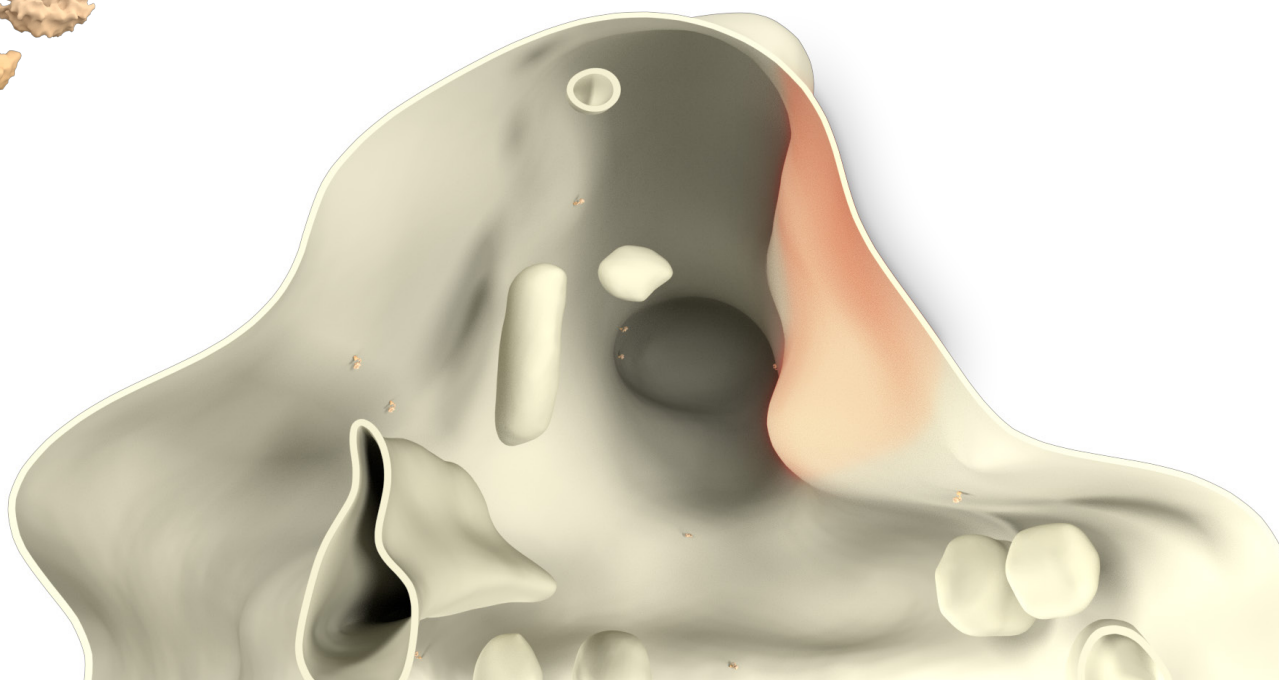
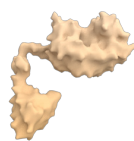


Whole cell copy number	395481.9 ± 58959.4	
Spine copy number	24.2 ± 11.0	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	22.6 ± 10.3	22.3 ± 10.2
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.3 ± 0.1	0.2 ± 0.1
PSD copy number	5 ± 2.3	0 ± 0.0
% in PSD	22.2 ± 10.1%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	22.6 ± 10.3	$0.0 \pm 0.0\%$	0.3 ± 0.1	5 ± 2.3
Stubby	22.3 ± 10.2	$0.0 \pm 0.0\%$	0.2 ± 0.1	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	22.6 ± 10.3	$0.0 \pm 0.0\%$	0.3 ± 0.1	5 ± 2.3
Stubby	22.3 ± 10.2	$0.0 \pm 0.0\%$	0.2 ± 0.1	0 ± 0.0



References

Antibody: Cell Signaling 4691

PDB Identifier: 5buu

Literature:

Dimmeler et al., 1999, Nature

Fulton et al., 1999, Nature

Gobert et al., 2008, J. Neurochem.

Karpova et al., 2006, J. Neurosci.

Kennedy et al., 1997, Genes & Dev.

Kennedy et al., 1999, Mol. Cell. Biol.

Man et al., 2003, Neuron

Pen et al., 2016, Hippocampus

Qin et al., 2005, Genes & Dev.

Schratt et al., 2004, J. Neurosci.

Wang et al., 2011, Br. J. Pharmacol.

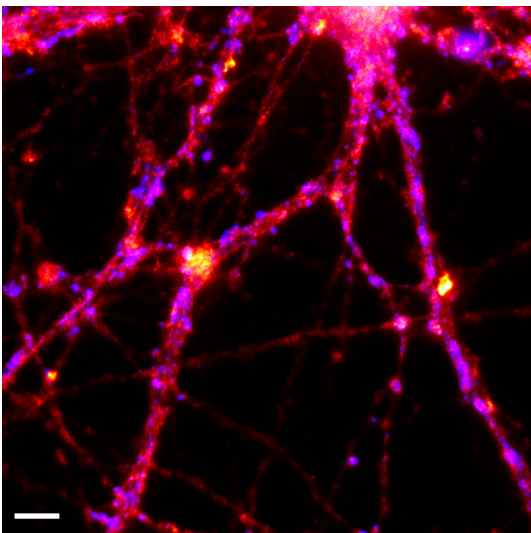
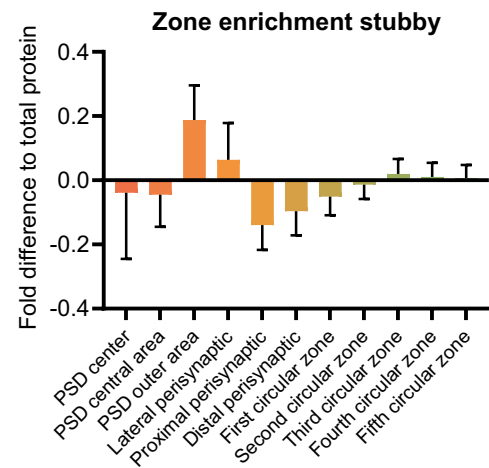
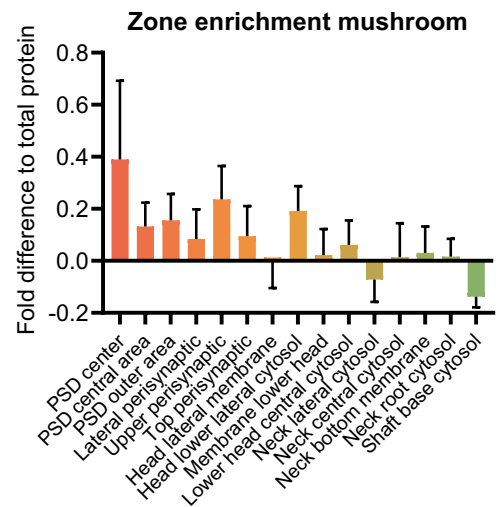
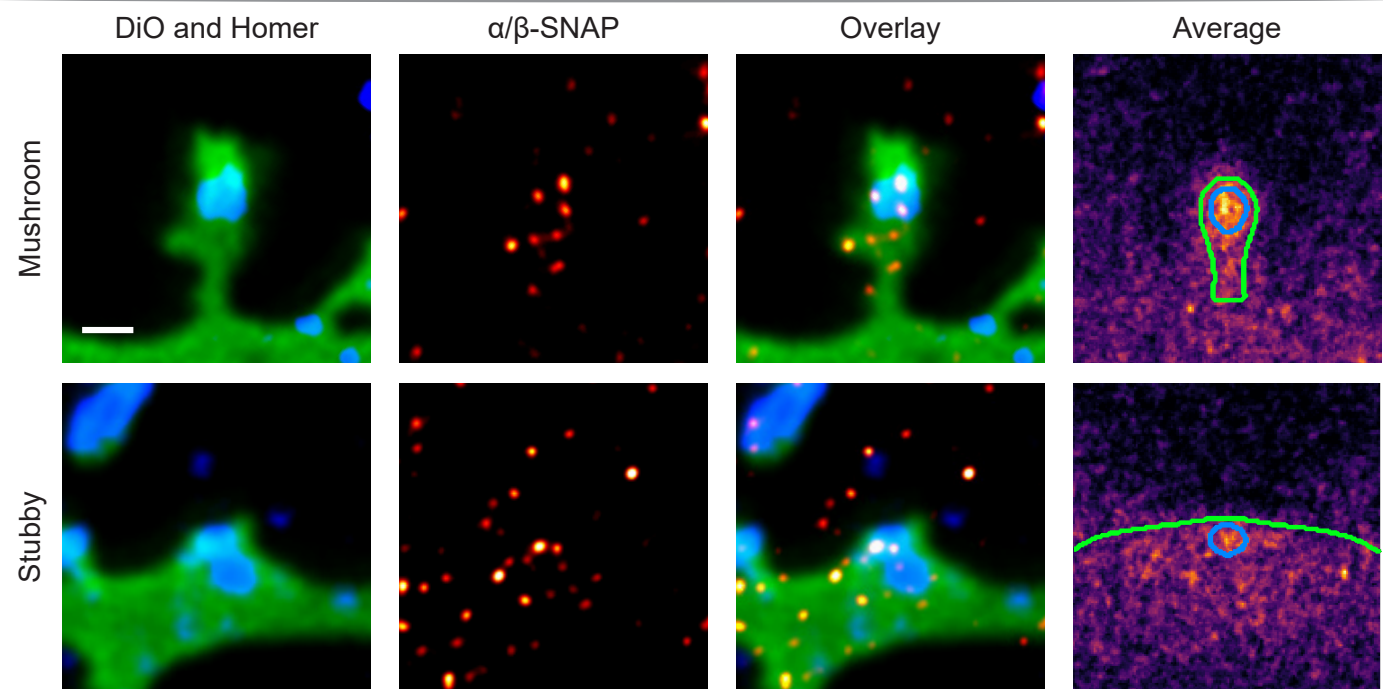
Znamensky et al., 2003, J. Neurosci.

α/β -SNAP (Genes: Napa and Napb, Uniprot ID: P54921 and P85969)

Known function: Bring SNARE complexes to NSF for disassembly

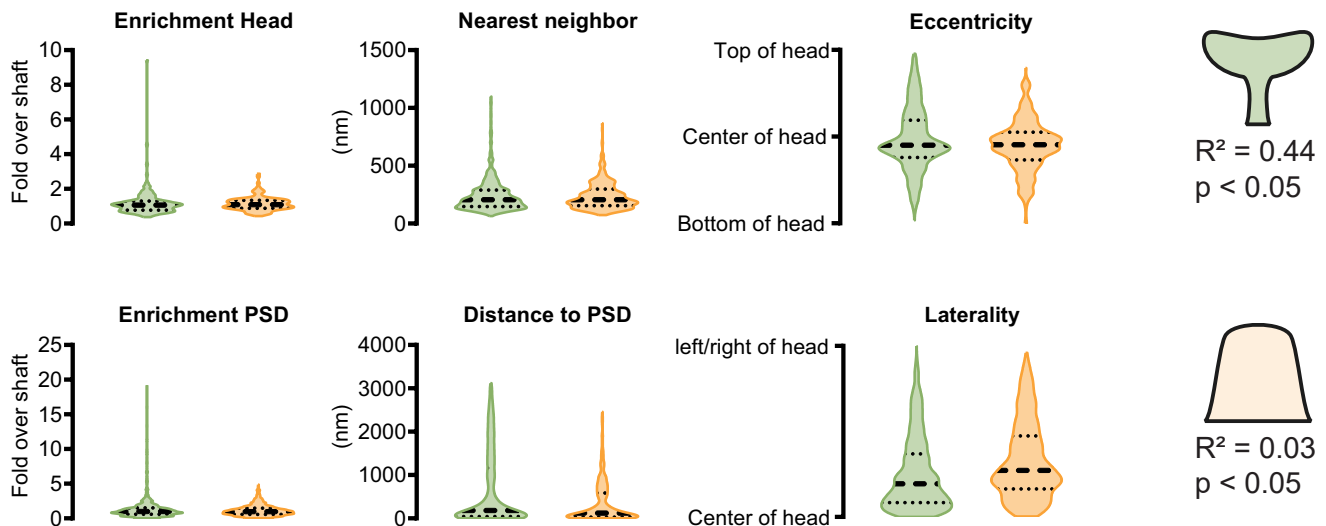
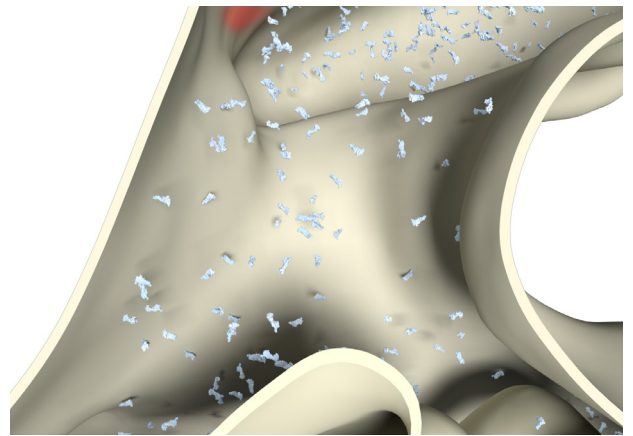
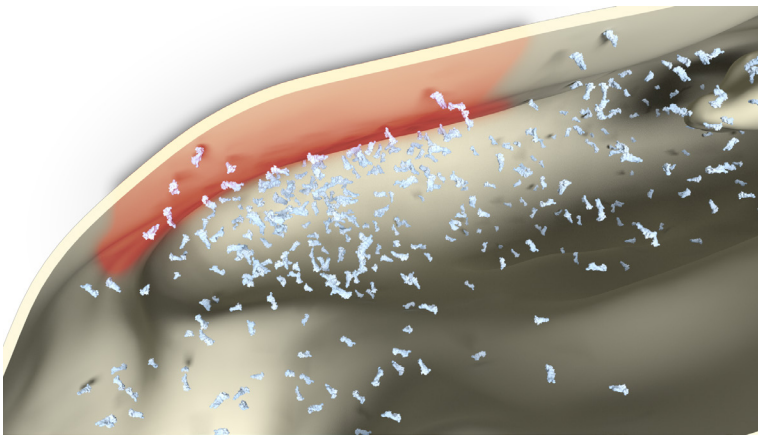
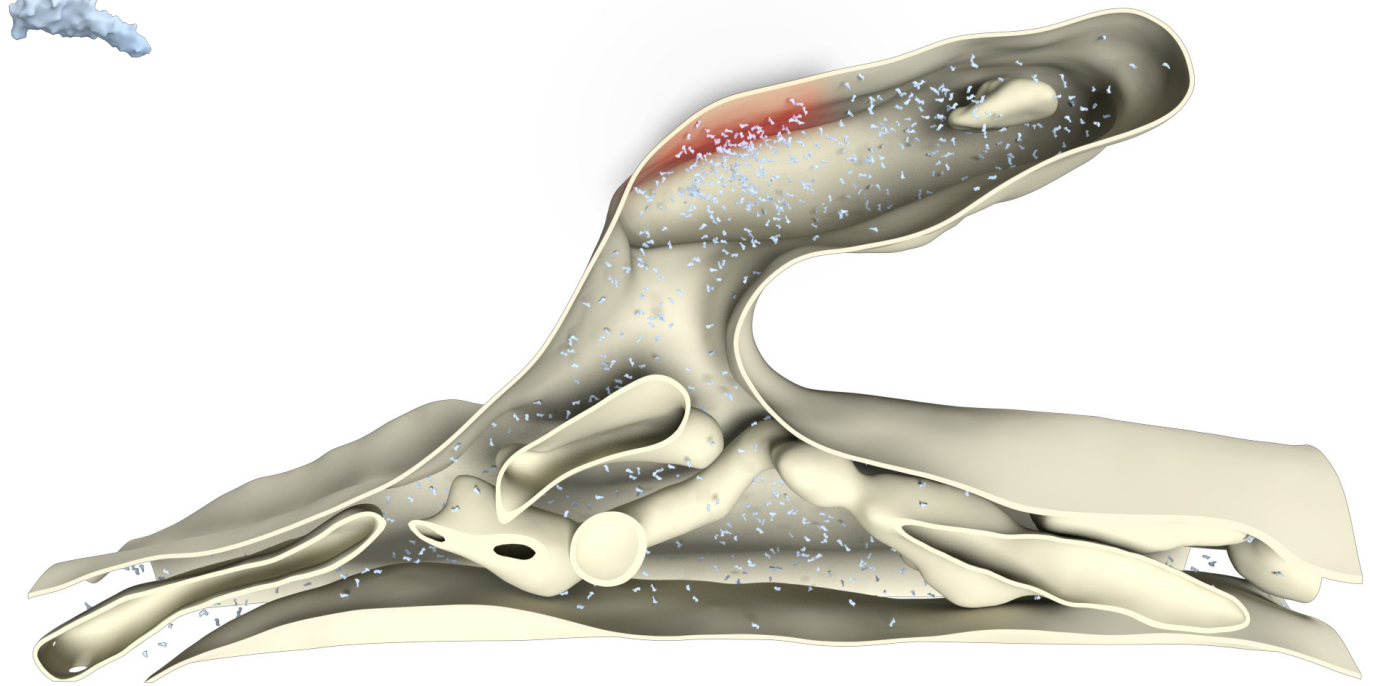
Known organization: Cytosolic

Known Interactions: SNARE complexes of different compositions, NSF

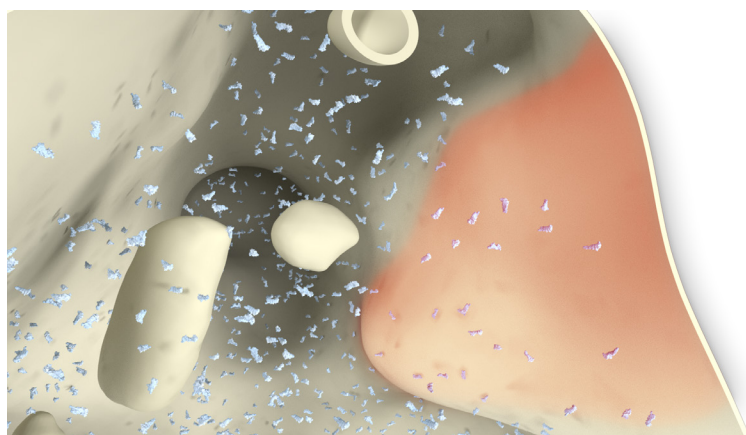
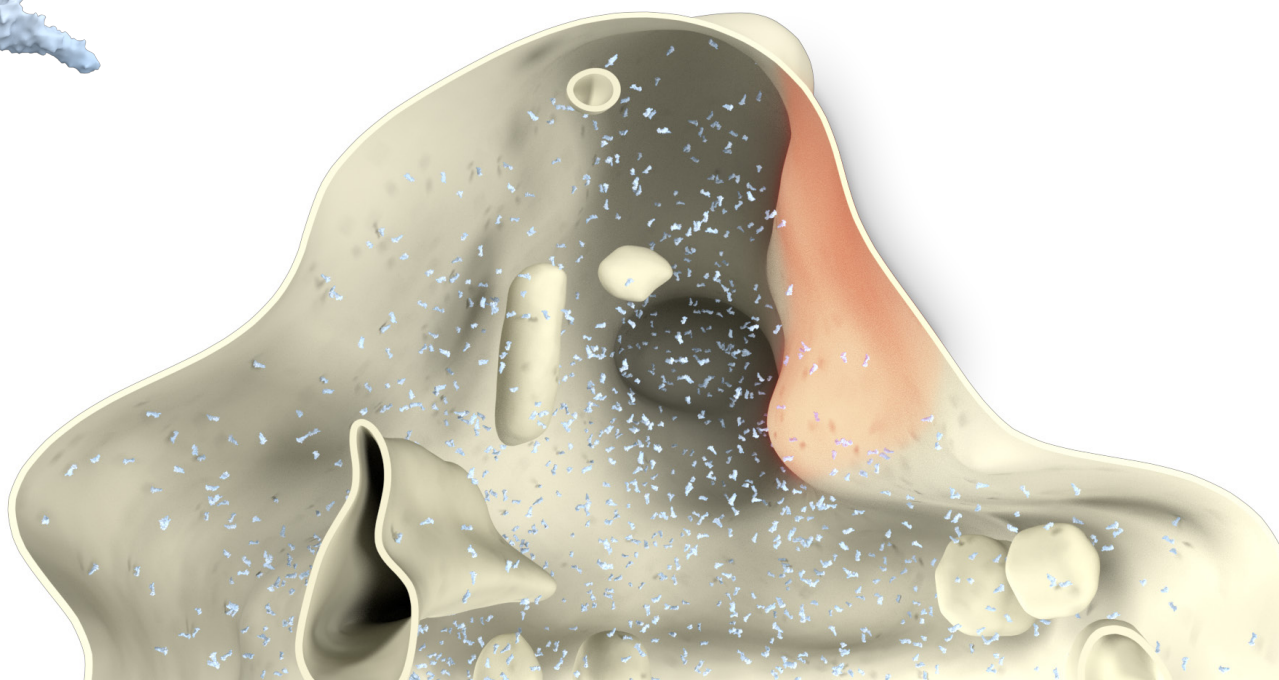


Whole cell copy number	9929012.8 \pm 386529.3	
Spine copy number	2076.6 \pm 354.0	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	1948.9 \pm 332.2	2351.8 \pm 400.9
% of total protein	0.3 \pm 0.1%	0.3 \pm 0.1%
Molarity (μ M)	24.8 \pm 4.2	22.2 \pm 3.8
PSD copy number	498 \pm 84.9	461 \pm 78.6
% in PSD	25.6 \pm 4.4%	19.6 \pm 3.3%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1948.9 ± 332.2	$0.3 \pm 0.1\%$	24.8 ± 4.2	498 ± 84.9
Stubby	2351.8 ± 400.9	$0.3 \pm 0.1\%$	22.2 ± 3.8	461 ± 78.6



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1948.9 ± 332.2	$0.3 \pm 0.1\%$	24.8 ± 4.2	498 ± 84.9
Stubby	2351.8 ± 400.9	$0.3 \pm 0.1\%$	22.2 ± 3.8	461 ± 78.6



References

Antibody: Reinhard Jahn, clone 77.2

PDB Identifier: 6mdm

Literature:

Clary et al., 1990, Cell

Hanson et al., 1995, J. Biol. Chem.

Hohl et al., 1998, Mol. Cell

Söllner et al., 1993a, Nature

Söllner et al., 1993b, Cell

Weidman et al., 1989, J. Cell. Biol.

Whiteheart et al., 1993, Nature

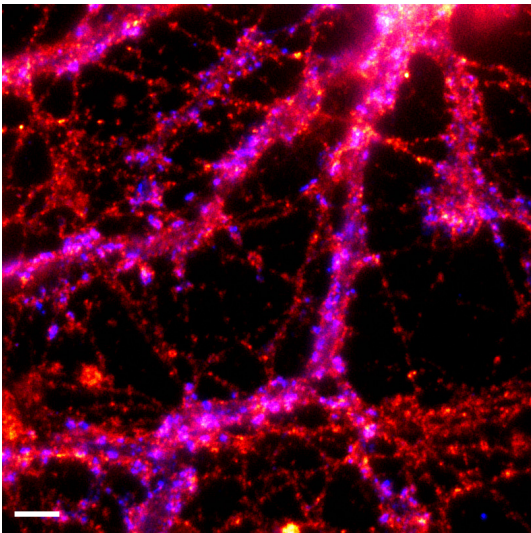
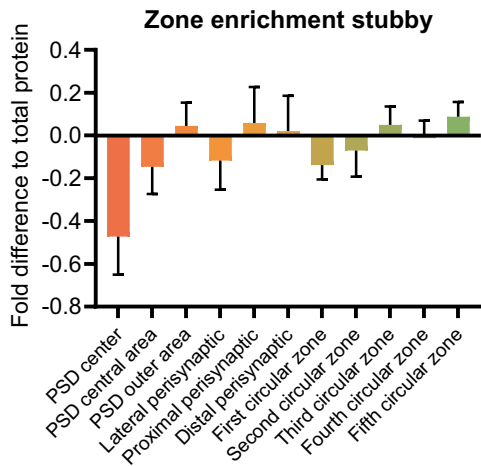
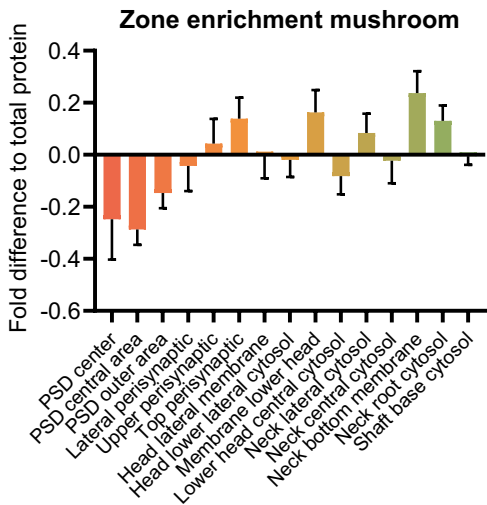
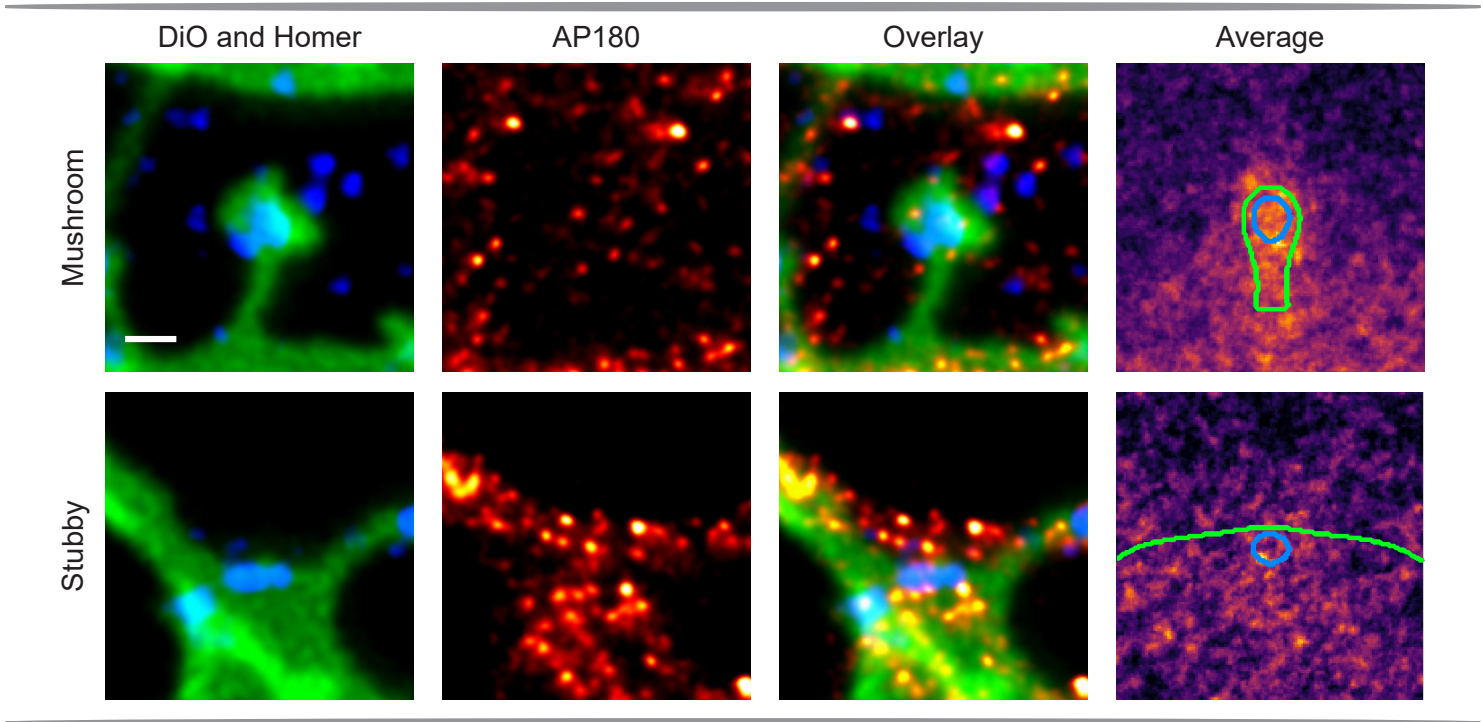
Wilson et al., 1989, Nature

AP180 (Gene: Snap91, Uniprot ID: Q05140)

Known function: Initiation of clathrin coat formation, AMPAR endocytosis

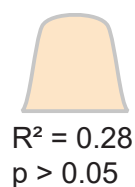
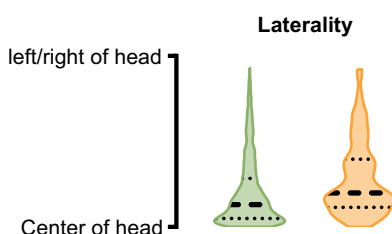
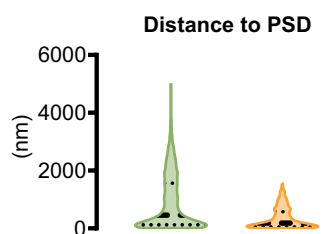
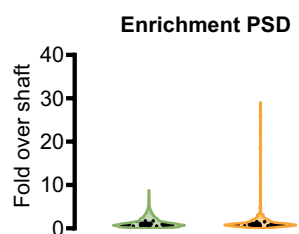
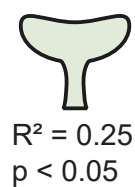
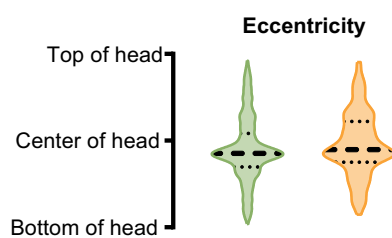
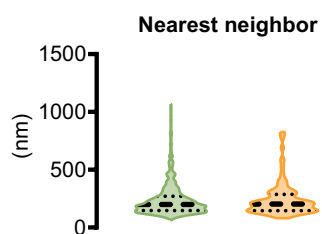
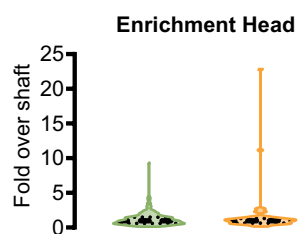
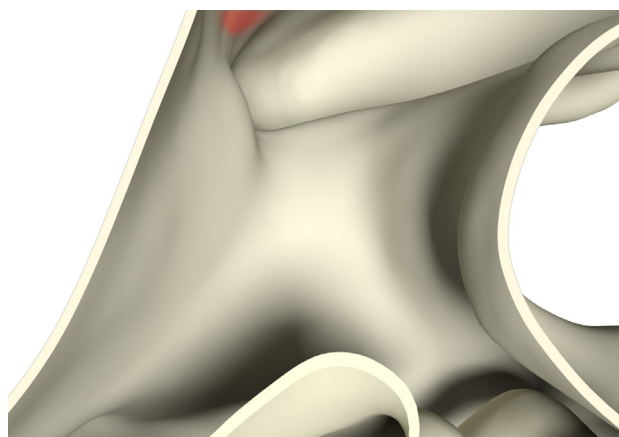
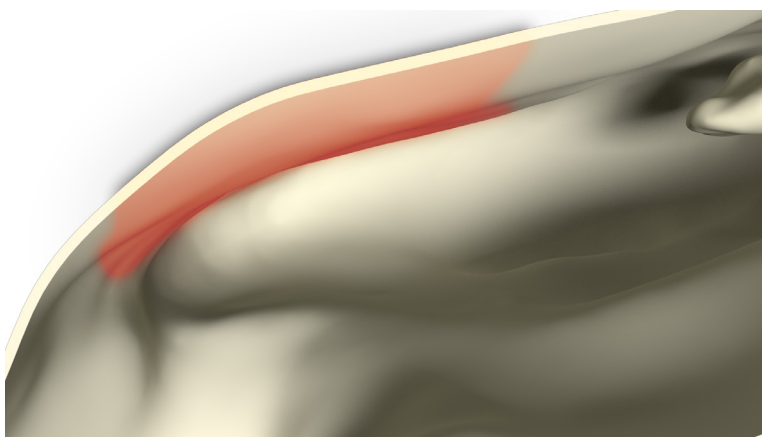
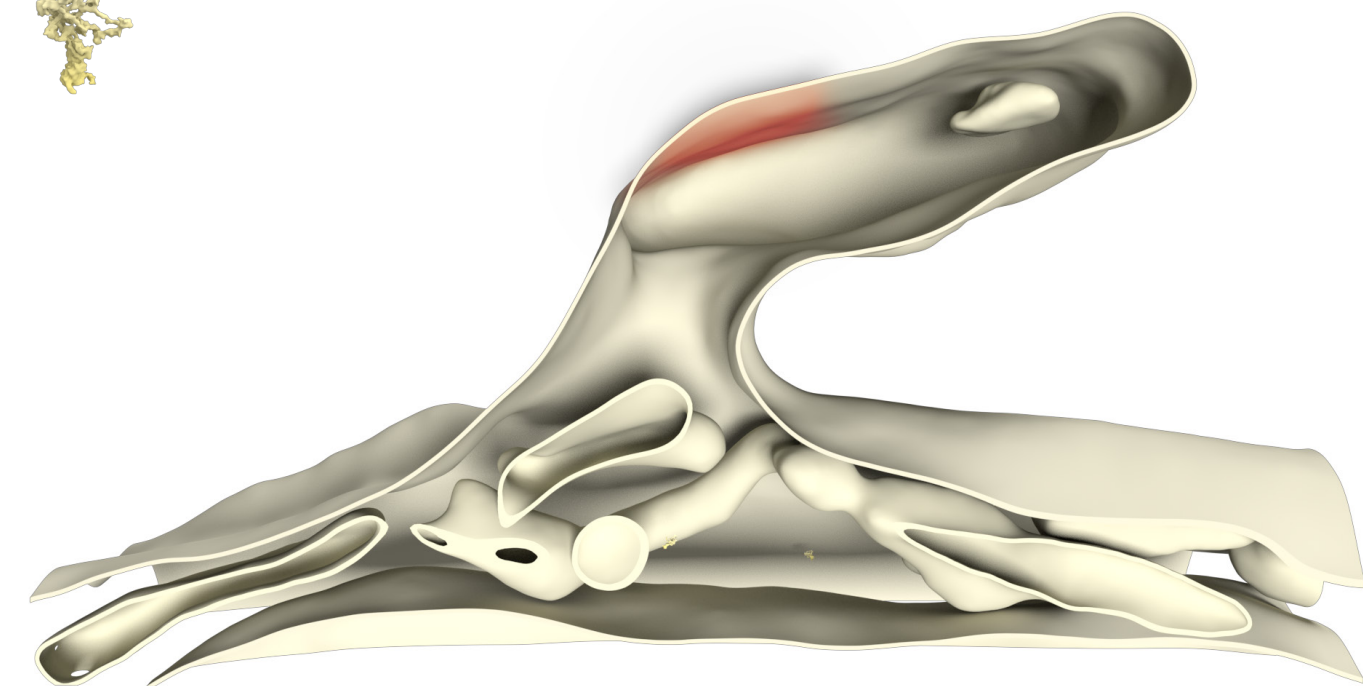
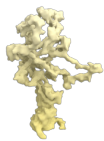
Known organization: Cytosolic or membrane-associated

Known Interactions: Clathrin

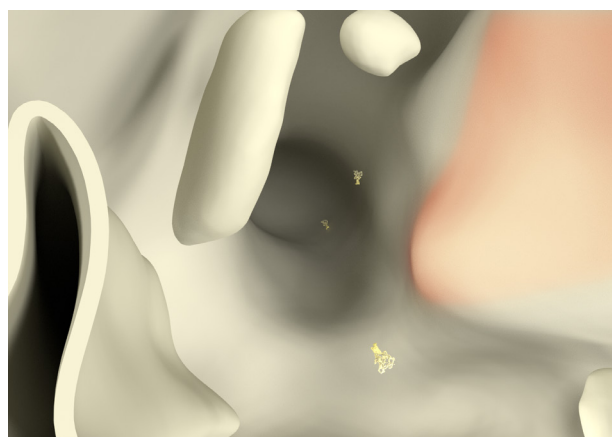
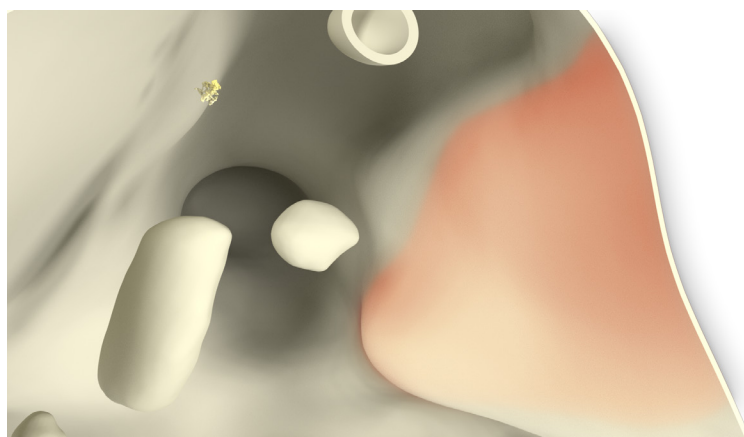


Whole cell copy number	195342.7 ± 99496.9	
Spine copy number	15.1 ± 10.0	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	14.1 ± 9.3	15.0 ± 9.9
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.2 ± 0.1	0.1 ± 0.1
PSD copy number	0 ± 0.0	2 ± 1.3
% in PSD	0.0 ± 0.0%	13.3 ± 8.8%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	14.1 ± 9.3	$0.0 \pm 0.0\%$	0.2 ± 0.1	0 ± 0.0
Stubby	15.0 ± 9.9	$0.0 \pm 0.0\%$	0.1 ± 0.1	2 ± 1.3



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	14.1 ± 9.3	$0.0 \pm 0.0\%$	0.2 ± 0.1	0 ± 0.0
Stubby	15.0 ± 9.9	$0.0 \pm 0.0\%$	0.1 ± 0.1	2 ± 1.3



References

Antibody: Synaptic Systems 155 003

PDB Identifier: Modelled with I-TASSER

Literature:

Ahle and Ungewickell, 1986, EMBO J.

Burbea et al., 2002, Neuron

Hering et al., 2003, J. Neurosci.

Keen, 1987, J. Cell. Biol.

Lindner and Ungewickell, 1992, J. Biol. Chem.

Murphy et al., 1991, J. Biol. Chem.

Norris et al., 1995, J. Biol. Chem.

Sousa et al., 1992, J. Neurosci.

Ye and Lafer, 1995, J. Biol. Chem.

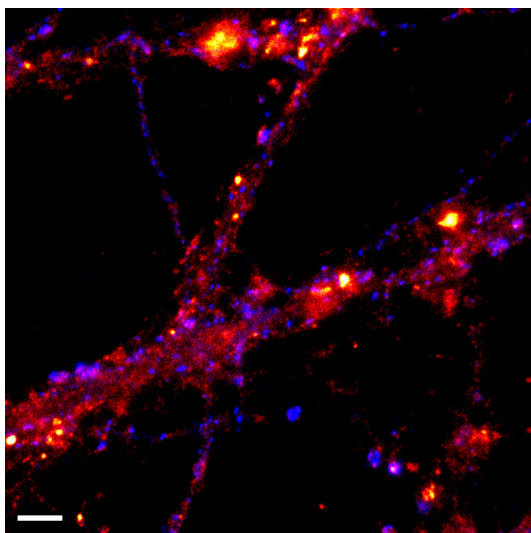
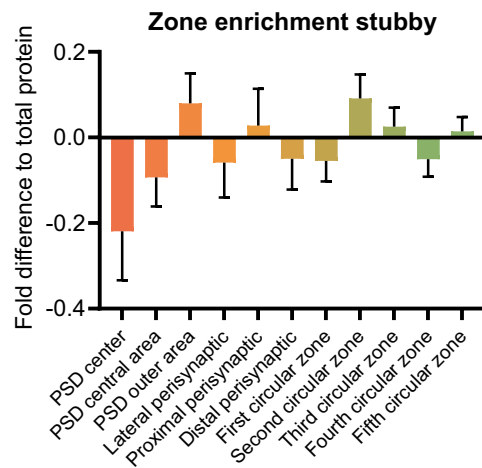
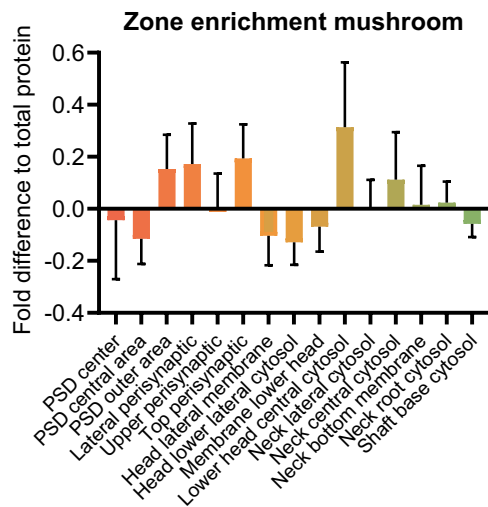
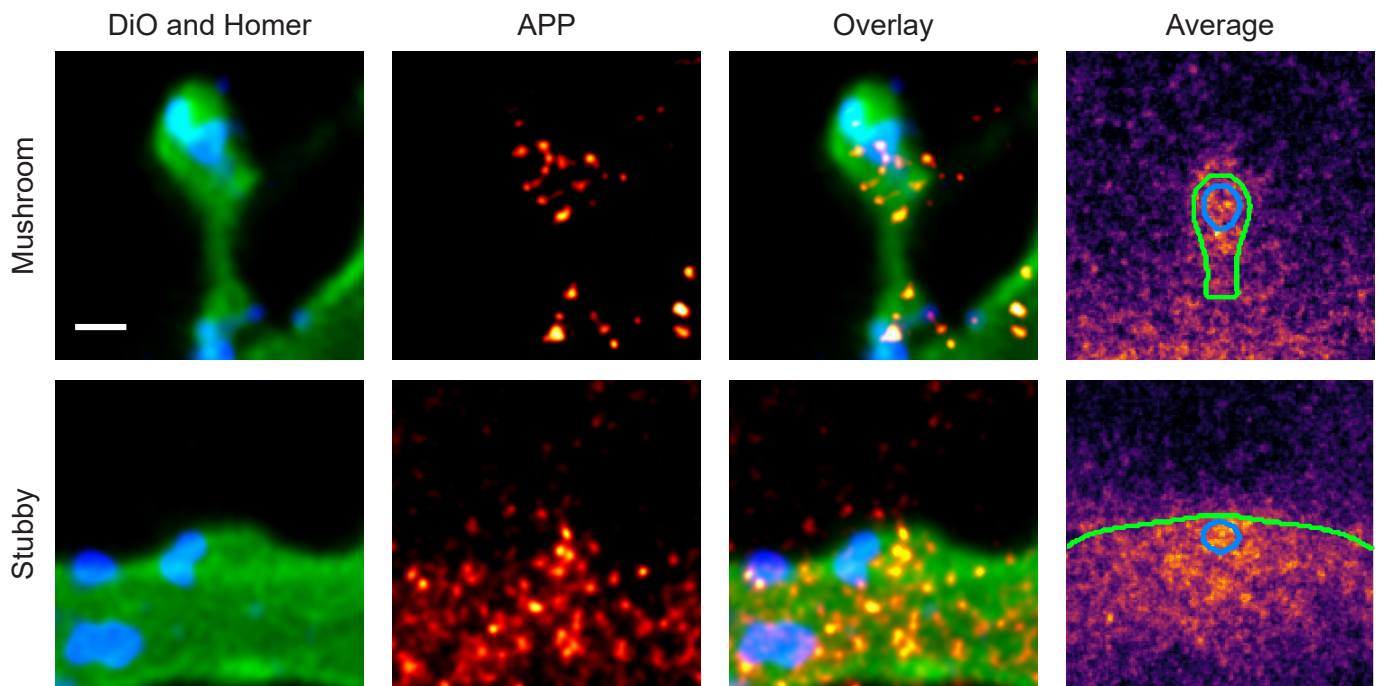
Zhou et al., 1992, J. Neurosci.

APP (Gene: App, Uniprot ID: P08592)

Known function: Exact function unknown, involved in neurite growth and LTP, Precursor protein of A β , the hallmark of Alzheimer's disease

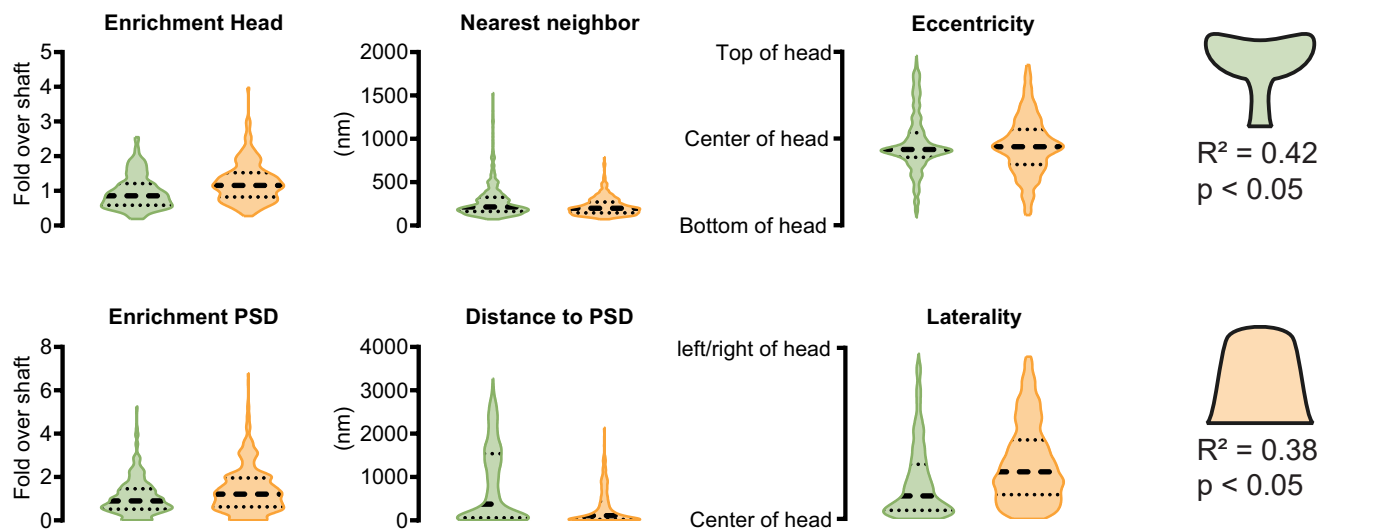
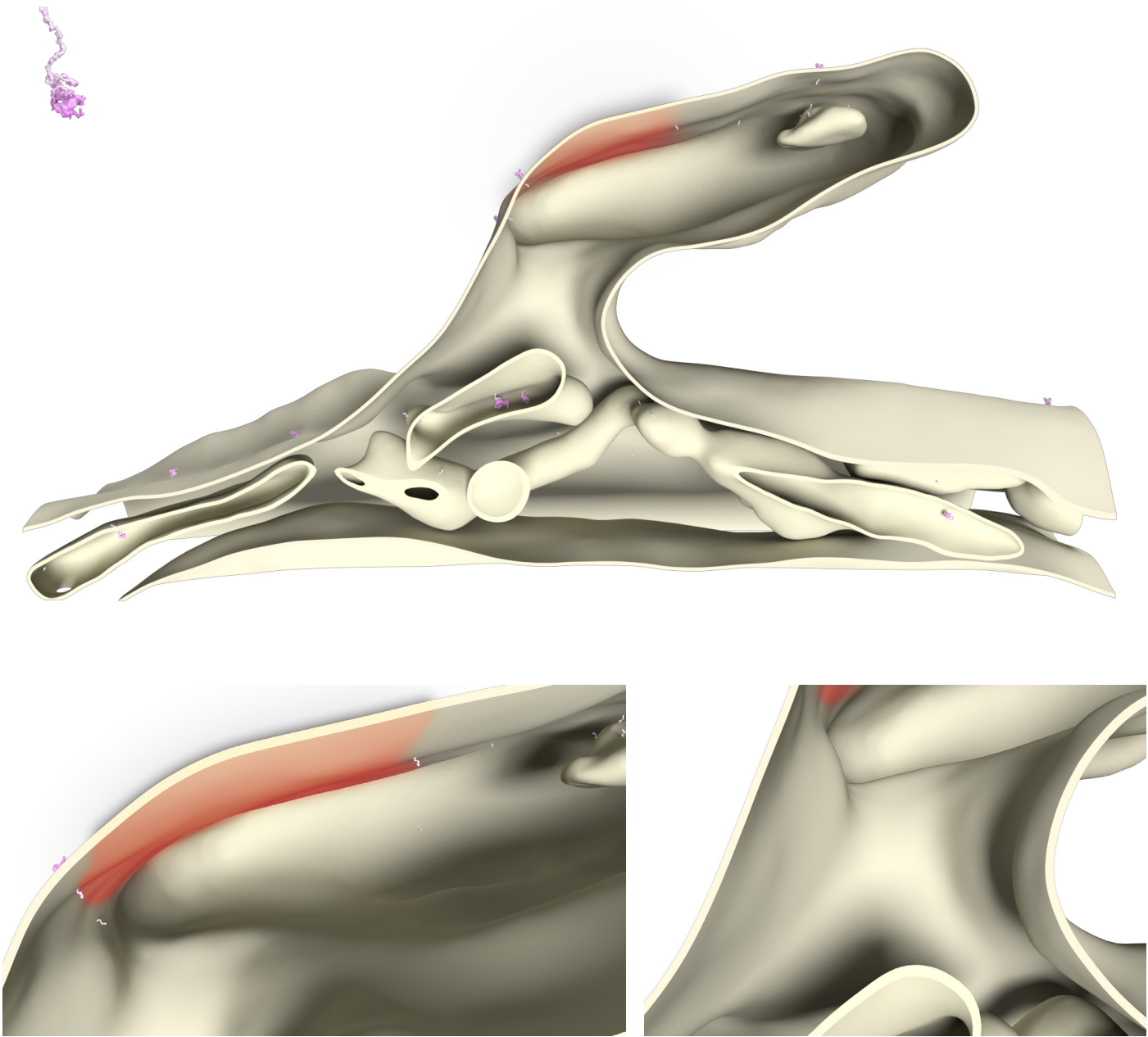
Known organization: Transmembrane protein, Also secreted to extracellular matrix

Known Interactions: None

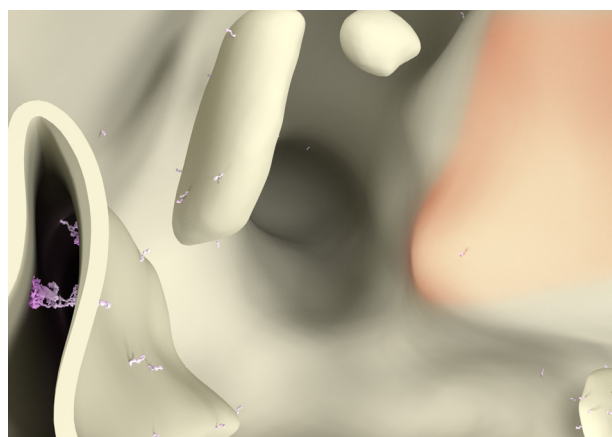
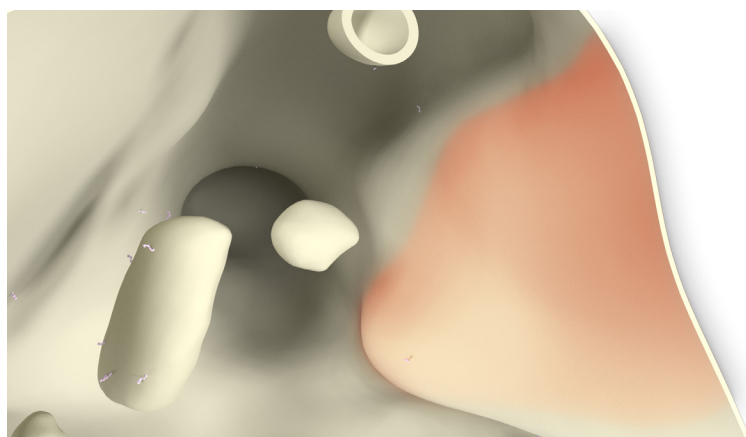
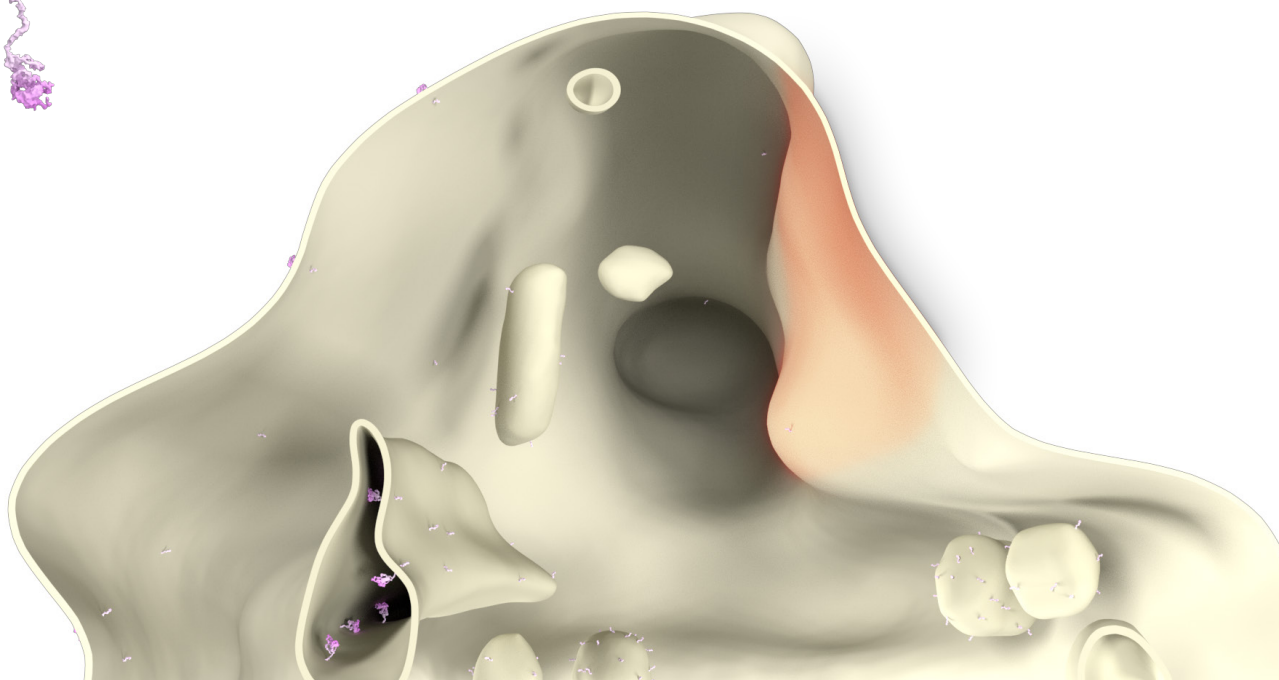


Whole cell copy number	769809.8 ± 74017.4	
Spine copy number	121.2 ± 29.9	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	87.5 ± 21.6	152.2 ± 37.6
% of total protein	0.0 ± 0.0%	0.1 ± 0.0%
Molarity (μM)	1.1 ± 0.3	1.4 ± 0.4
PSD copy number	4 ± 1.0	4 ± 1.0
% in PSD	4.6 ± 1.1%	2.6 ± 0.6%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	87.5 ± 21.6	$0.0 \pm 0.0\%$	1.1 ± 0.3	4 ± 1.0
Stubby	152.2 ± 37.6	$0.1 \pm 0.0\%$	1.4 ± 0.4	4 ± 1.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	87.5 ± 21.6	$0.0 \pm 0.0\%$	1.1 ± 0.3	4 ± 1.0
Stubby	152.2 ± 37.6	$0.1 \pm 0.0\%$	1.4 ± 0.4	4 ± 1.0



References

Antibody: Merck-Millipore MAB-348

PDB Identifier: 2fkl, 4yno

Literature:

Müller and Zheng, 2012, Cold Spring Harb. Perspect. Med.

Perez et al., 1997, J. Neurosci.

Simons et al., 1996, J. Neurosci.

Slunt et al., 1994, J. Biol. Chem.

Taylor et al., 2008, Neurobiol. Dis.

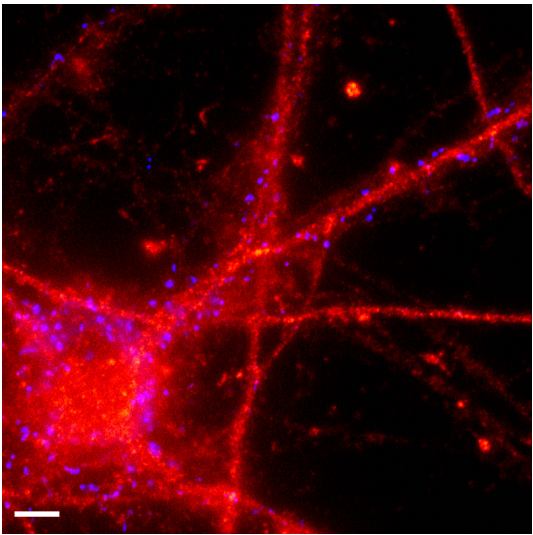
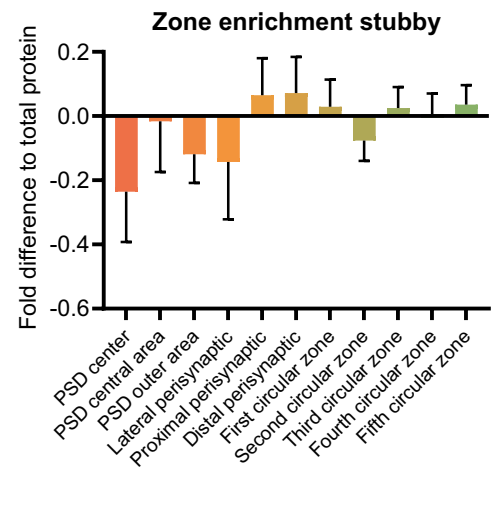
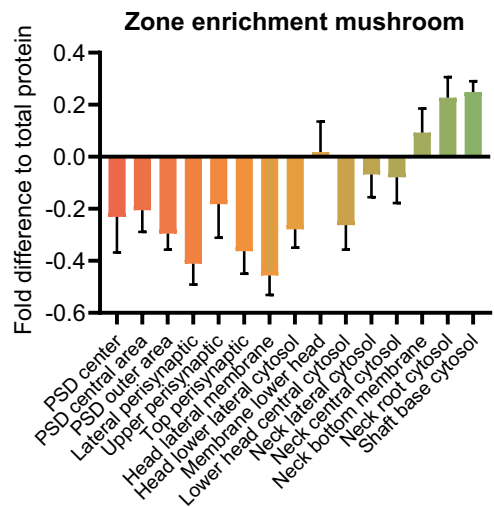
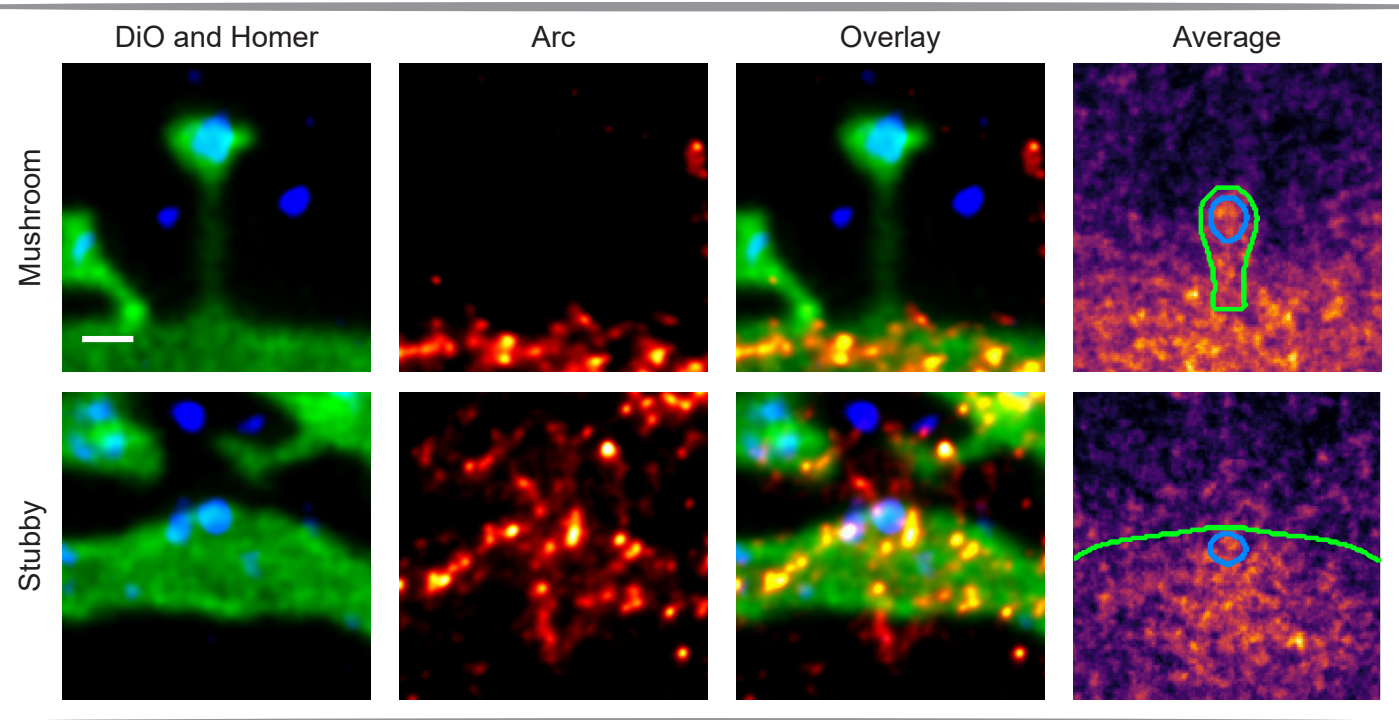
Young-Pearse et al., 2008, Neural Dev.

Arc (Arg1.3, Gene: Arc, Uniprot ID: Q63053)

Known function: master regulator of synaptic plasticity, required for LTP, also involved in LTD and homeostatic plasticity, facilitates GluR1 endocytosis, regulates actin polymerization

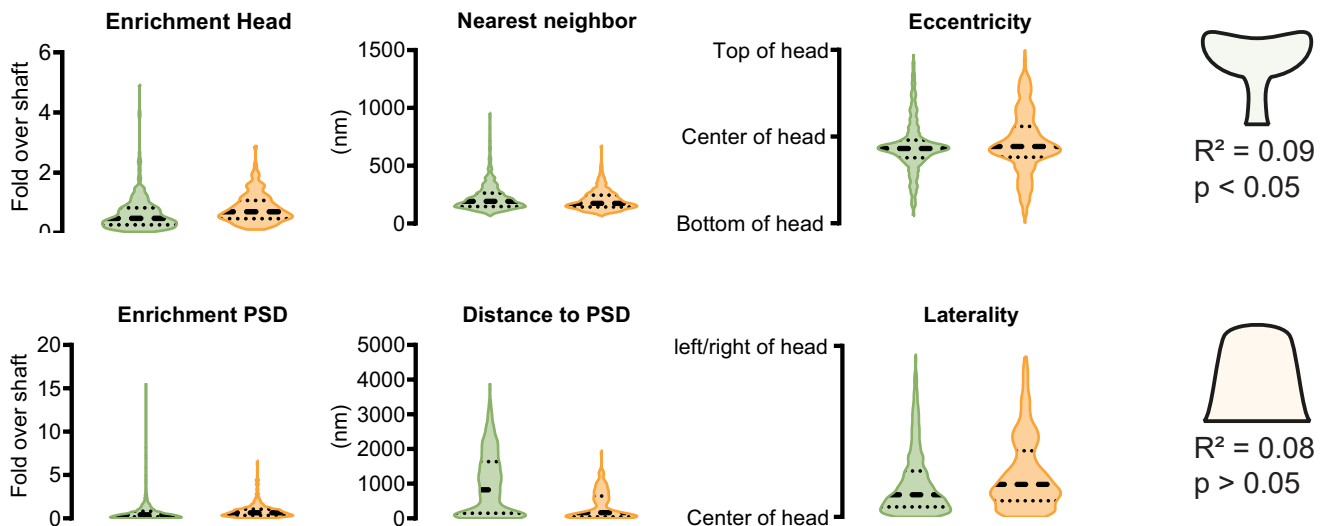
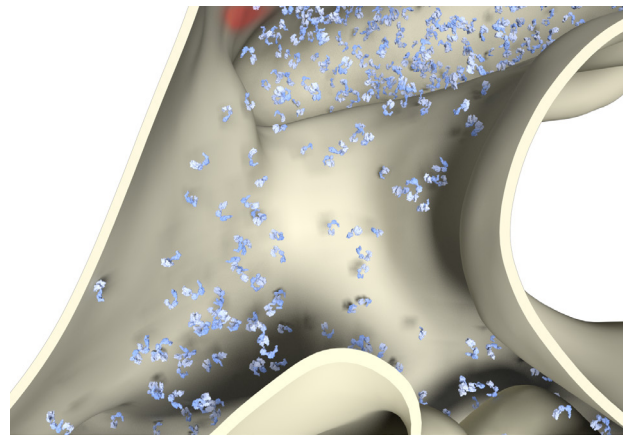
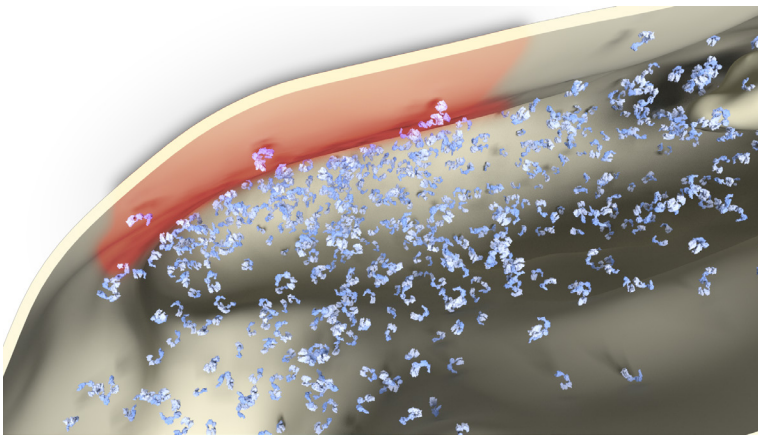
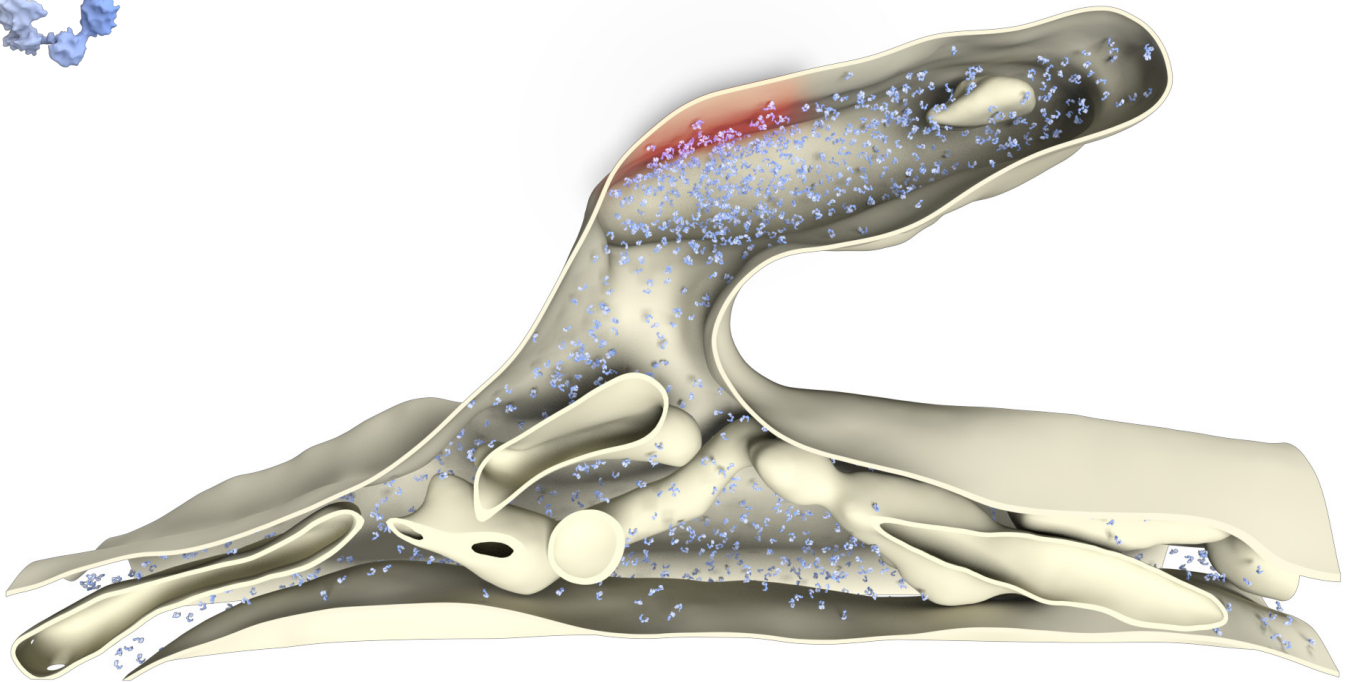
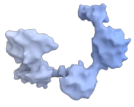
Known organization: Transported to activated synapses, can selfassemble into virion-like capsids

Known Interactions: CamKII, Drebrin, Dynamin2, GluN2A, GluN2B, GluR1, PSD95

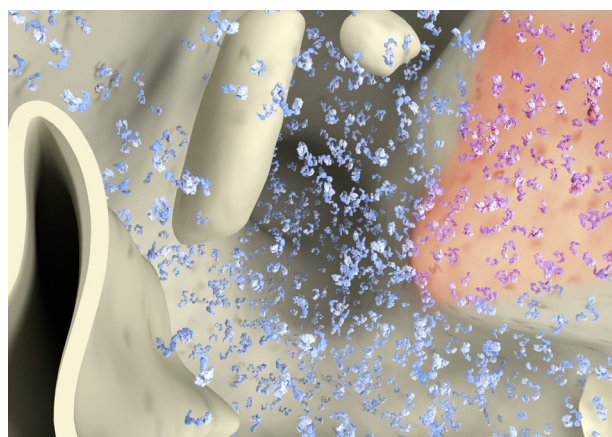
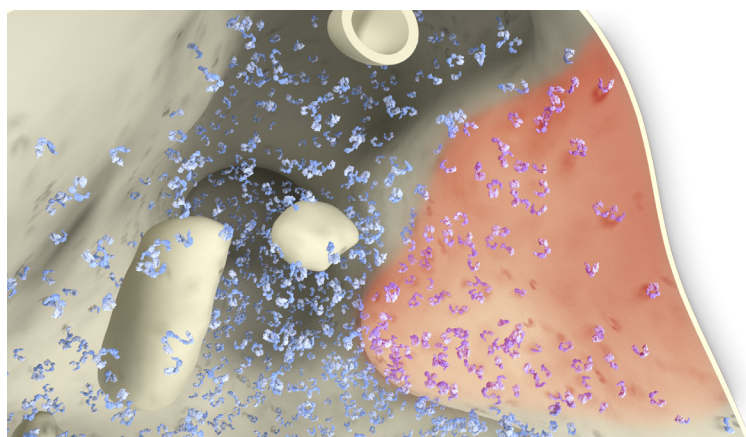
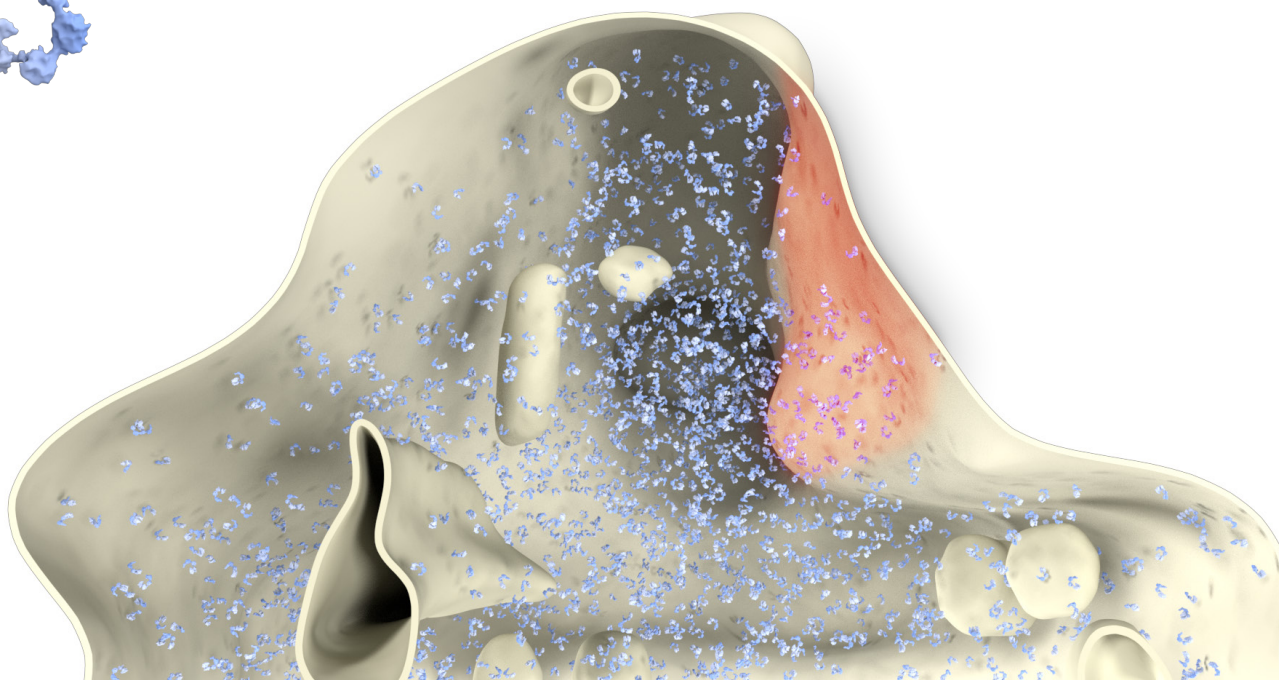
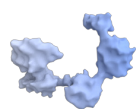


Whole cell copy number	23101133.8 ± 6022734.4 (extrapolated)	
Spine copy number	3291.3 (from literature)	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	2885.4	3549.6
% of total protein	0.6%	0.7%
Molarity (µM)	36.6	33.5
PSD copy number	543	536
% in PSD	18.8%	15.1%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	2885.4	0.6%	36.6	543
Stubby	3549.6	0.7%	33.5	536



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	2885.4	0.6%	36.6	543
Stubby	3549.6	0.7%	33.5	536



References

Antibody: Synaptic Systems 156 003

PDB Identifier: 4x3x, 3x3i

Literature:

Beique et al., 2011, Proc. Natl. Acad. Sci. U S A

Chowdury et al., 2006, Neuron

Guzowski et al., 2000, J. Neurosci.

Korb and Finkbeiner, 2011, Trends in Neurosci.

Korb et al., 2013, Nat. Neurosci.

Messaoudi et al., 2007, J. Neurosci.

Nair et al., 2017, Front. Synaptic Neurosci.

Nielsen et al., 2019, Structure

Peebles et al., 2010, Proc. Natl. Acad. Sci. U S A

Plath et al., 2006, Neuron

Shepherd & Bear, 2011, Nat. Neurosci.

Wu et al., 2017, Cell

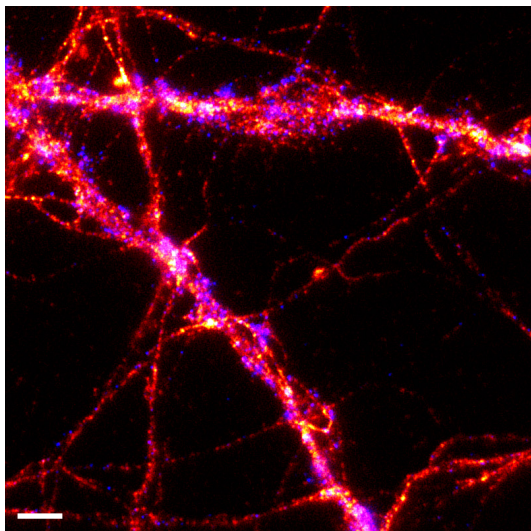
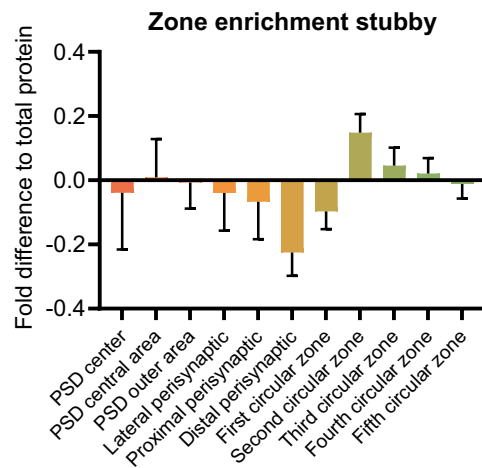
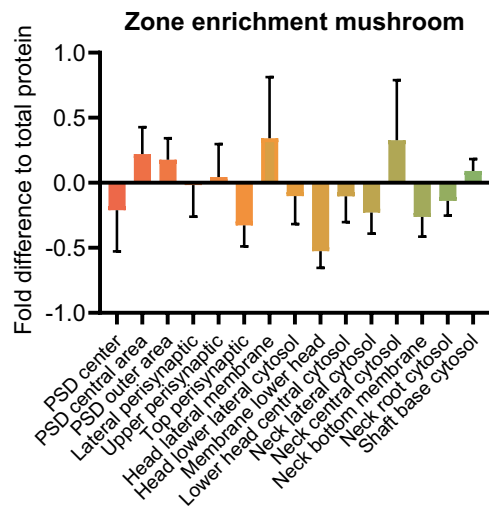
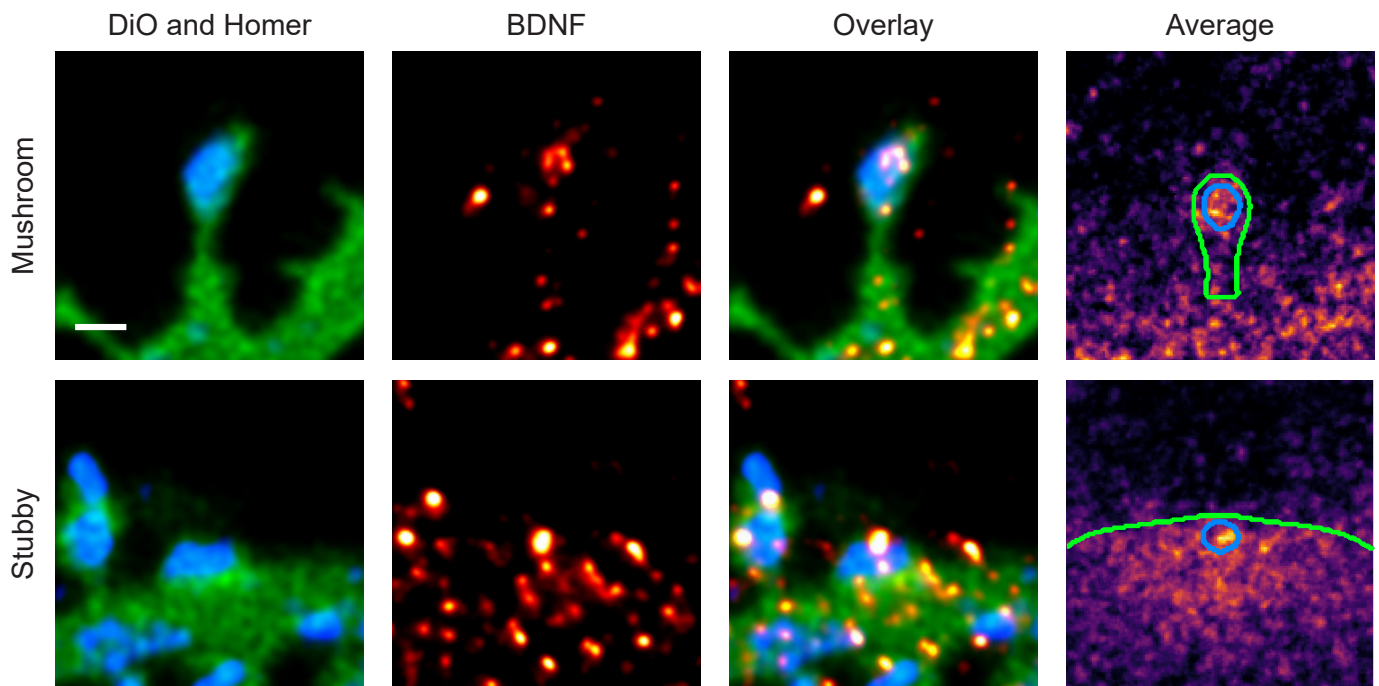
Zhang et al., 2019, Mol. Cell

BDNF (Gene: Bdnf, Uniprot ID: P23363)

Known function: Important neurotrophin, Involved in neuronal growth and plasticity

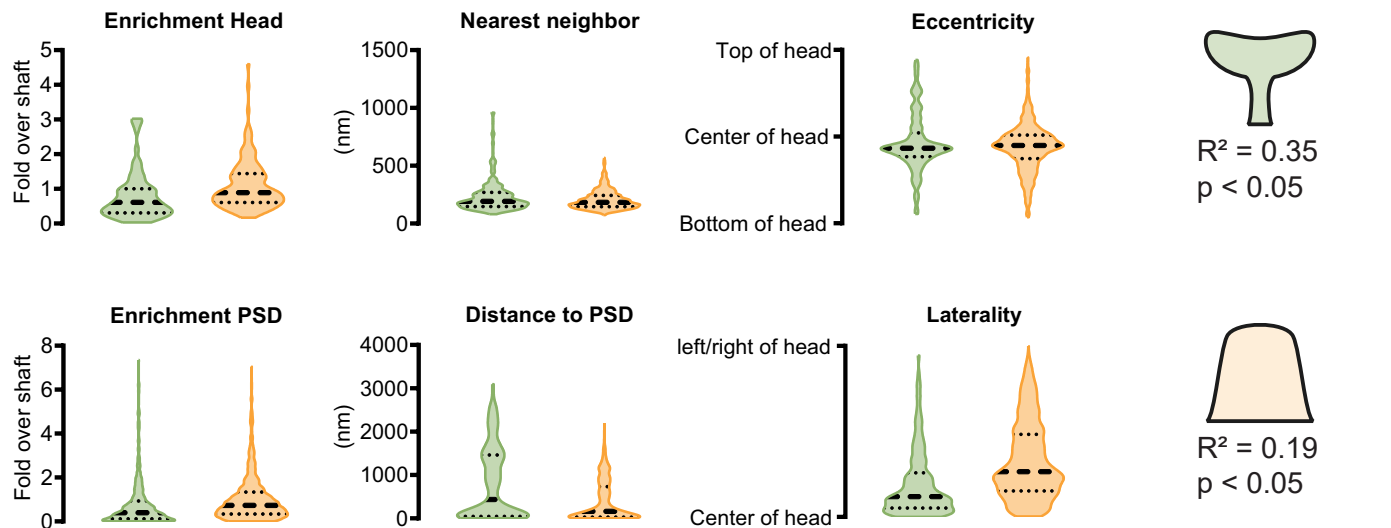
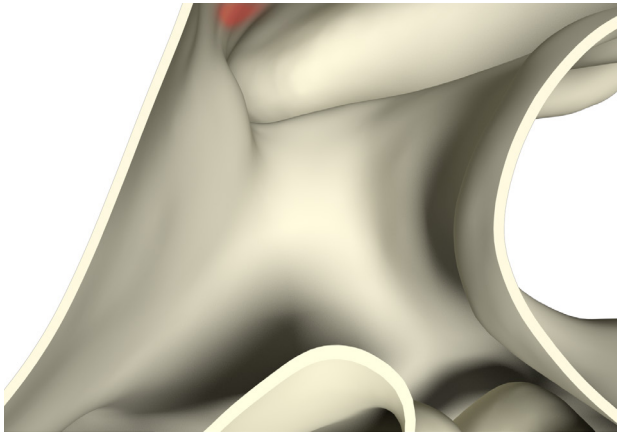
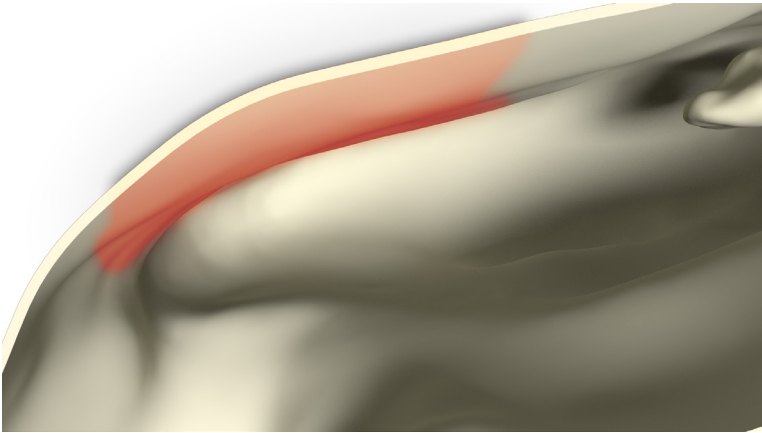
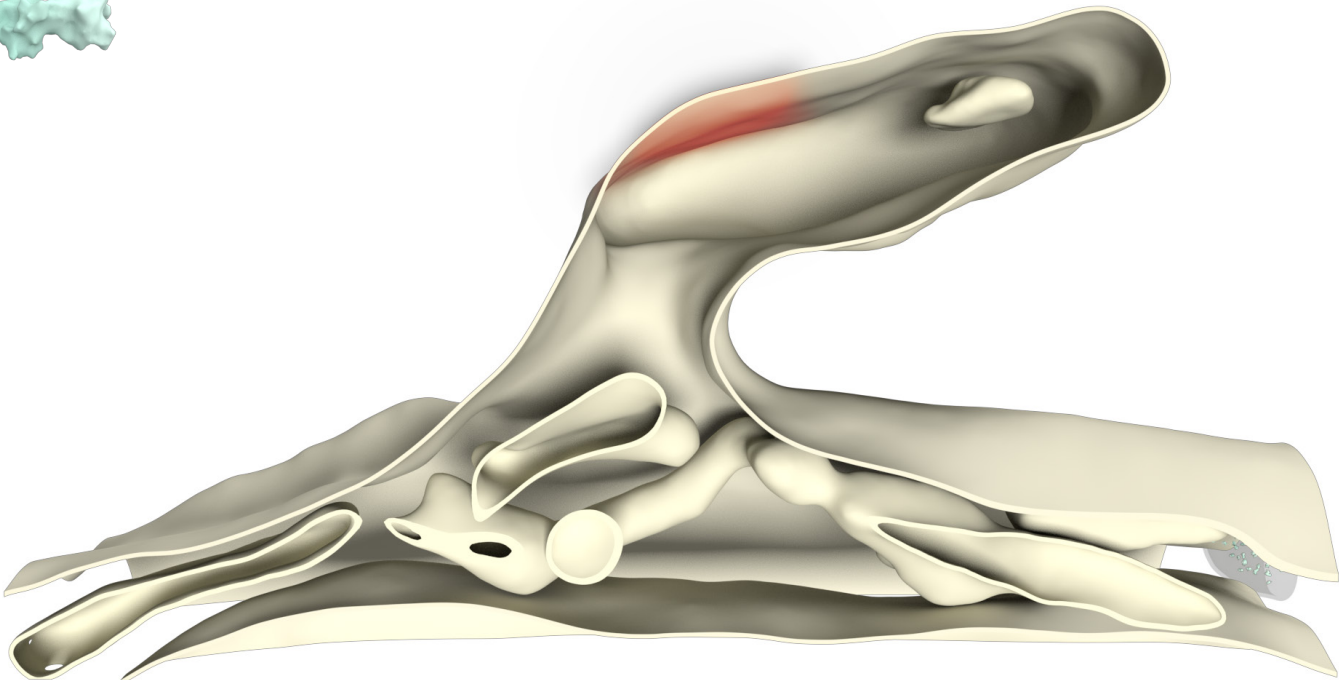
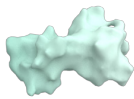
Known organization: In ER and secretory granules

Known Interactions: TrkB, LNGFR

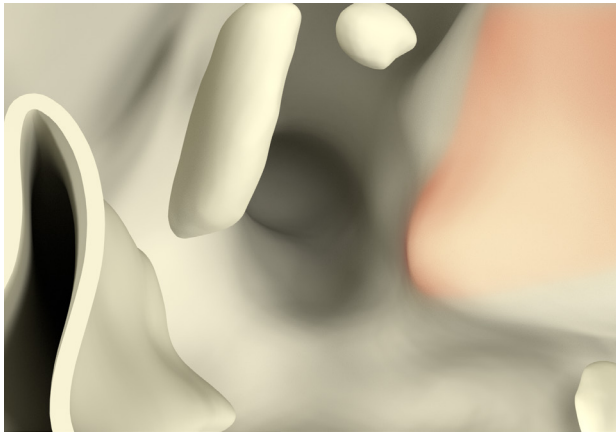
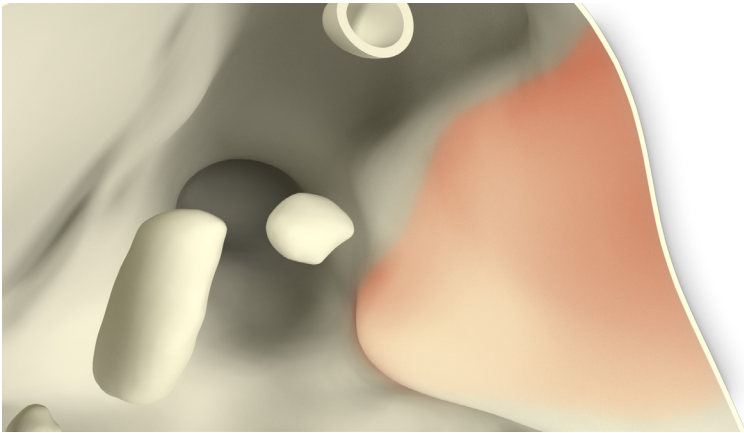
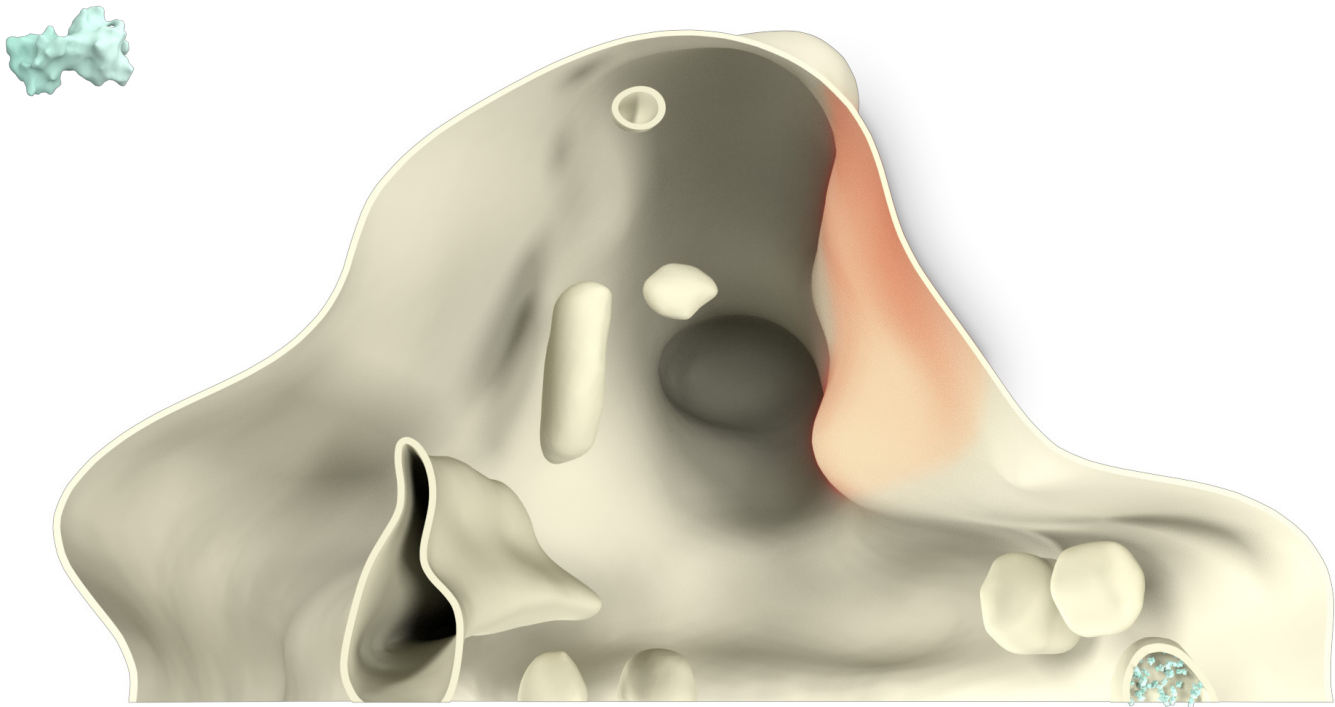


Whole cell copy number	316783.2 ± 67934.0	
Spine copy number	70.9 ± 18.2	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	52.9 ± 13.6	100.8 ± 25.9
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.7 ± 0.2	1.0 ± 0.2
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	52.9 ± 13.6	$0.0 \pm 0.0\%$	0.7 ± 0.2	0 ± 0.0
Stubby	100.8 ± 25.9	$0.0 \pm 0.0\%$	1.0 ± 0.2	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	52.9 ± 13.6	$0.0 \pm 0.0\%$	0.7 ± 0.2	0 ± 0.0
Stubby	100.8 ± 25.9	$0.0 \pm 0.0\%$	1.0 ± 0.2	0 ± 0.0



References

Antibody: Biorbyt orb38809

PDB Identifier: 1b8m

Literature:

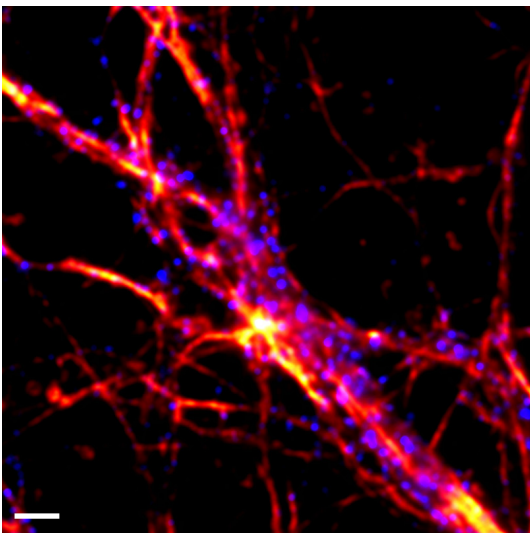
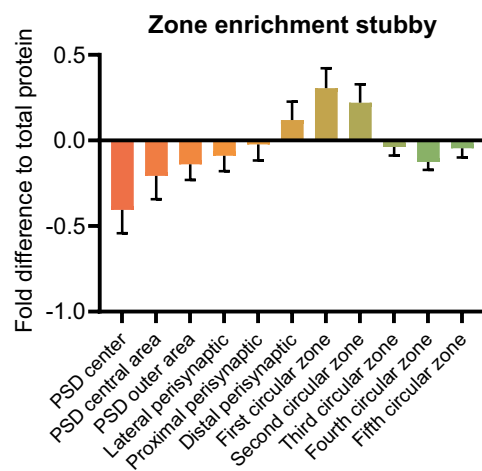
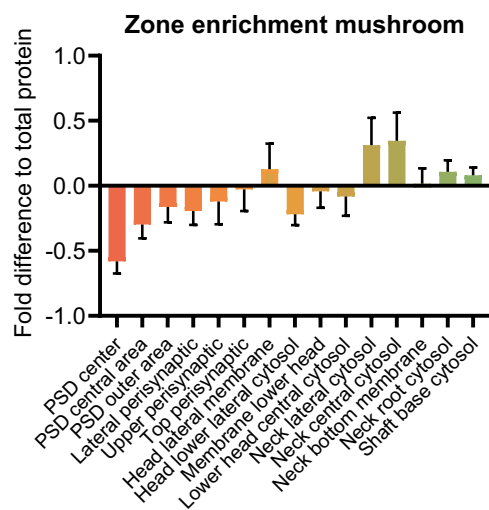
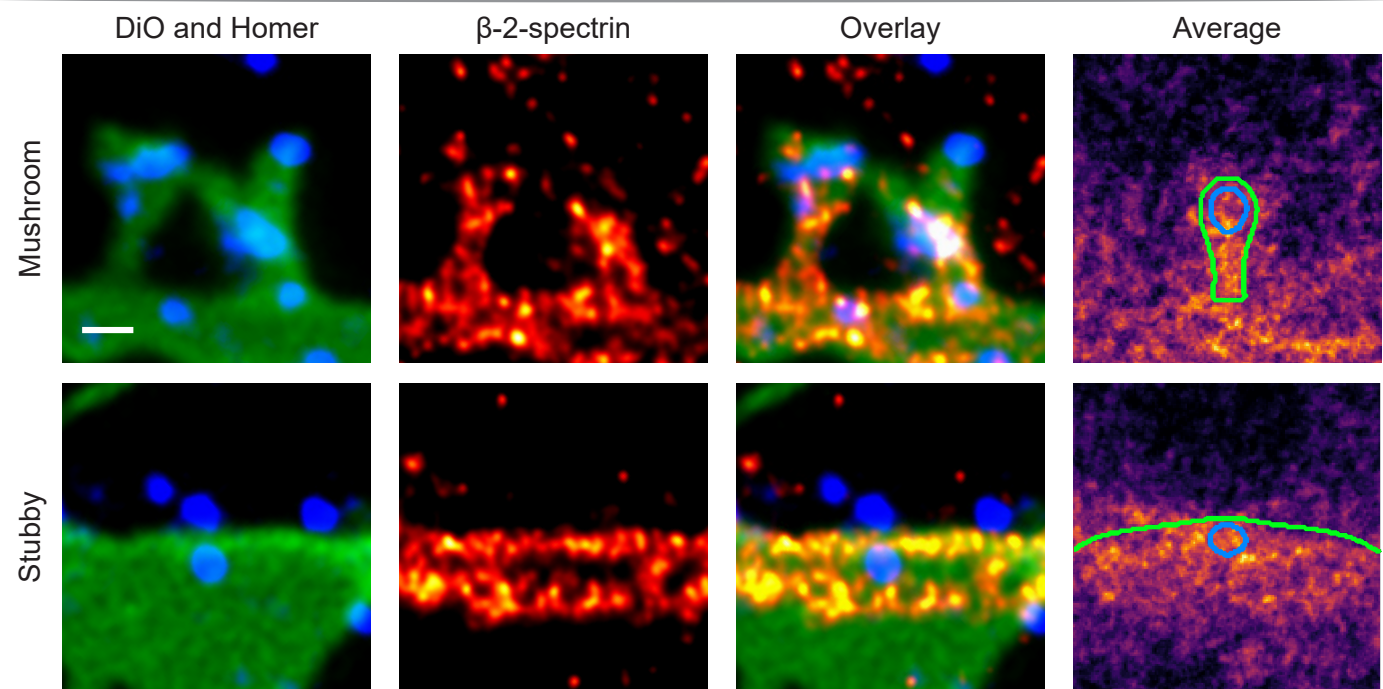
Adachi et al., 2005, BMC Neurosci.
Hartmann et al., 2001, EMBO J.
Kohara et al., 2001, Science
Korte et al., 1995, Proc. Natl. Acad. Sci. U S A
Leal et al., 2015, Brain Res.
Minichiello et al., 2002, Neuron
Patterson et al., 1996, Neuron
Soppet et al., 1991, Cell

β -2-spectrin (β -3-spectrin, Gene: Sptnb2, Uniprot ID: Q9QWN8)

Known function: Acts as spacer for actin rings

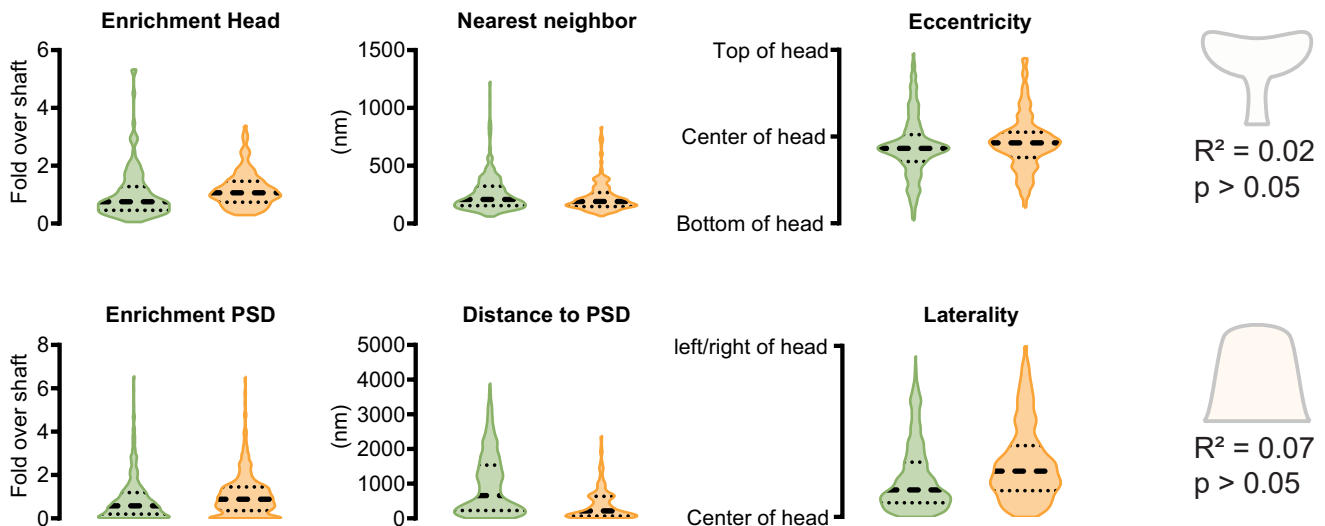
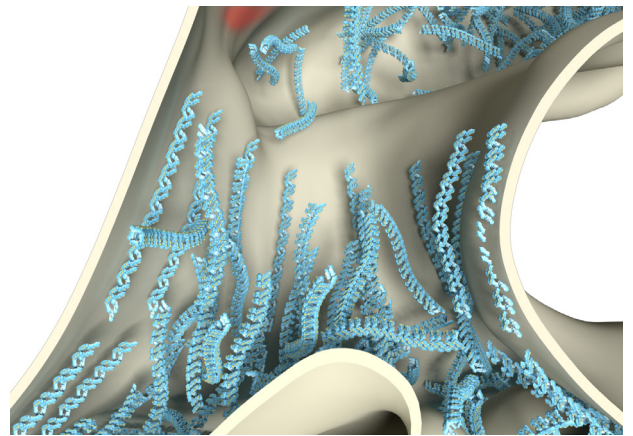
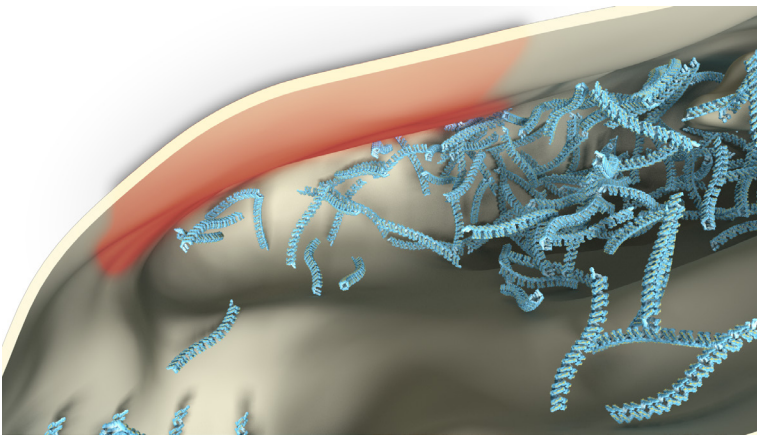
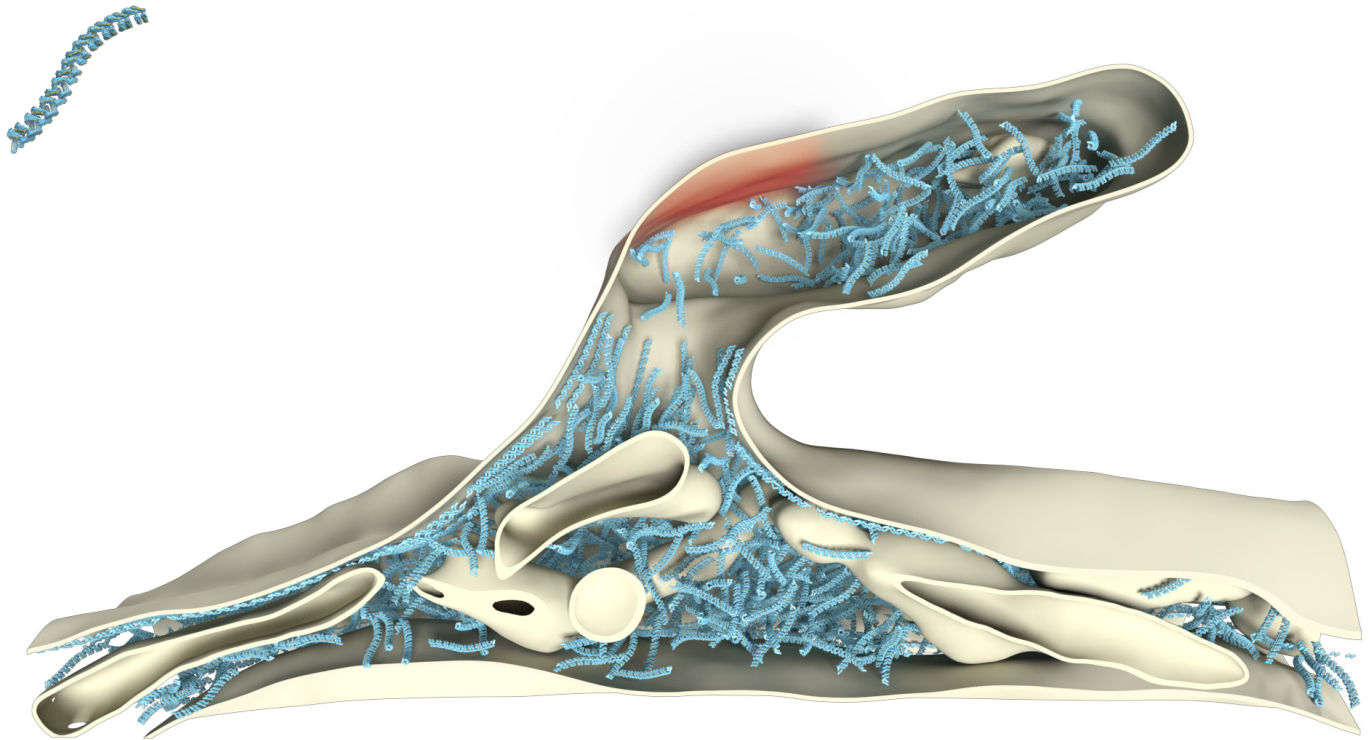
Known organization: Cytosolic

Known Interactions: Actin

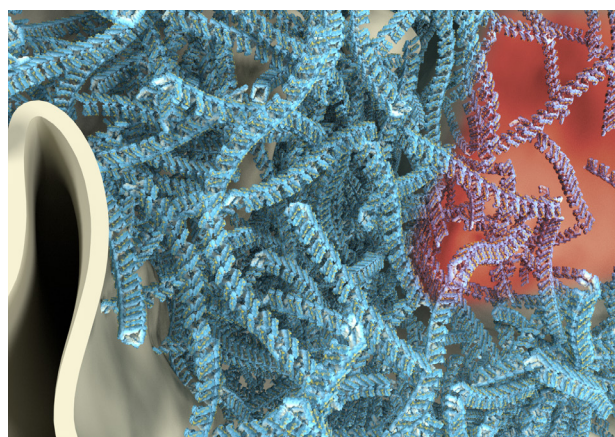
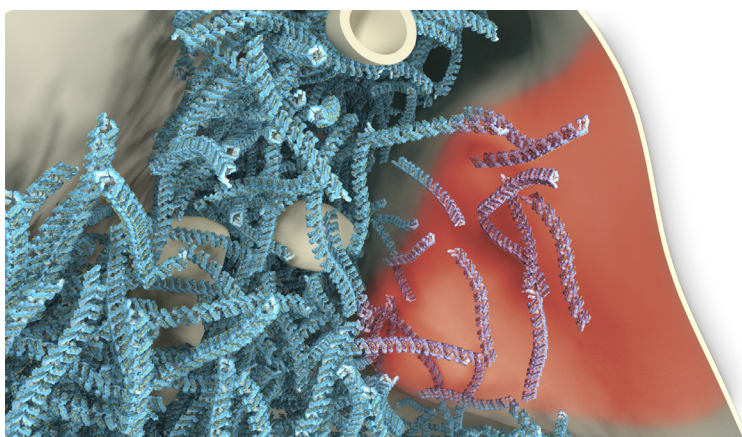
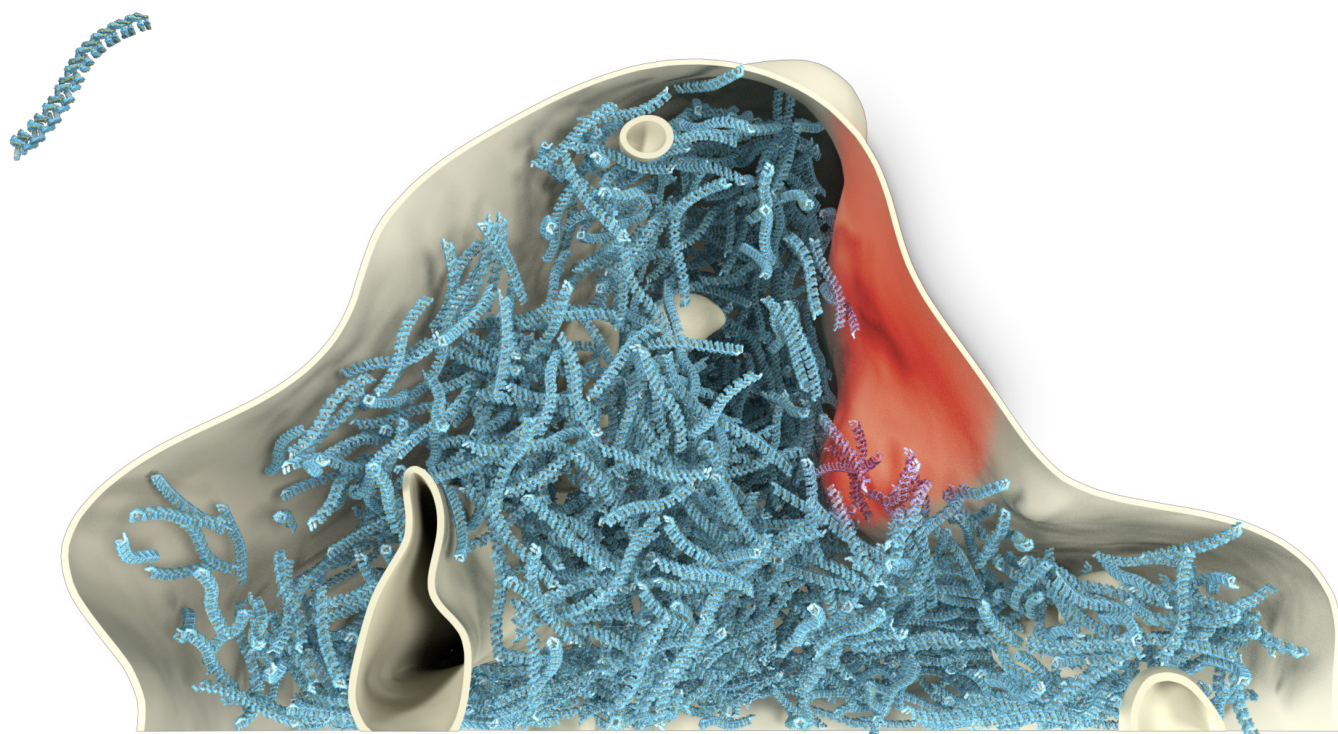


Whole cell copy number	198535936.9 \pm 293727058.6 (extrapolated)	
Spine copy number	5591.1 \pm 3922.8	
Function	Cytoskeleton	
	Mushroom	Stubby
Spine copy number	4937.4 \pm 3464.2	6899.0 \pm 4840.5
% of total protein	6.5 \pm 4.6%	7.8 \pm 5.5%
Molarity (μ M)	62.7 \pm 44.0	65.2 \pm 0.2
PSD copy number	354 \pm 248.4	751 \pm 526.9
% in PSD	7.2 \pm 5.0%	10.9 \pm 7.6%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	4937.4 ± 3464.2	$6.5 \pm 4.6\%$	62.7 ± 44.0	354 ± 248.4
Stubby	6899.0 ± 4840.5	$7.8 \pm 5.5\%$	65.2 ± 0.2	751 ± 526.9



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	4937.4 ± 3464.2	$6.5 \pm 4.6\%$	62.7 ± 44.0	354 ± 248.4
Stubby	6899.0 ± 4840.5	$7.8 \pm 5.5\%$	65.2 ± 0.2	751 ± 526.9



References

Antibody: BD Biosciences 612562

PDB Identifier: 1s35

Literature:

Xu et al., 2013, Science

Bär et al., 2016, Sci. Rep.

Sidenstein et al., 2016, Sci. Rep.

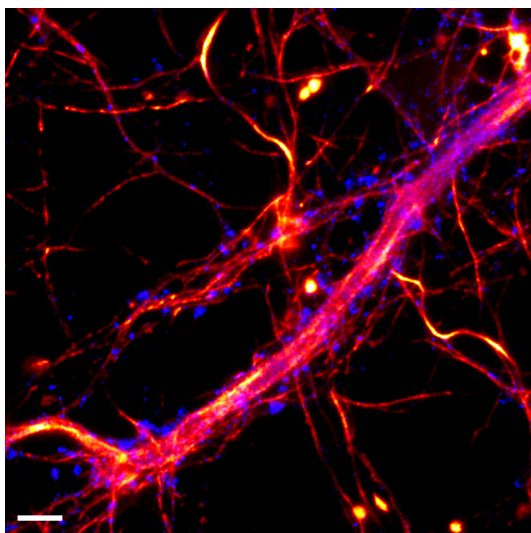
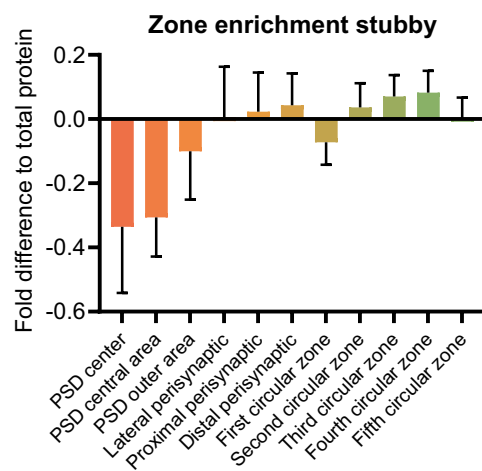
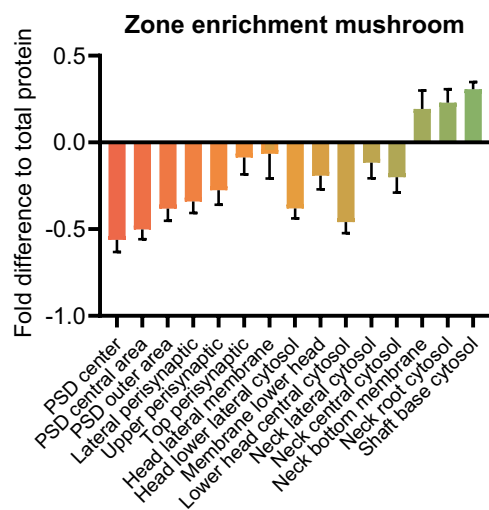
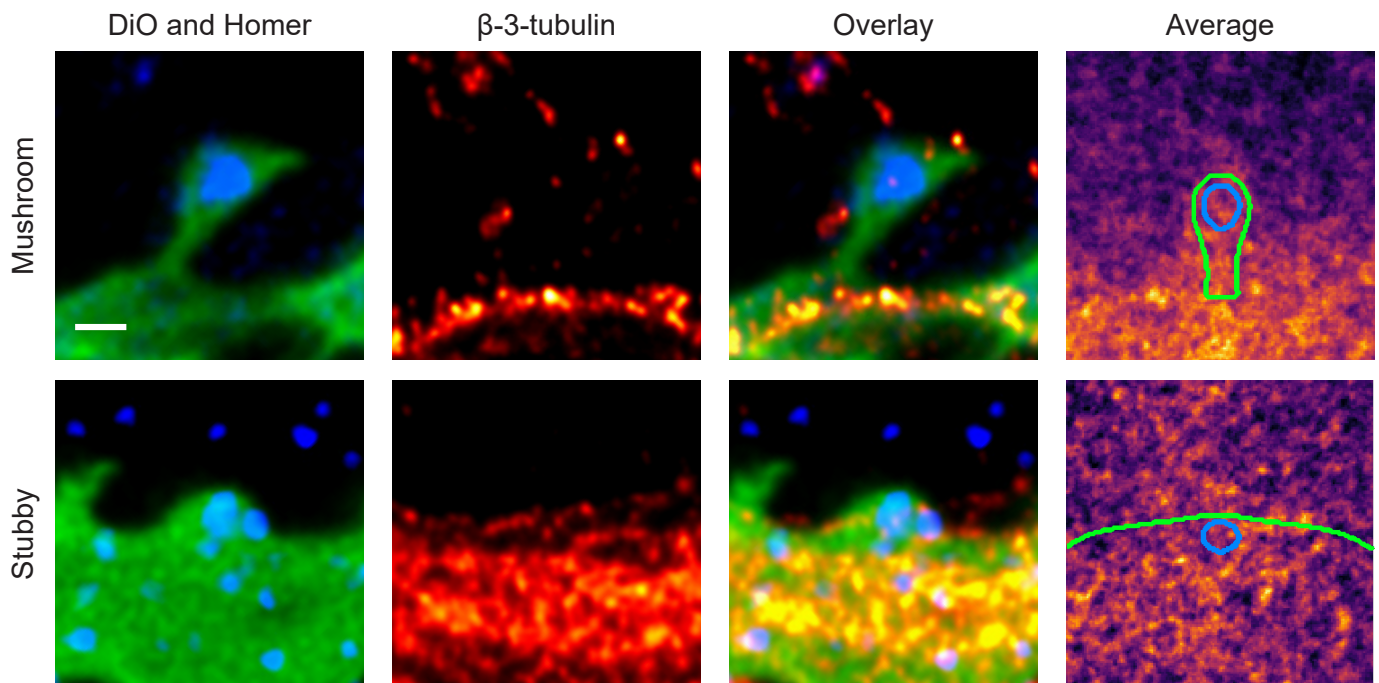
Brown et al., 2015, PLoS Comput Biol.

β -3-tubulin (Gene: Tubb3, Uniprot ID: Q4QRB4)

Known function: Forms microtubules

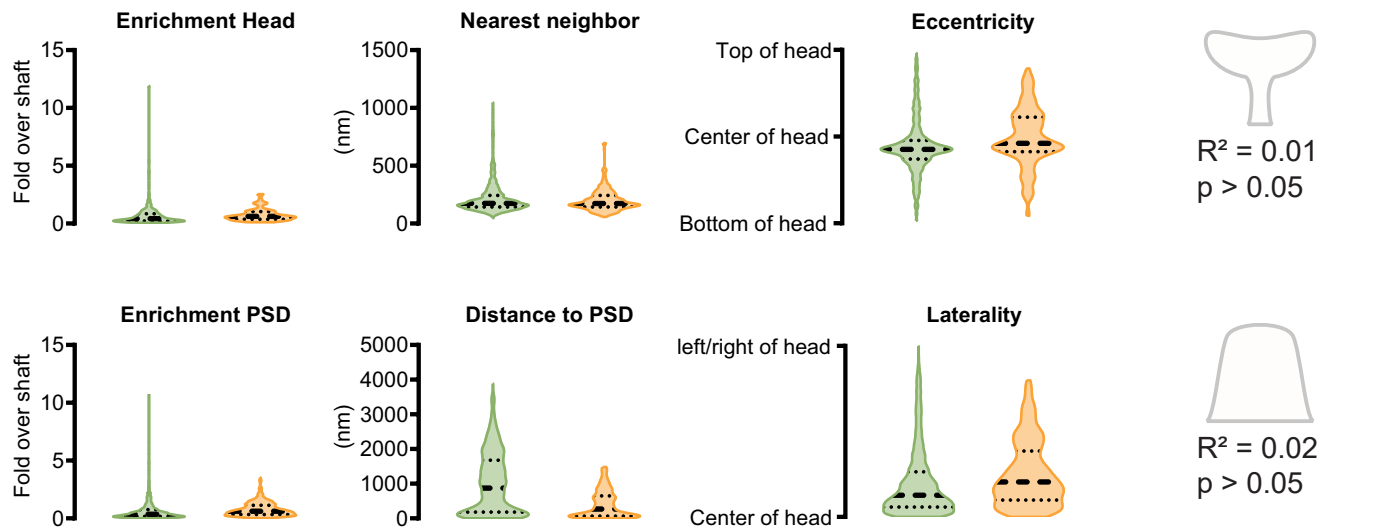
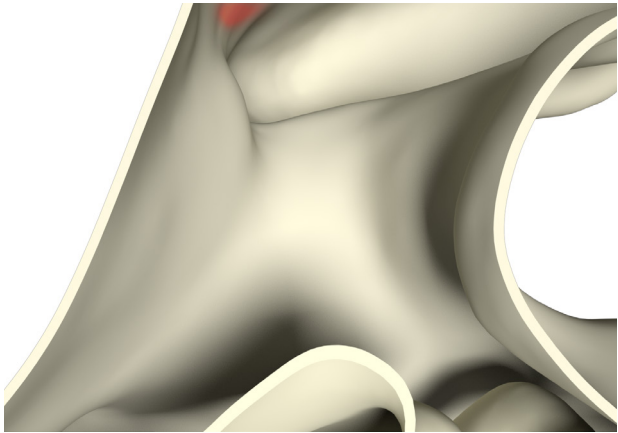
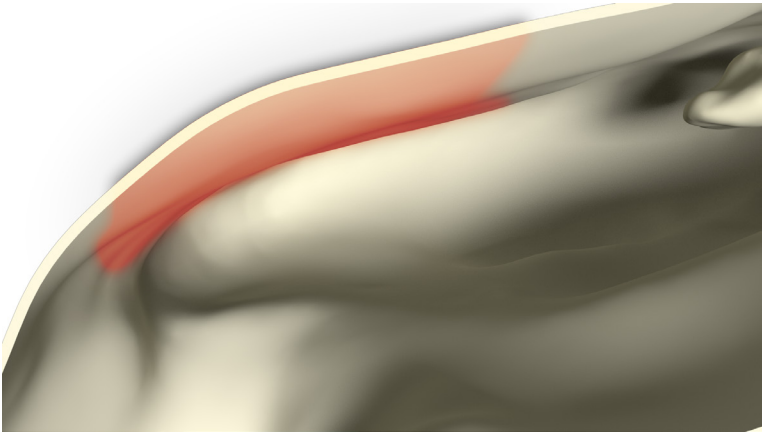
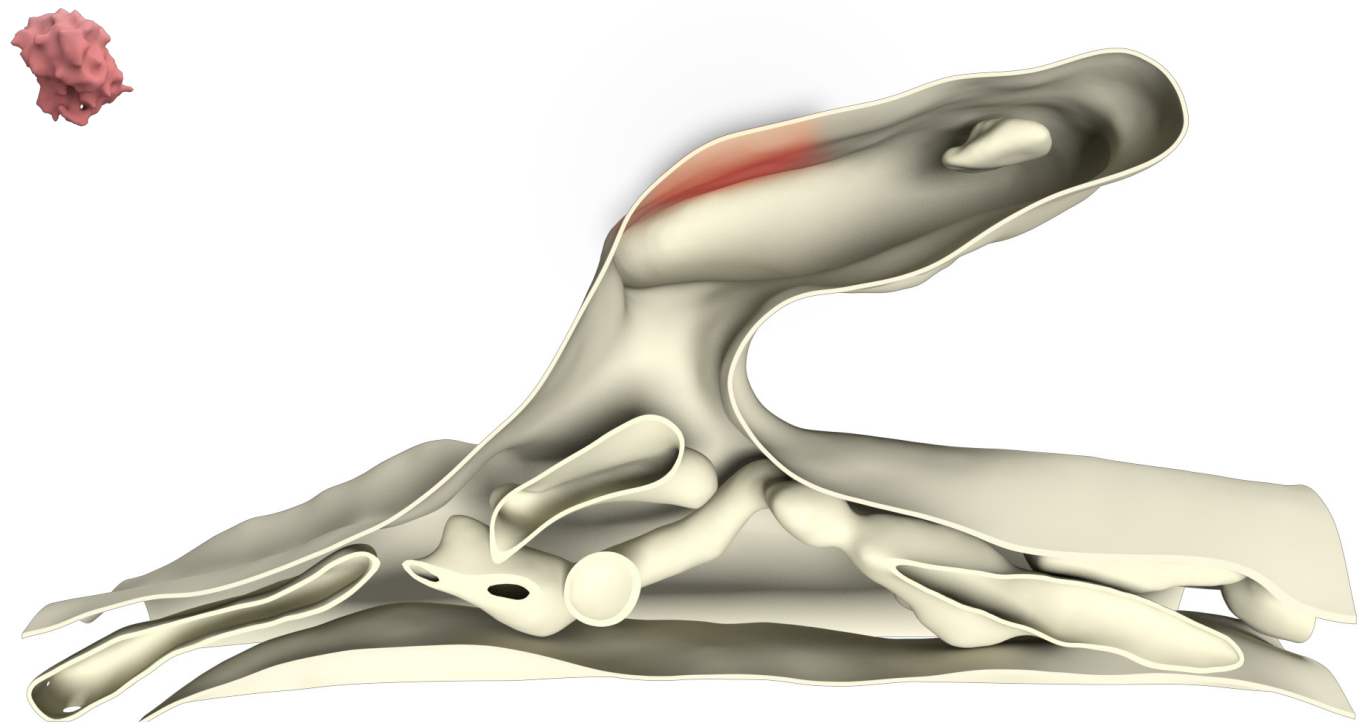
Known organization: Cytosolic, Forms hollow microtubule, Neuron specific

Known Interactions: α -tubulins, α -internexin

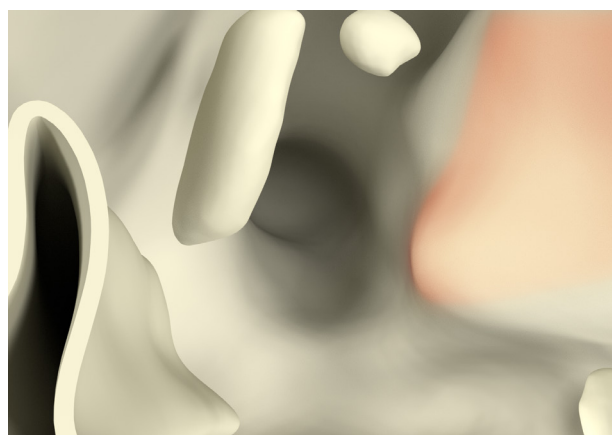
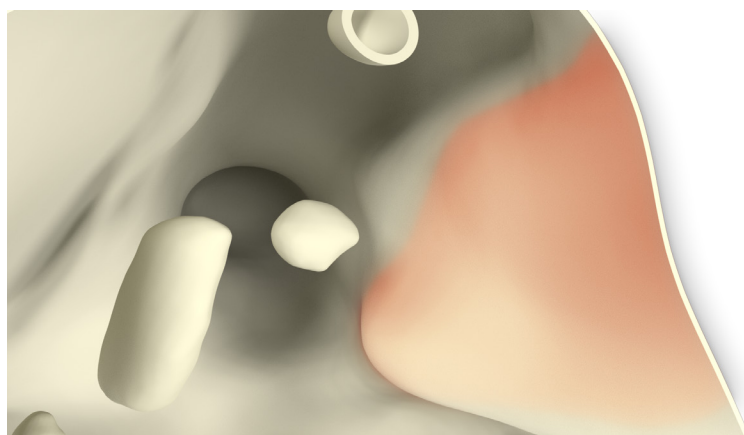
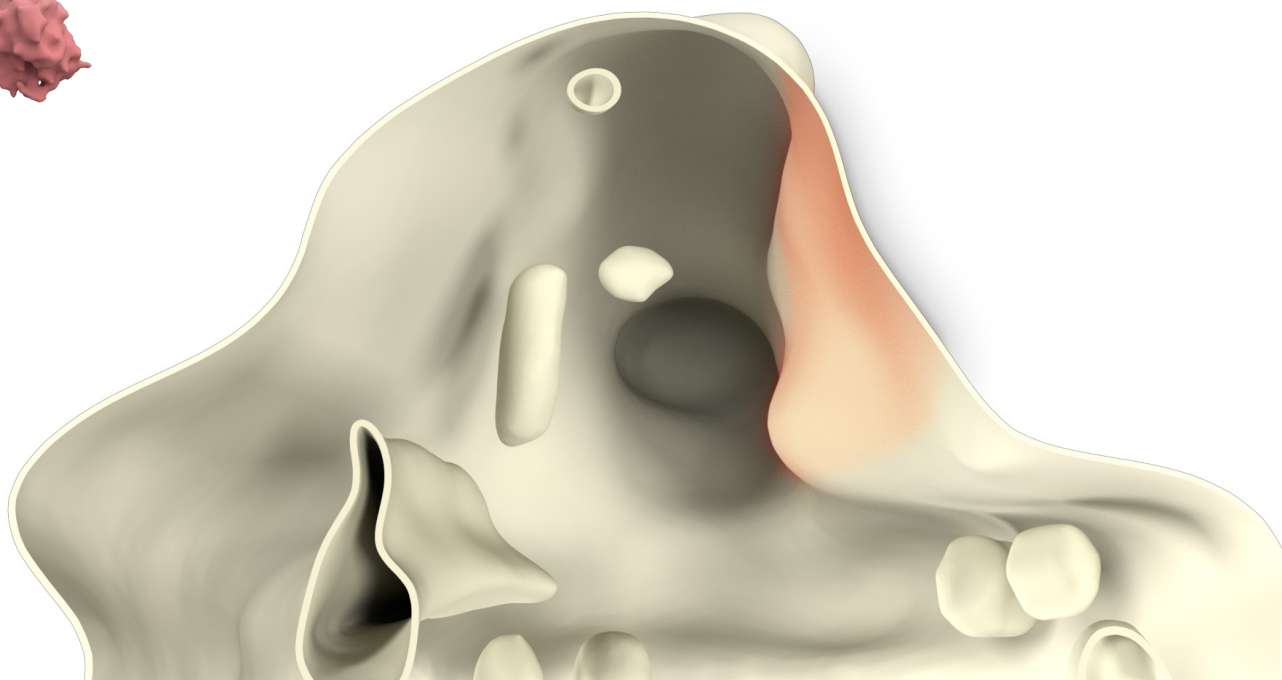
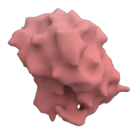


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Spine copy number	not present	
Function	Cytoskeleton	
	Mushroom	Stubby
Spine copy number	not present	not present
% of total protein	not present	not present
Molarity (μ M)	not present	not present
PSD copy number	not present	not present
% in PSD	not present	not present

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	not present	not present	not present	not present
Stubby	not present	not present	not present	not present



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	not present	not present	not present	not present
Stubby	not present	not present	not present	not present



References

Antibody: Cell Signaling 5568

PDB Identifier: 6e7b

Literature:

Sullivan and Cleveland, 1986, PNAS

Jaworski et al., 2009, Neuron

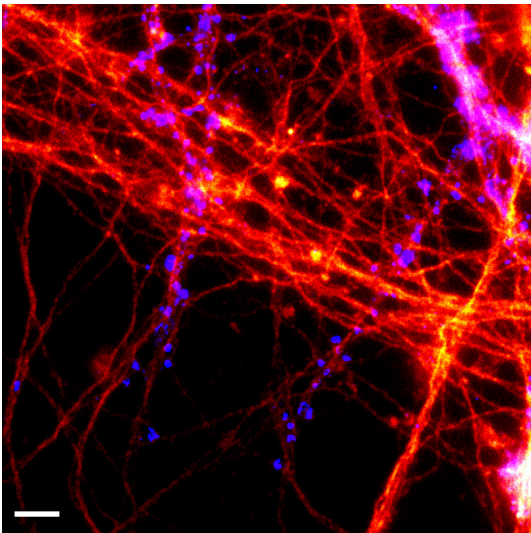
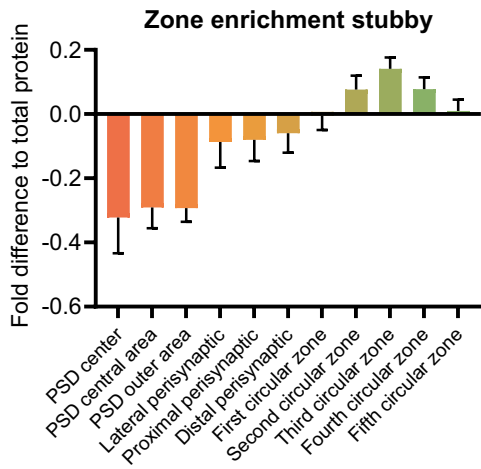
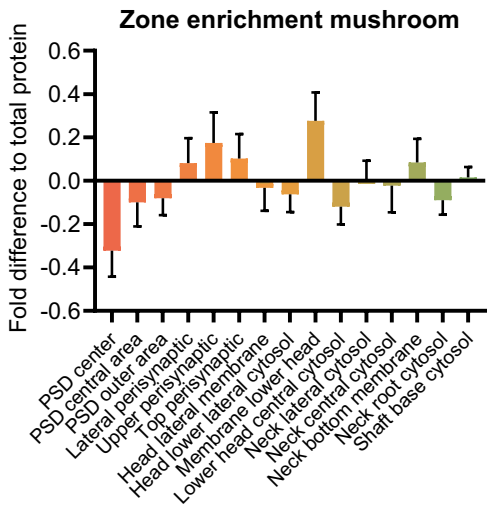
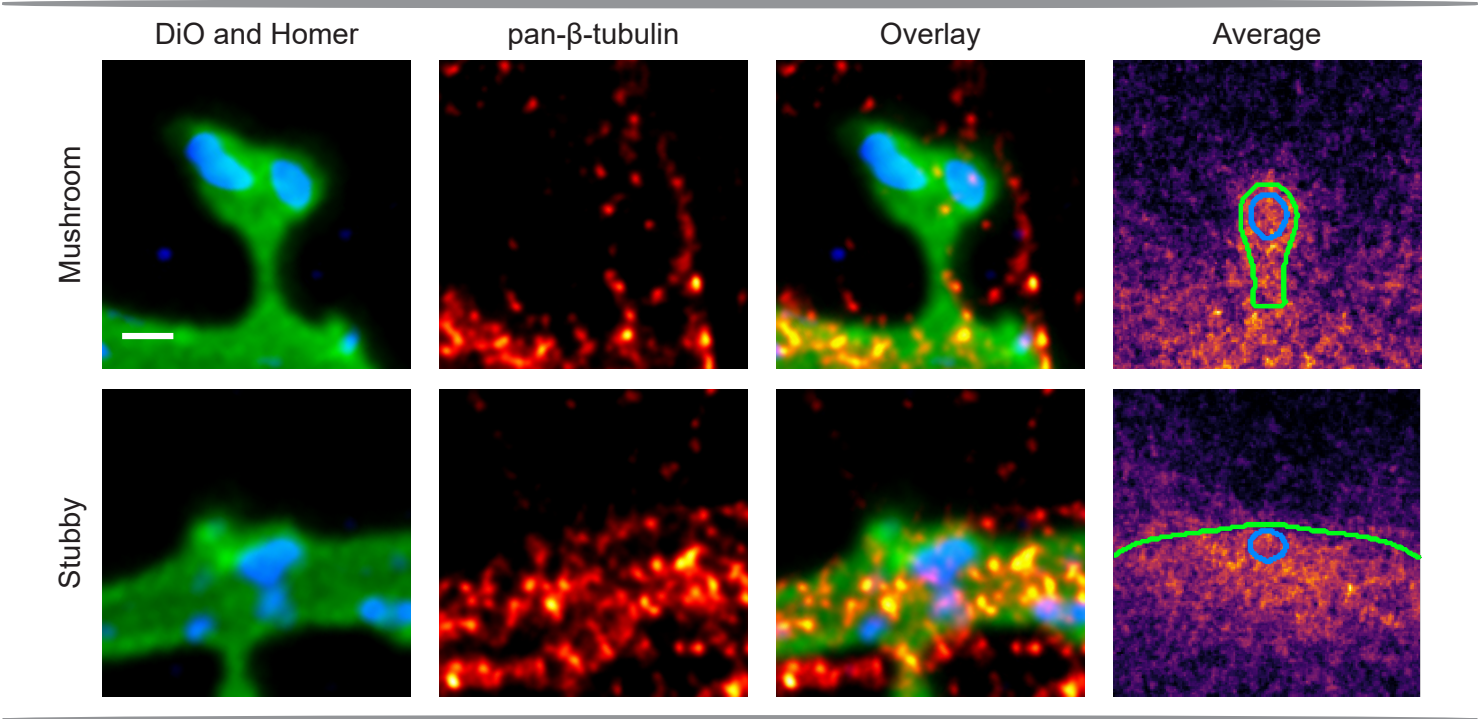
Kaech et al., 2001, PNAS

Landis and Reese, 1983, J. Cell. Biol.

pan-β-tubulin (Genes: Tubb1, Tubb2a, Tubb2b, Tubb3, Tubb4a, Tubb4b, Tubb5, Tubb6, Uniprot IDs: M0R8B6, P85108, Q3KRE8, Q4QRB4, B4F7C2, Q6P9T8, P69897, Q4QQV0)

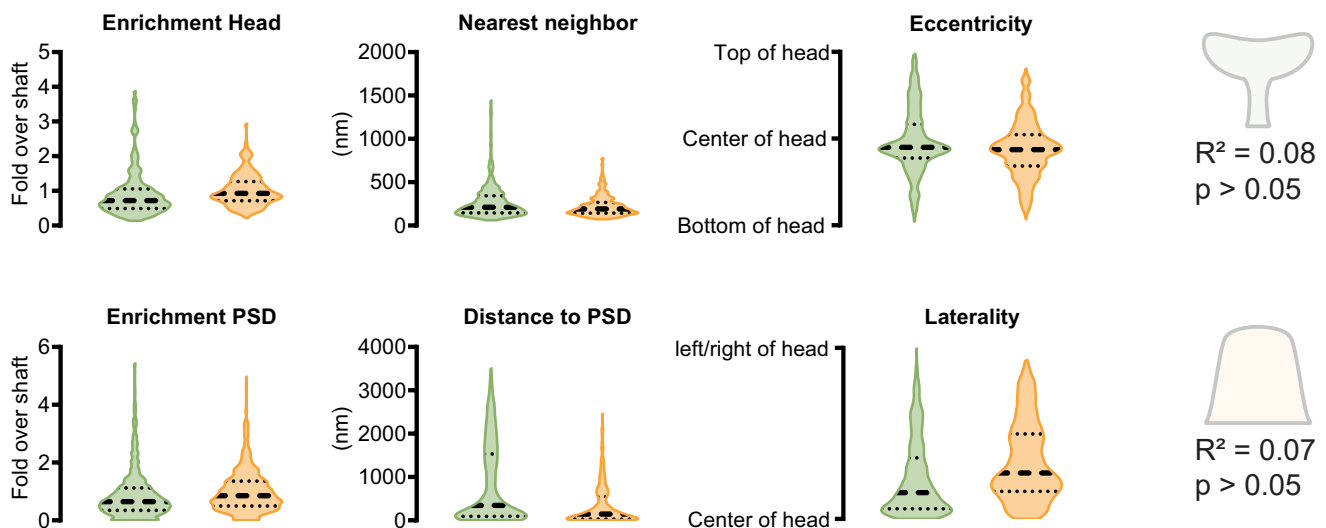
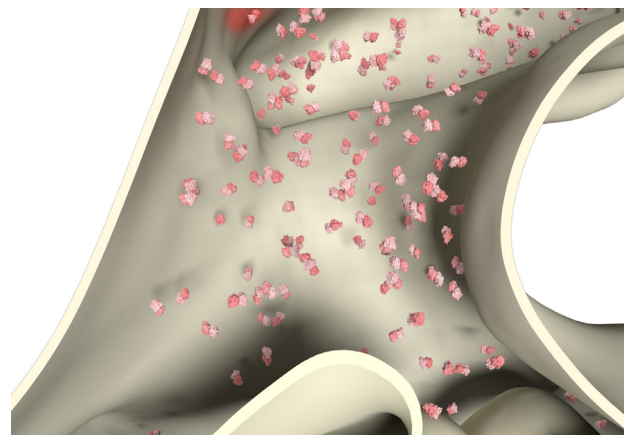
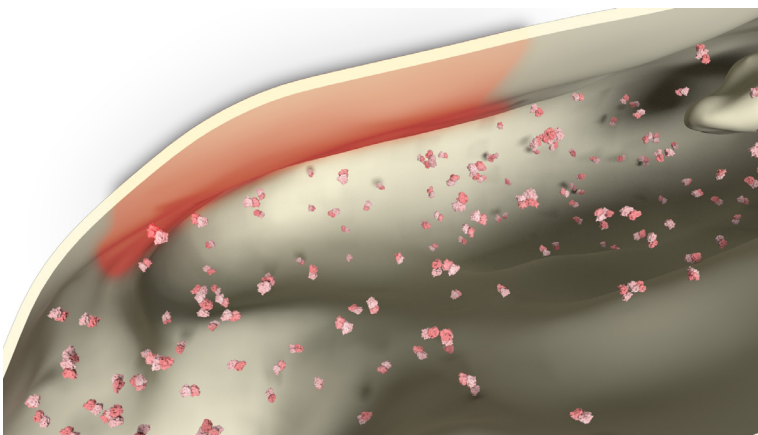
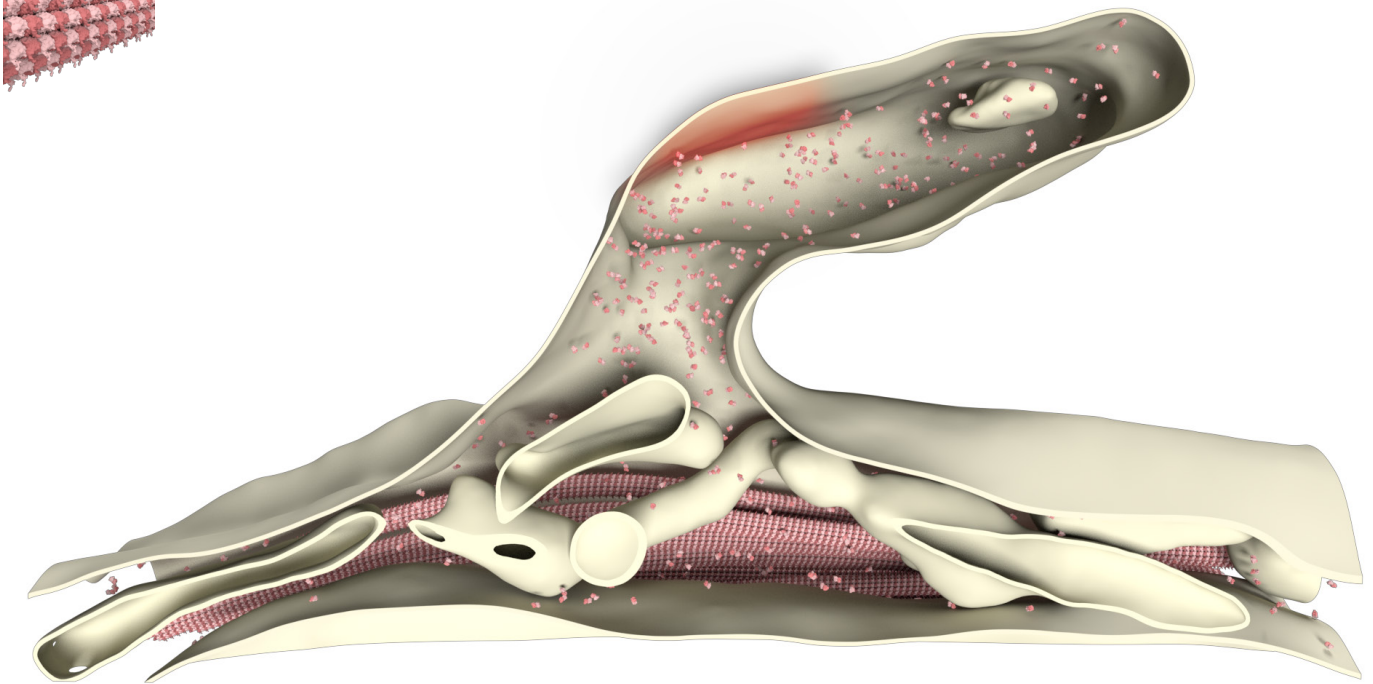
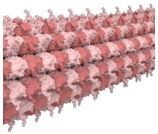
Known function: Forms microtubules. Known organization: Cytosolic, Forms hollow microtubule

Known Interactions: α-tubulins, α-internexin

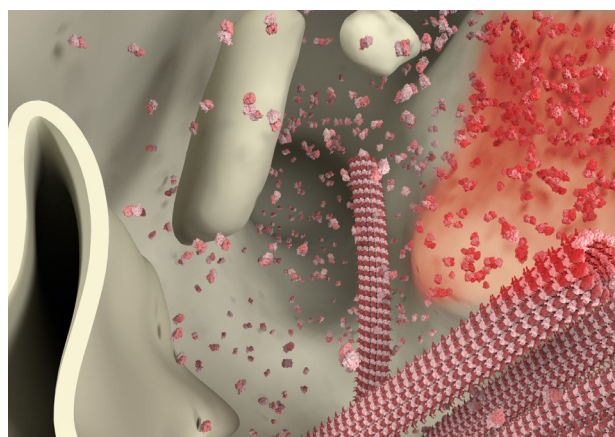
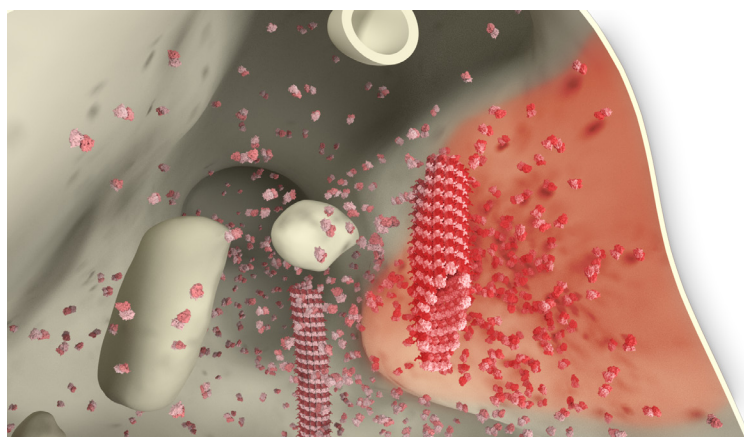
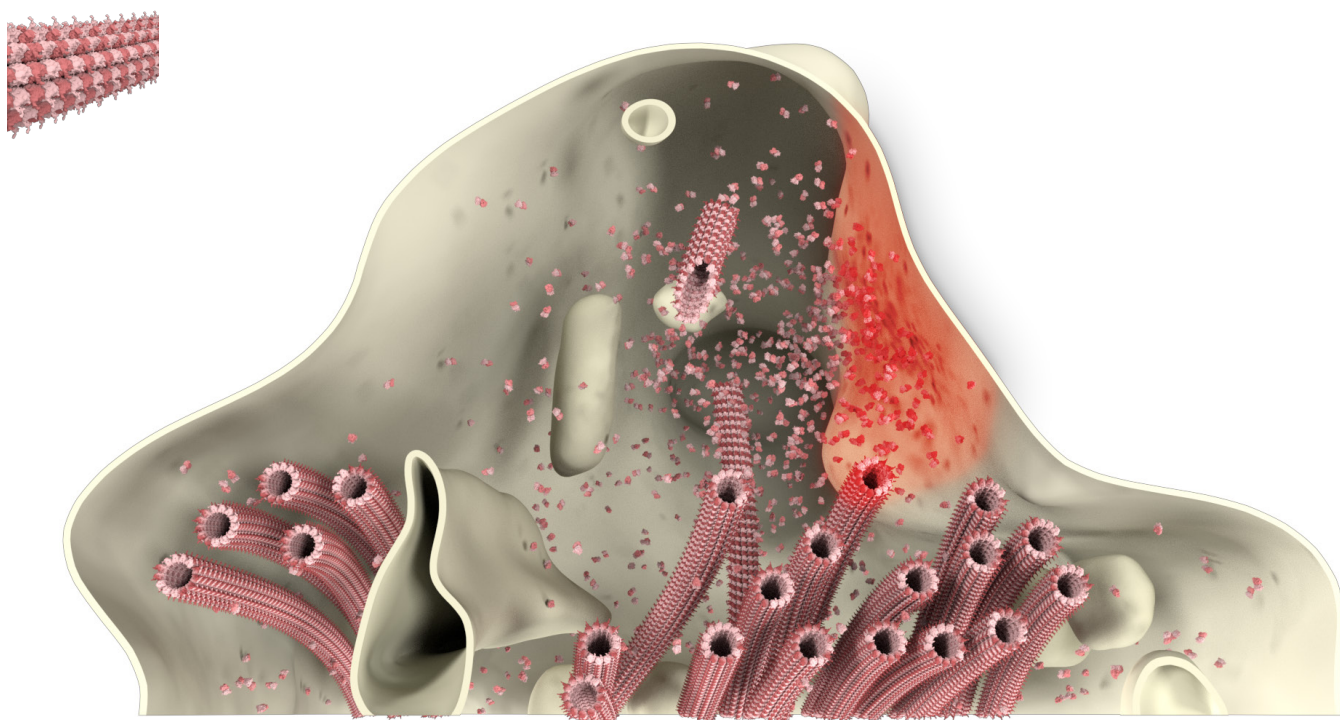


Whole cell copy number	669979114.3 ± 8363767.6	
Spine copy number	54900.4 ± 22979.8	
Function	Cytoskeleton	
	Mushroom	Stubby
Spine copy number	42095.1 ± 17619.8	75104.1 ± 31436.5
% of total protein	10.5 ± 4.4%	16.2 ± 6.8%
Molarity (μM)	534.6 ± 223.8	709.8 ± 297.1
PSD copy number	4317 ± 1807.0	6460 ± 2704.0
% in PSD	10.3 ± 4.3%	8.6 ± 3.6%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	42095.1 ± 17619.8	$10.5 \pm 4.4\%$	534.6 ± 223.8	4317 ± 1807.0
Stubby	75104.1 ± 31436.5	$16.2 \pm 6.8\%$	709.8 ± 297.1	6460 ± 2704.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	42095.1 ± 17619.8	$10.5 \pm 4.4\%$	534.6 ± 223.8	4317 ± 1807.0
Stubby	75104.1 ± 31436.5	$16.2 \pm 6.8\%$	709.8 ± 297.1	6460 ± 2704.0



References

Antibody: Self-made nanobody (Mikhalyova et al. 2015) **PDB Identifier:** 1tub

Literature:

Jaworski et al., 2009, Neuron

Kaech et al., 2001, PNAS

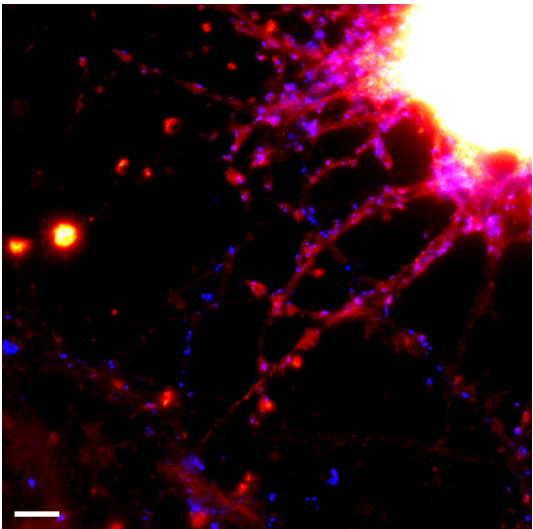
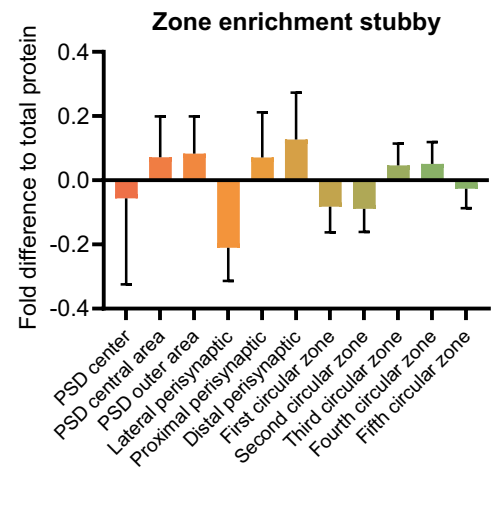
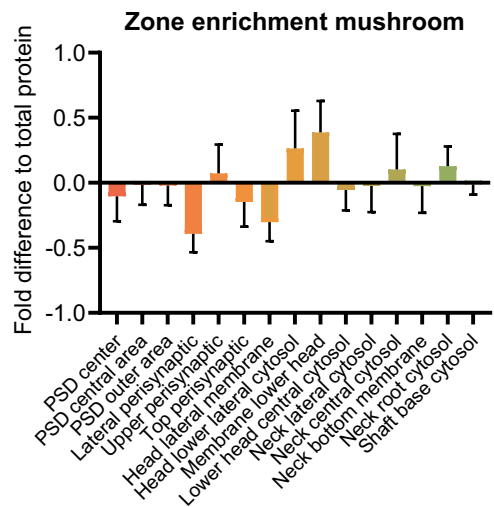
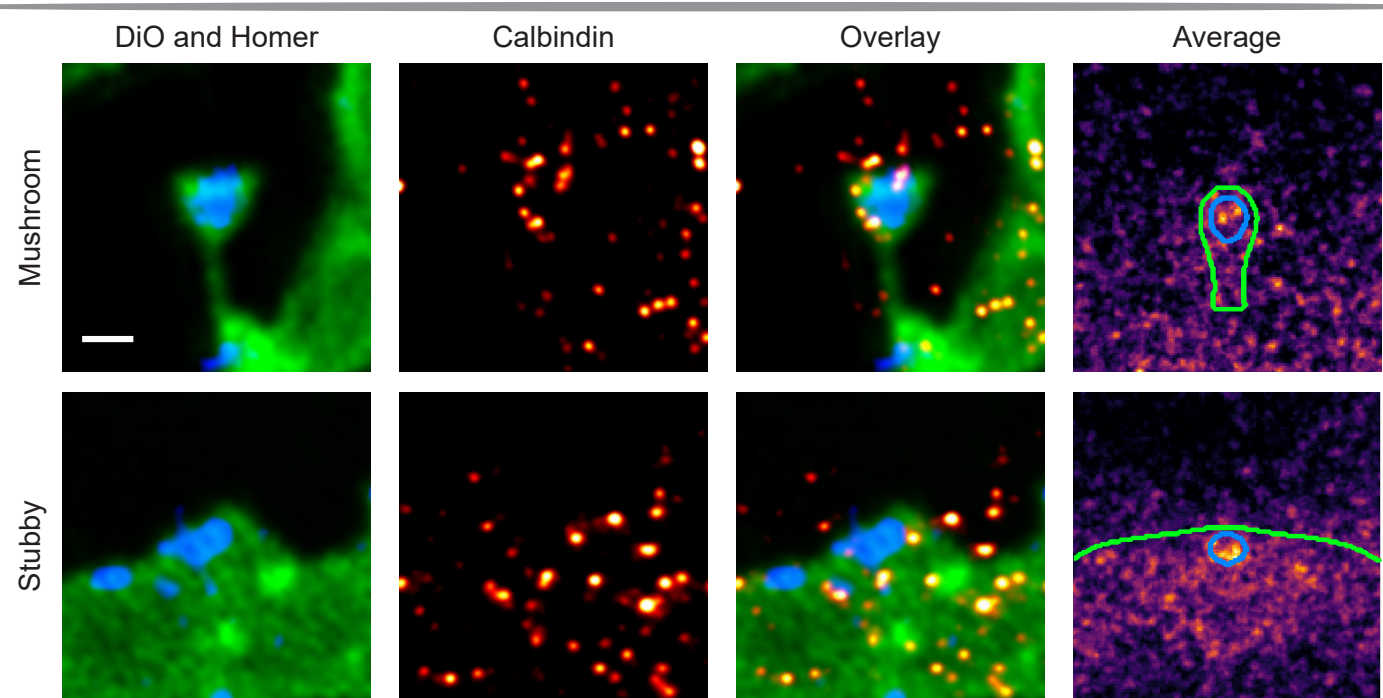
Landis and Reese, 1983, J. Cell. Biol.

Calbindin-D28K (Gene: Calb1, Uniprot ID: P07171)

Known function: Calcium buffer, Only found in a subset of hippocampal neurons

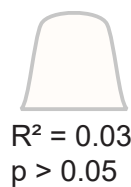
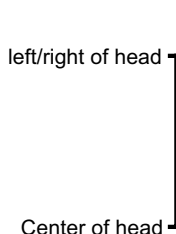
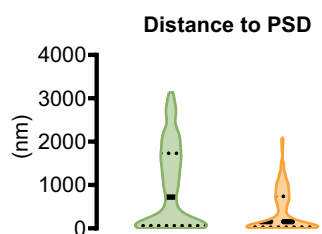
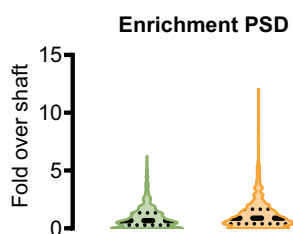
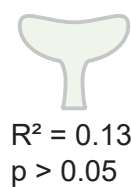
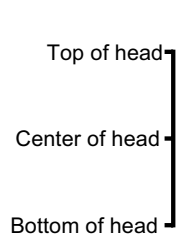
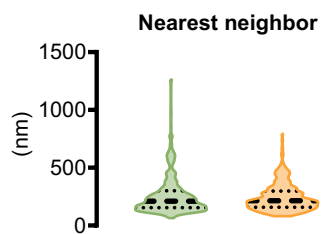
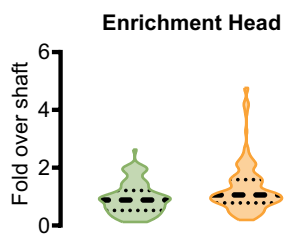
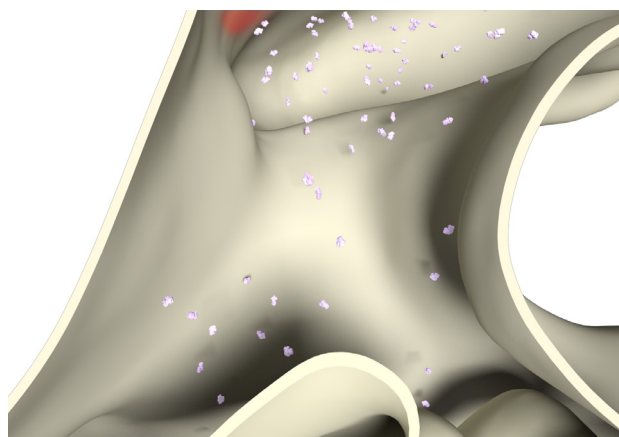
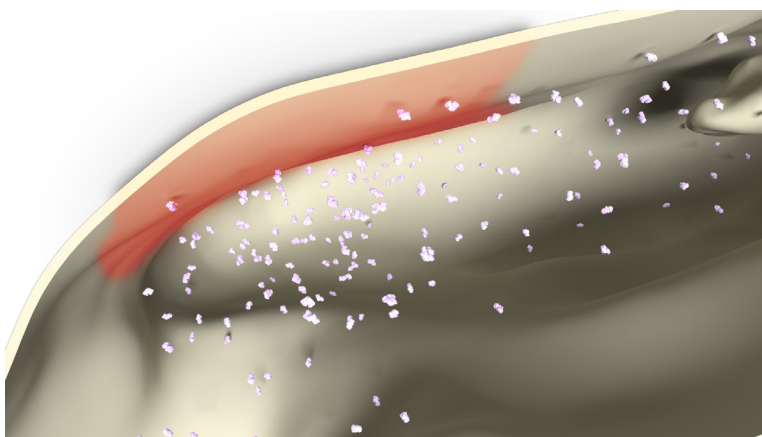
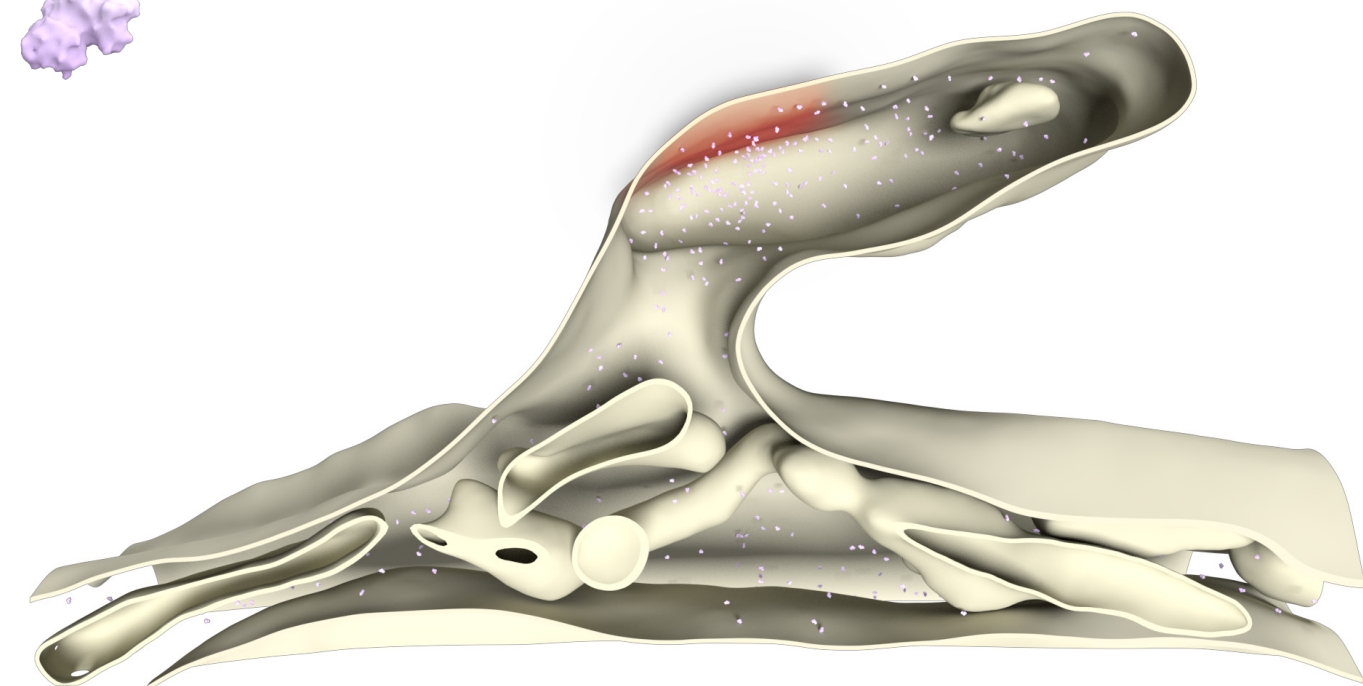
Known organization: Cytosolic

Known Interactions: None

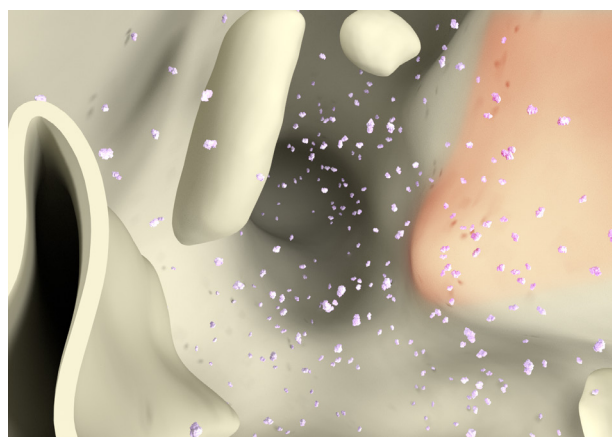
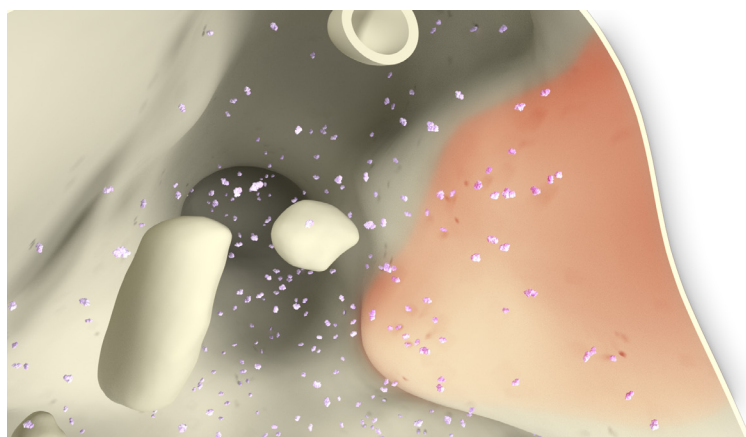
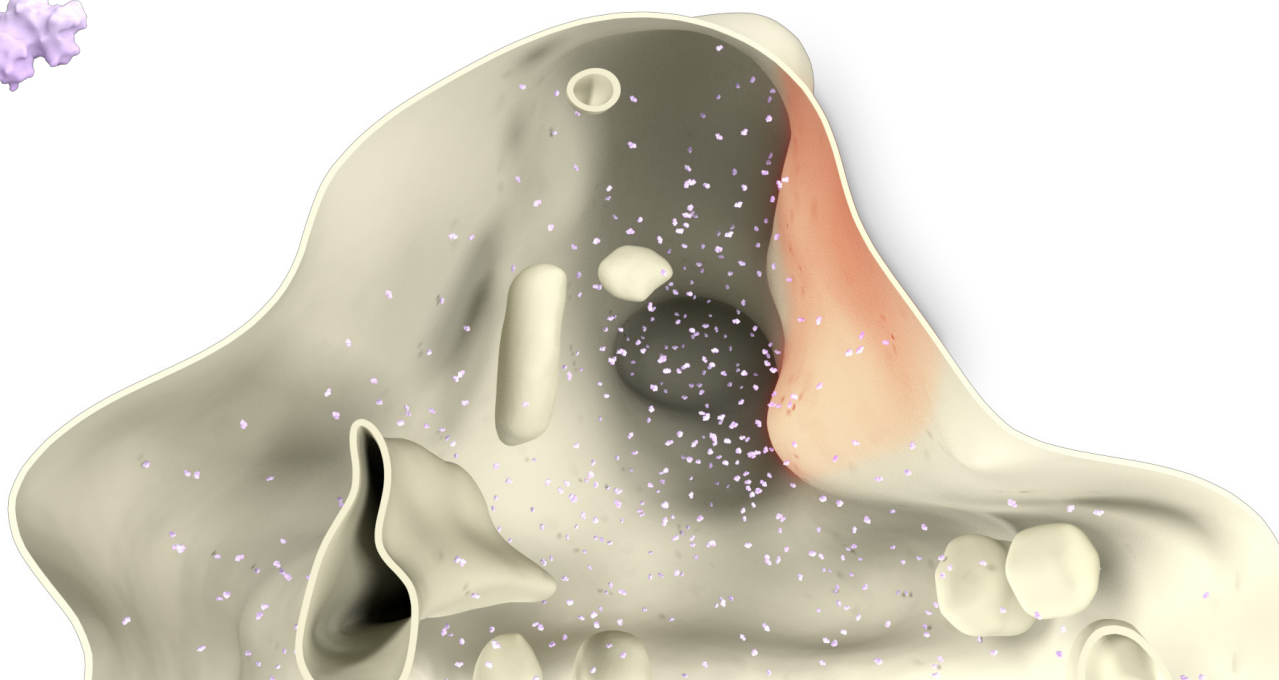
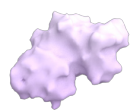


Whole cell copy number	5458926.1 ± 584718.7	
Spine copy number	785.1 ± 190.9	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	685.3 ± 166.6	959.0 ± 233.2
% of total protein	0.1 ± 0.0%	0.1 ± 0.0%
Molarity (μM)	8.7 ± 2.1	9.1 ± 2.2
PSD copy number	138 ± 33.6	246 ± 59.8
% in PSD	20.1 ± 4.9%	25.7 ± 6.2%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	685.3 ± 166.6	$0.1 \pm 0.0\%$	8.7 ± 2.1	138 ± 33.6
Stubby	959.0 ± 233.2	$0.1 \pm 0.0\%$	9.1 ± 2.2	246 ± 59.8



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	685.3 ± 166.6	$0.1 \pm 0.0\%$	8.7 ± 2.1	138 ± 33.6
Stubby	959.0 ± 233.2	$0.1 \pm 0.0\%$	9.1 ± 2.2	246 ± 59.8



References

Antibody: Synaptic Systems 214 002

PDB Identifier: 2g9b

Literature:

Berggard et al., 2002, J. Biol. Chem.

Veenstra et al., 1997, Biochemistry

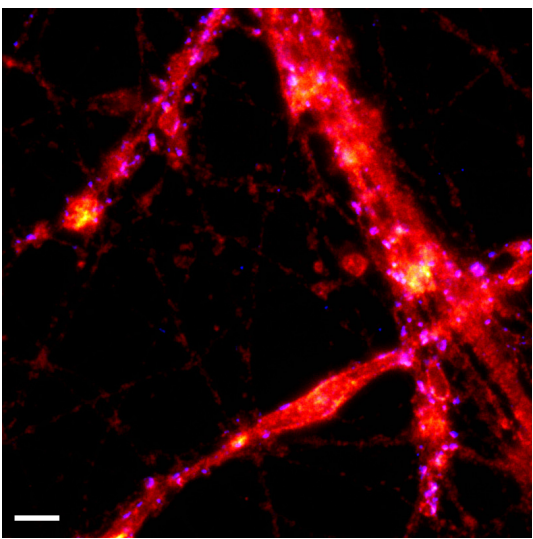
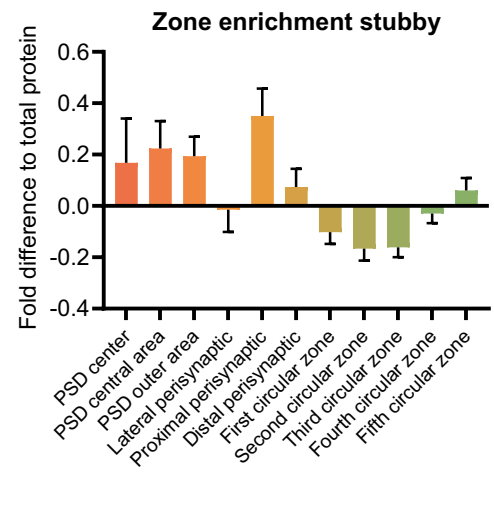
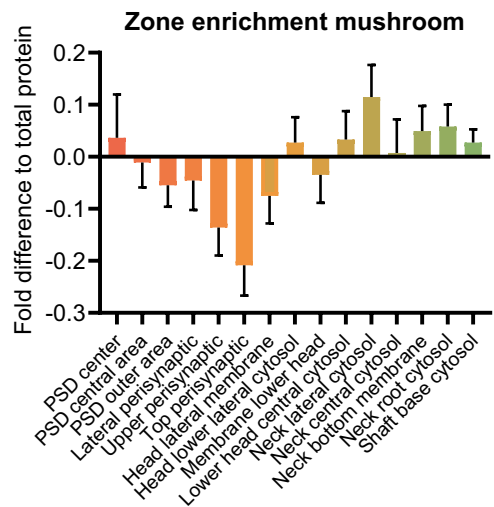
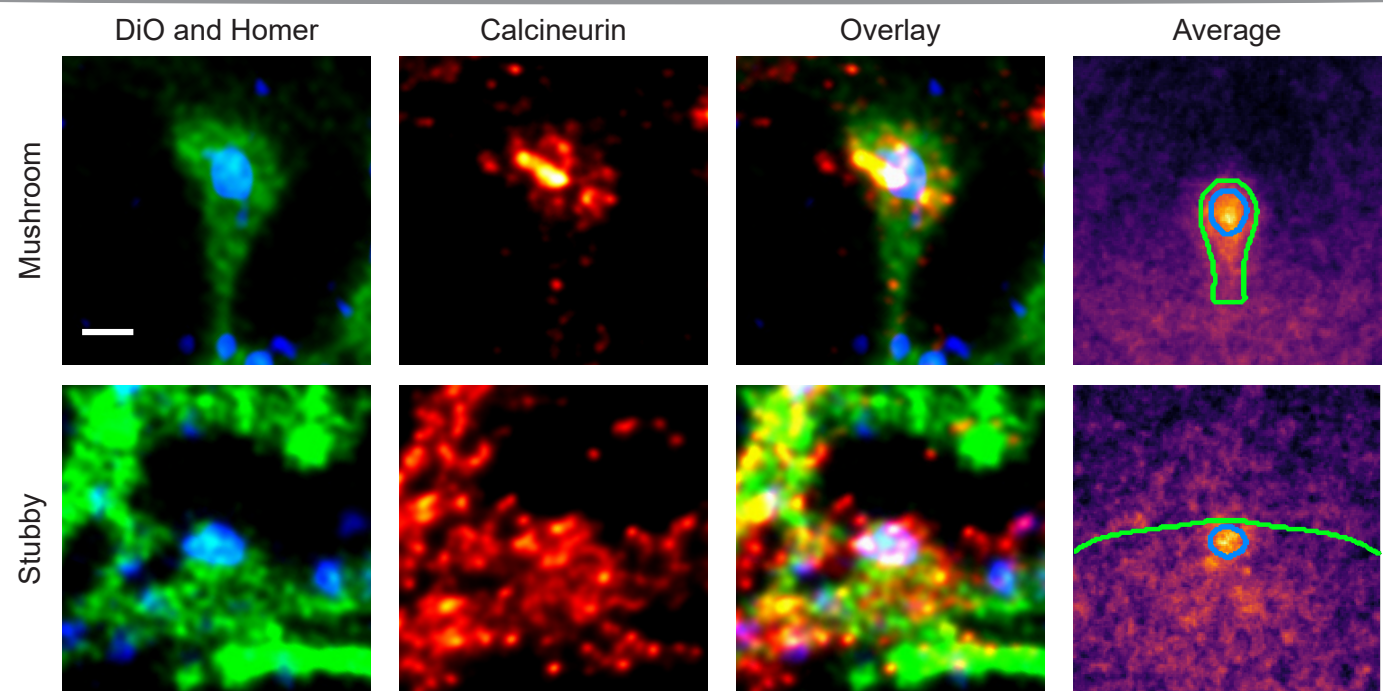
Villa et al., 1994, Eur. J. Neurosci.

Calcineurin (Protein Phosphatase 2B, Gene: Ppp3ca, Uniprot ID: P63329)

Known function: Serine/Threonin Phosphatase, important for LTD

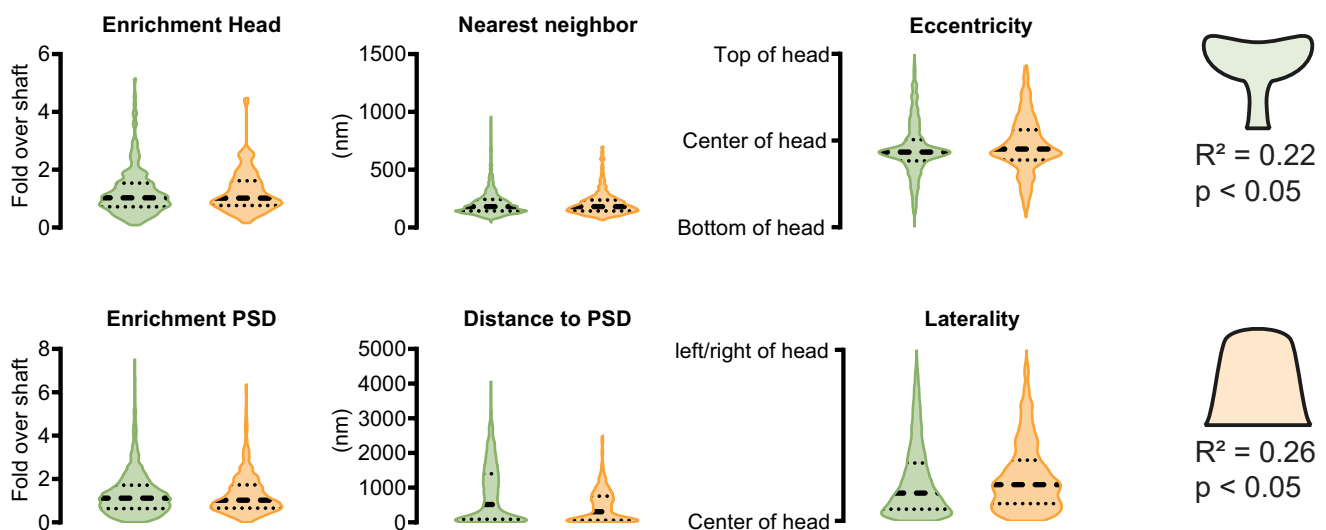
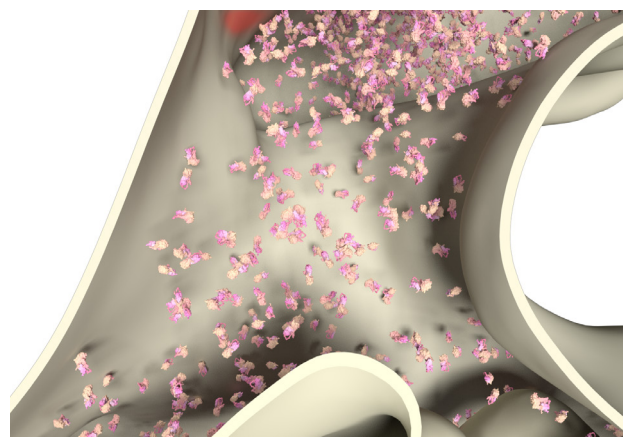
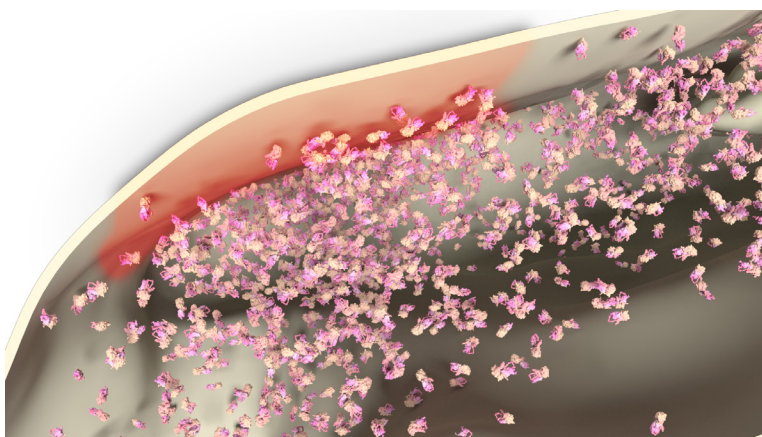
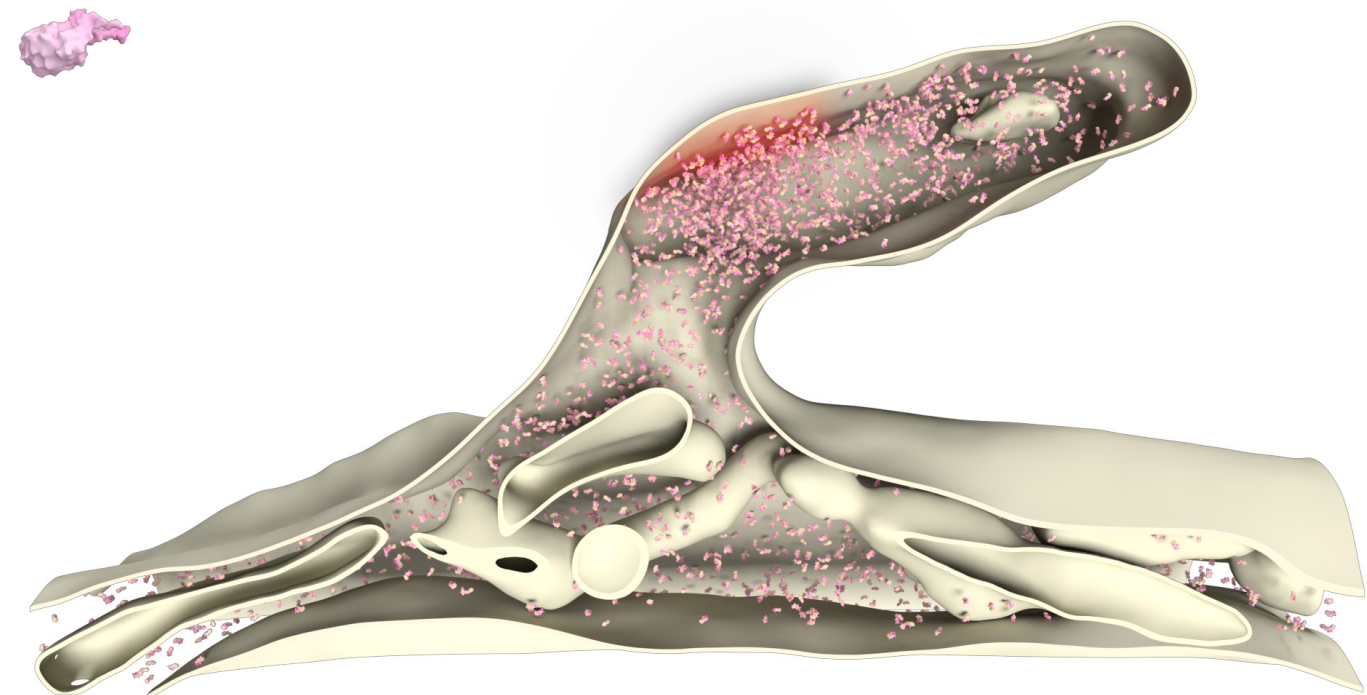
Known organization: Close to PSD, Anchored to PSD95 and PSD93

Known Interactions: actin, AMPA receptors, calcium channels, Dynamin1, NMDA receptors, nNOS, tubulins

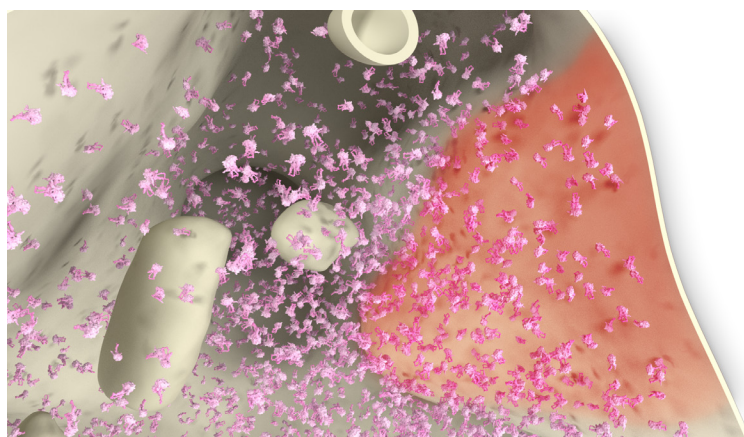
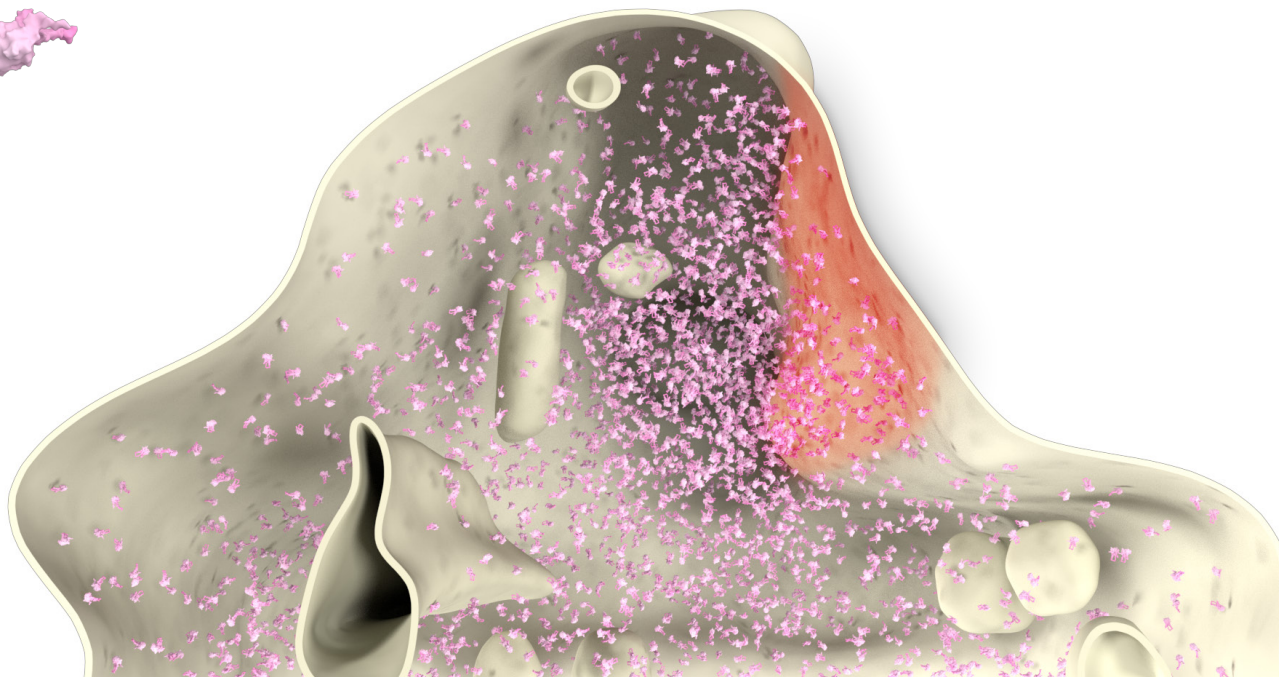
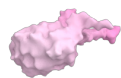


Whole cell copy number	9397256.7 ± 917478.0	
Spine copy number	5086.7 ± 660.3	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	5205.0 ± 675.6	5090.3 ± 660.7
% of total protein	1.5 ± 0.2%	1.2 ± 0.2%
Molarity (µM)	66.1 ± 8.6	48.1 ± 6.2
PSD copy number	1920 ± 249.2	1797 ± 233.3
% in PSD	36.9 ± 4.8%	35.3 ± 4.6%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	5205.0 ± 675.6	$1.5 \pm 0.2\%$	66.1 ± 8.6	1920 ± 249.2
Stubby	5090.3 ± 660.7	$1.2 \pm 0.2\%$	48.1 ± 6.2	1797 ± 233.3



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	5205.0 ± 675.6	$1.5 \pm 0.2\%$	66.1 ± 8.6	1920 ± 249.2
Stubby	5090.3 ± 660.7	$1.2 \pm 0.2\%$	48.1 ± 6.2	1797 ± 233.3



References

Antibody: Synaptic Systems 387 002

PDB Identifier: 4il1

Literature:

Coghlan et al., 1995, Science

Dawson et al., 1993, Proc. Natl. Acad. Sci. U S A

Day et al., 2002, J. Neurosci.

Fraser & Scott, 1999, Neuron

Goto et al., 1985, J. Neurochem.

Groth et al., 2003, Biochem. Biophys. Res. Comm.

Halpain et al., 1998, J. Neurosci.

Hernandez-Lopez et al., 2000, J. Neurosci.

Liebermann et al., 1994, Nature

Liu et al., 1994, Science

Mandelkow et al., 1995, Neurobiol.

Mulkey et al., 1994, Nature

Norris et al., 2002, Neuroscience

Tong et al., 1995, Science

Traynelis et al., 1997, J. Physiol.

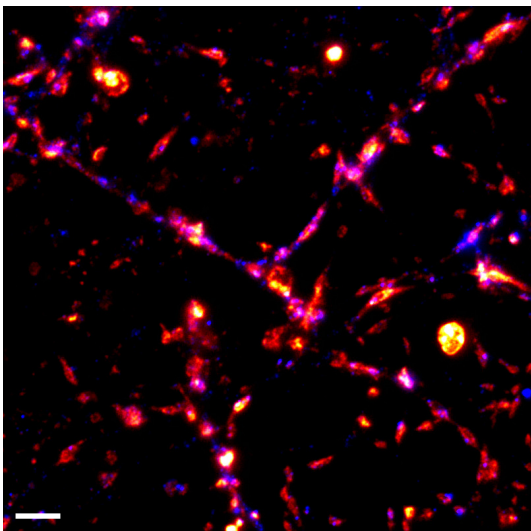
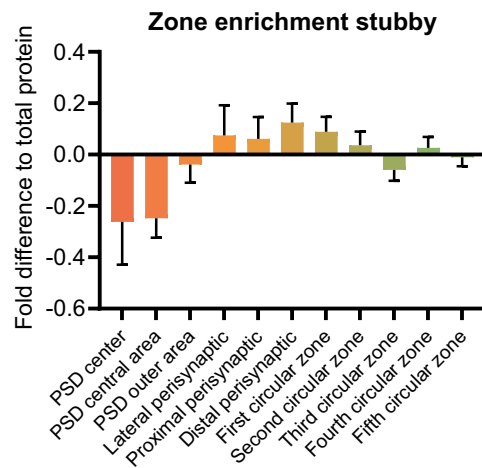
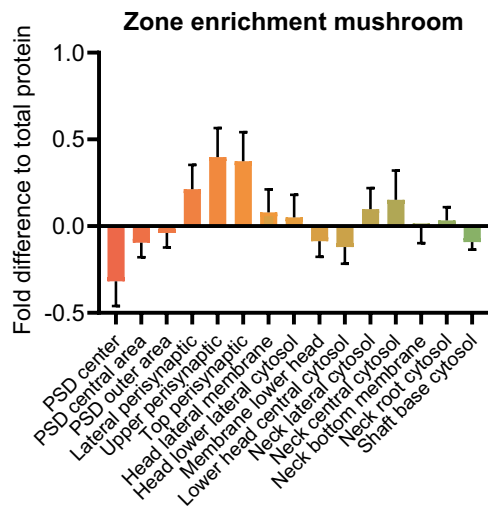
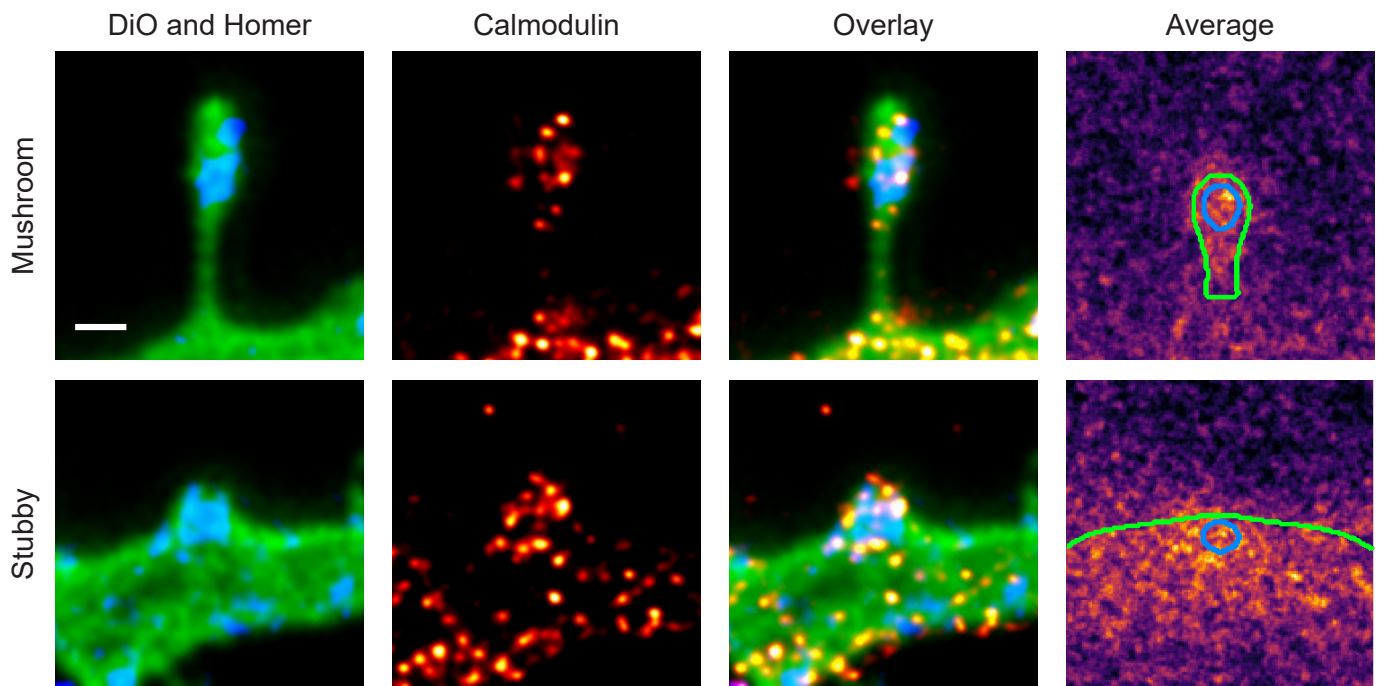
Zeng et al., 2001, Cell

Calmodulin (Gene: *Calm*, Uniprot ID: P0DP29)

Known function: Important calcium binding protein, Regulates over 100 target proteins.

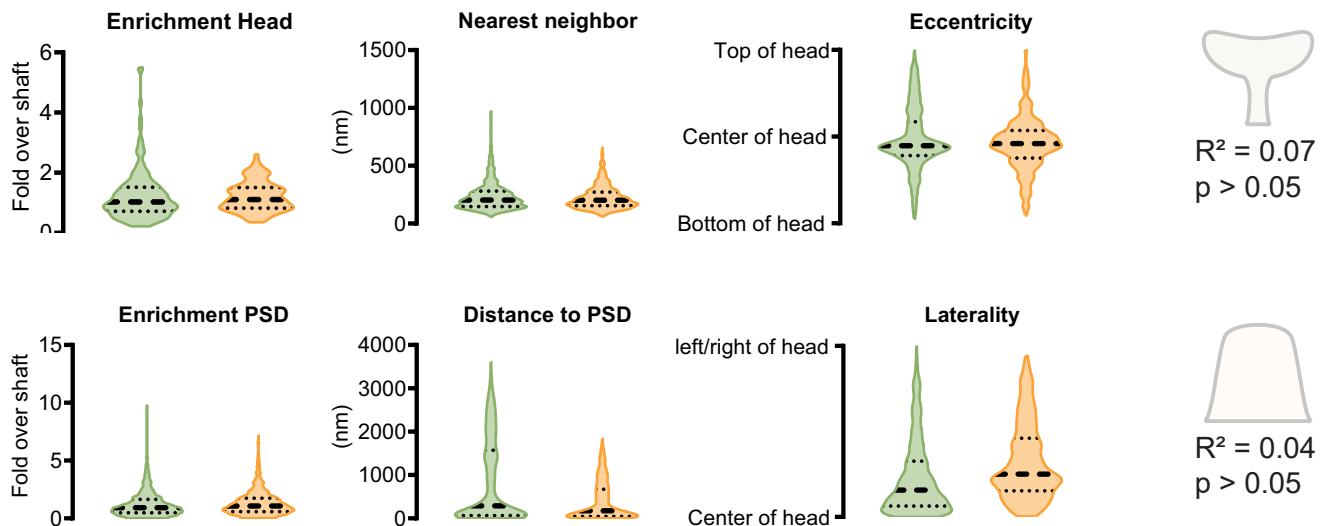
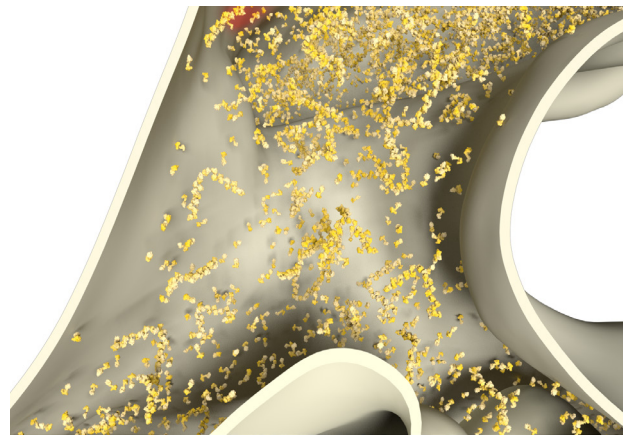
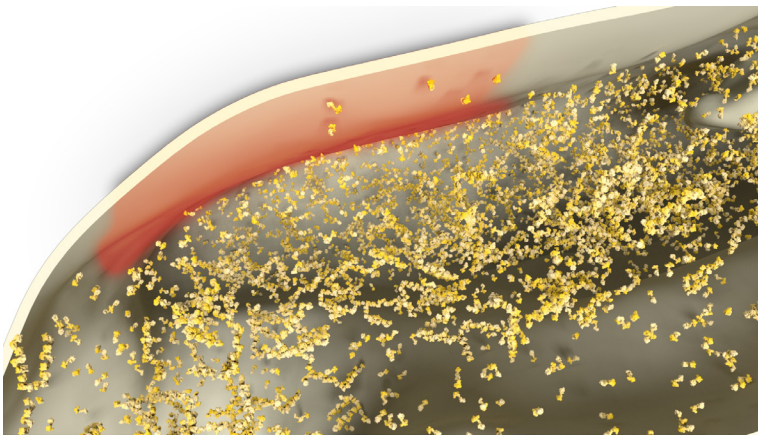
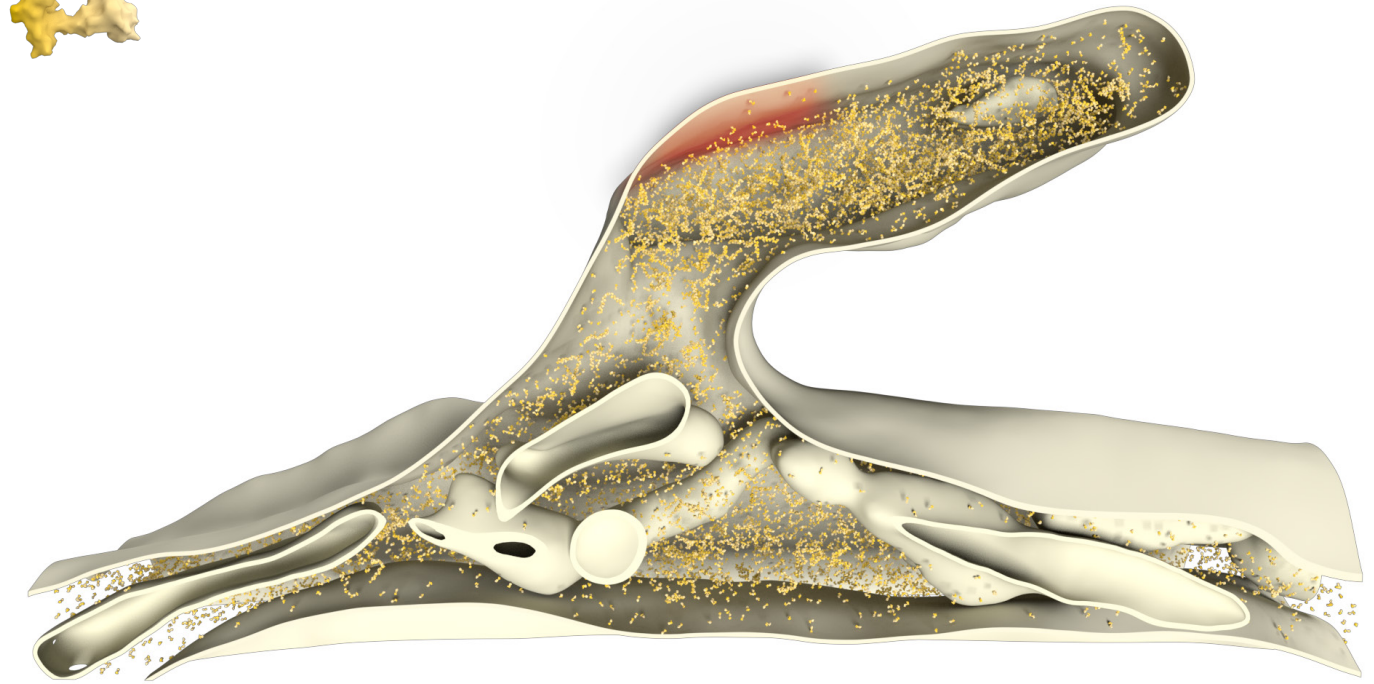
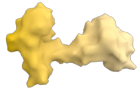
Known organization: Cytosolic. Also membrane-attached via interaction with neurogranin

Known Interactions: CaMKII, Calcineurin, Calcium channels, nNOS, PSD95

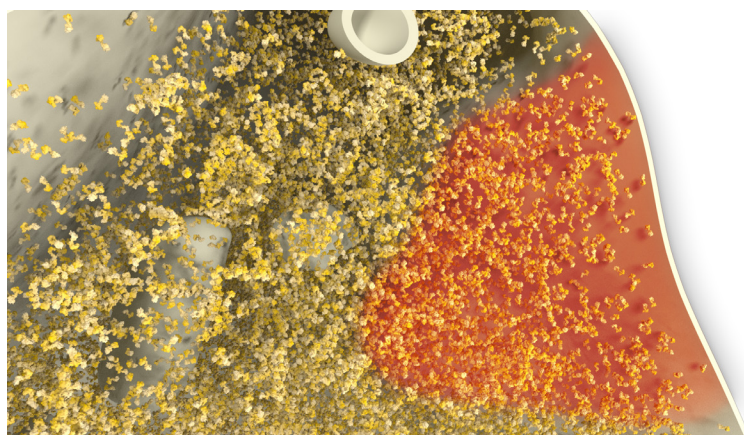
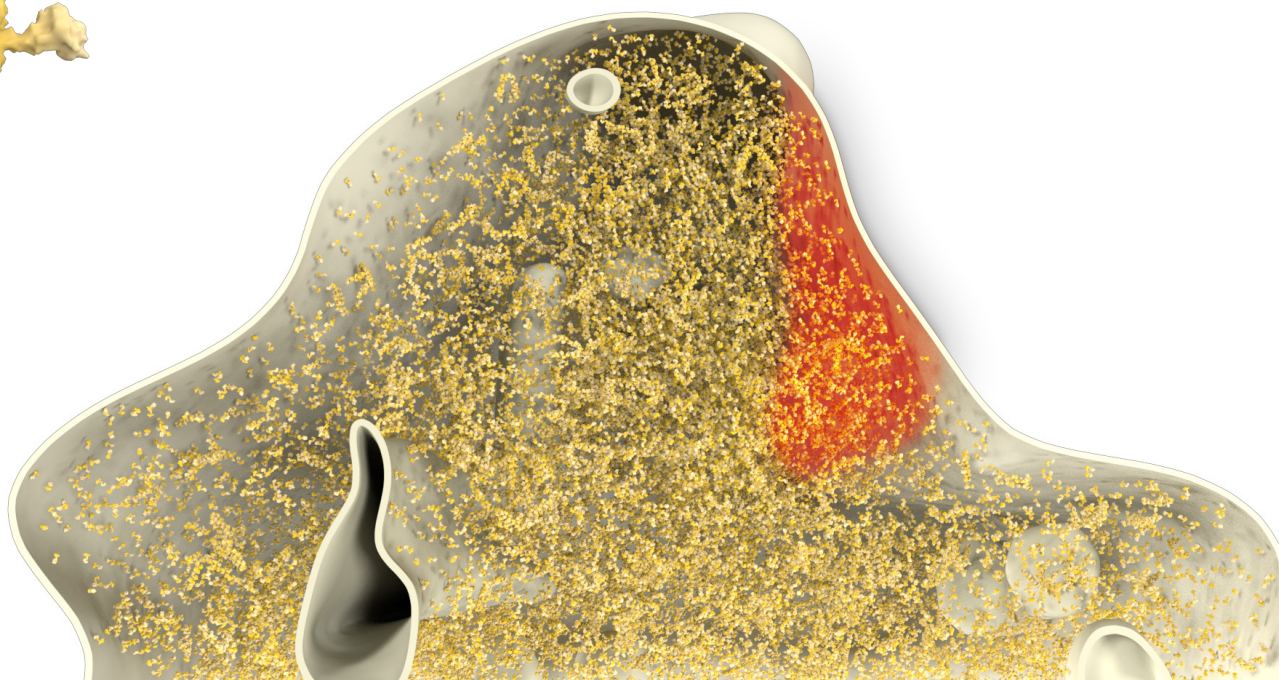
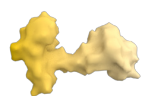


Whole cell copy number	287210966.5 ± 61193722.7	
Spine copy number	36712.8 ± 17167.3	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	32696.6 ± 15289.2	39629.3 ± 18531.0
% of total protein	2.7 ± 1.3%	2.8 ± 1.3%
Molarity (μM)	415.2 ± 194.2	374.5 ± 175.1
PSD copy number	6188 ± 2893.6	4793 ± 2241.3
% in PSD	18.9 ± 8.8%	12.1 ± 5.7%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	32696.6 ± 15289.2	$2.7 \pm 1.3\%$	415.2 ± 194.2	6188 ± 2893.6
Stubby	39629.3 ± 18531.0	$2.8 \pm 1.3\%$	374.5 ± 175.1	4793 ± 2241.3



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	32696.6 ± 15289.2	$2.7 \pm 1.3\%$	415.2 ± 194.2	6188 ± 2893.6
Stubby	39629.3 ± 18531.0	$2.8 \pm 1.3\%$	374.5 ± 175.1	4793 ± 2241.3



References

Antibody: Abcam ab45689

PDB Identifier: 1up5

Literature:

Bartos et al., 2010, J. Neurosci.

Baudier et al., 1991, J. Biol. Chem.

Chowdhury et al., 2017, EMBO J.

Fukunaga et al., 2005, J. Biochem

Olwin et al., 1984, Adv. Cyclic. Nucleotide Protein

Phosphorylation Res.

Prichard et al., 1999, J. Biol. Chem.

Xia and Storm, 2005, Nat. Rev. Neurosci.

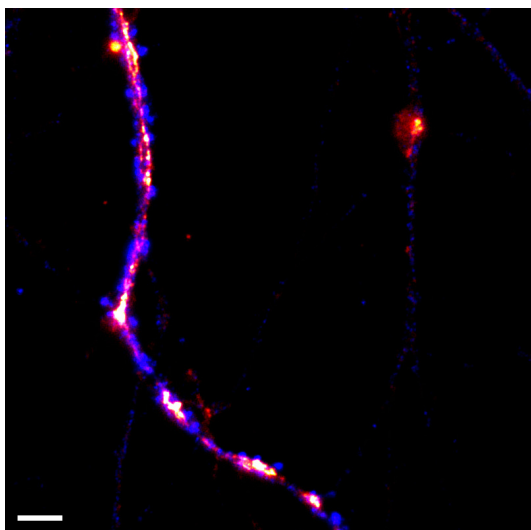
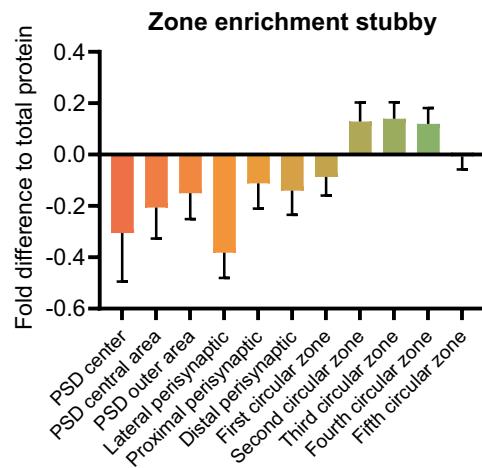
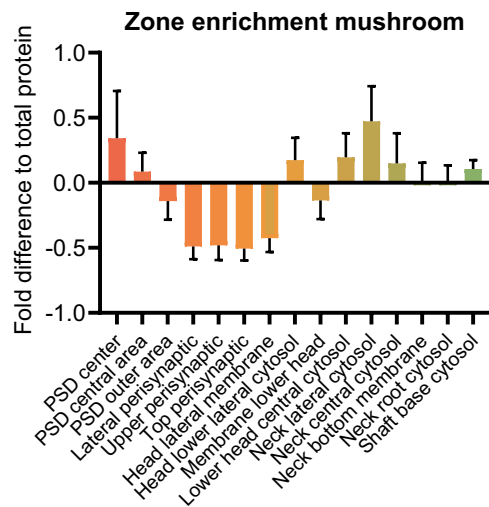
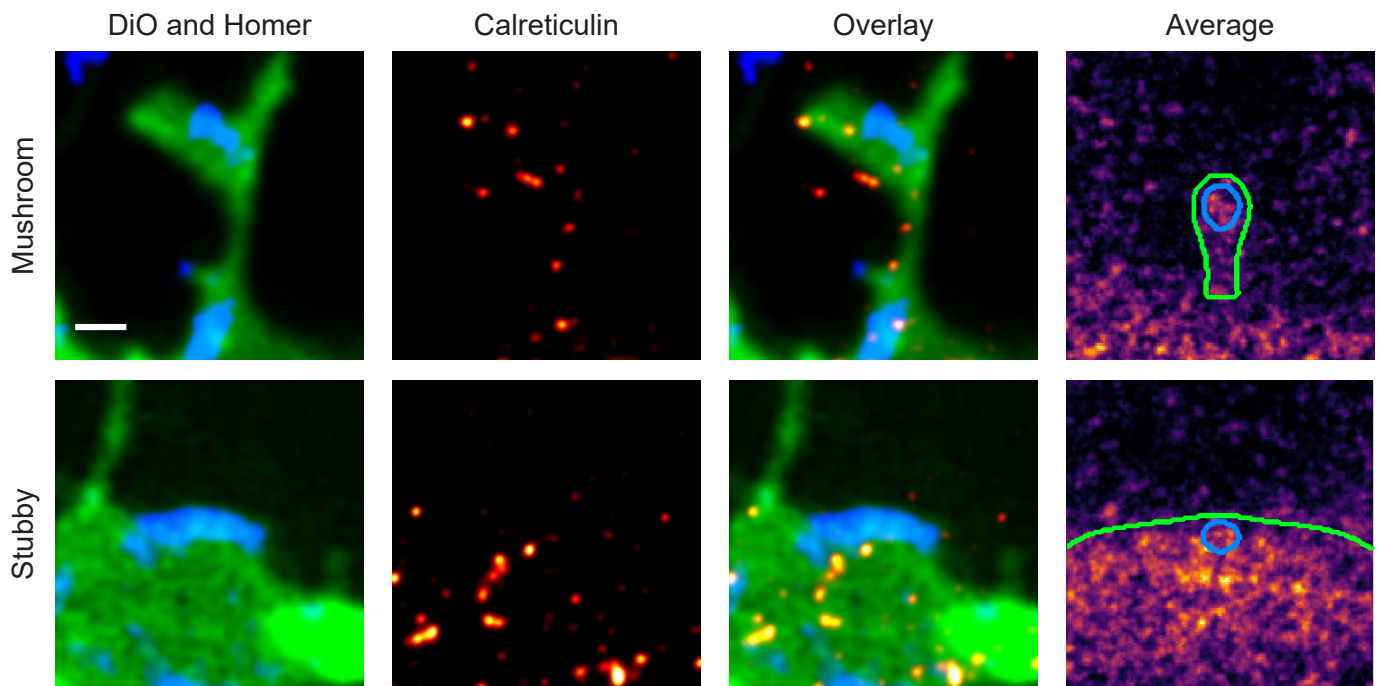
Zhang et al., 2014, EMBO J.

Calreticulin (CALBP, Gene: Calr, Uniprot ID: P18418)

Known function: ER resident chaperone, Calcium buffer

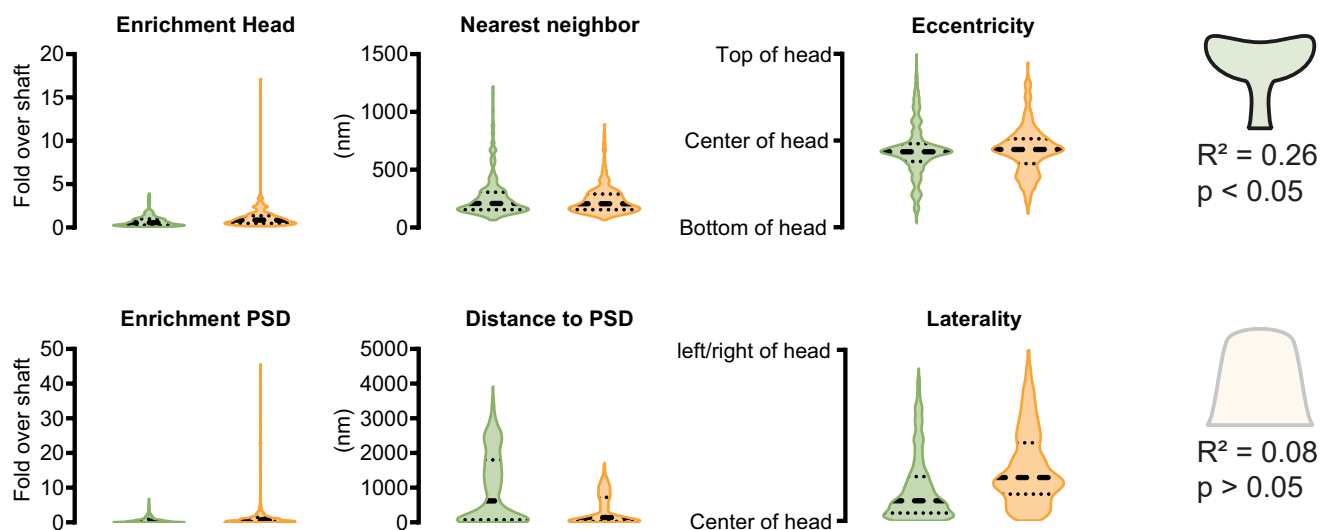
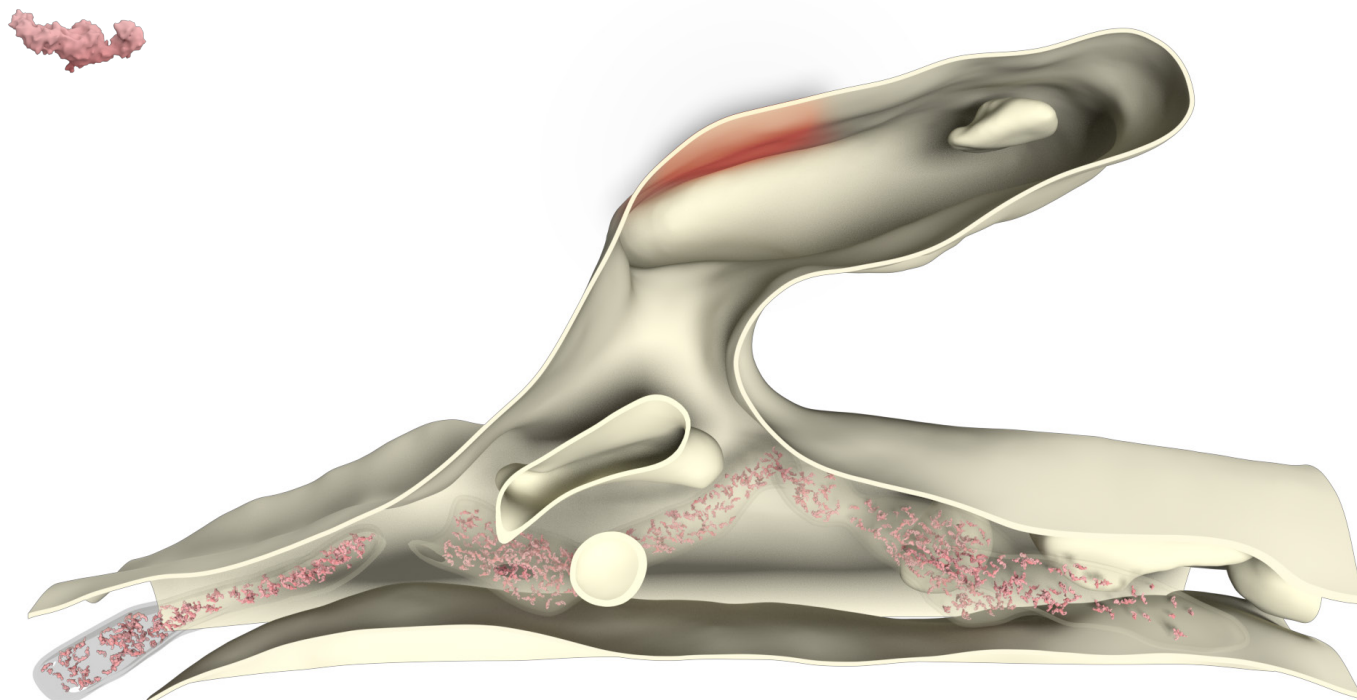
Known organization: ER lumen

Known Interactions: None

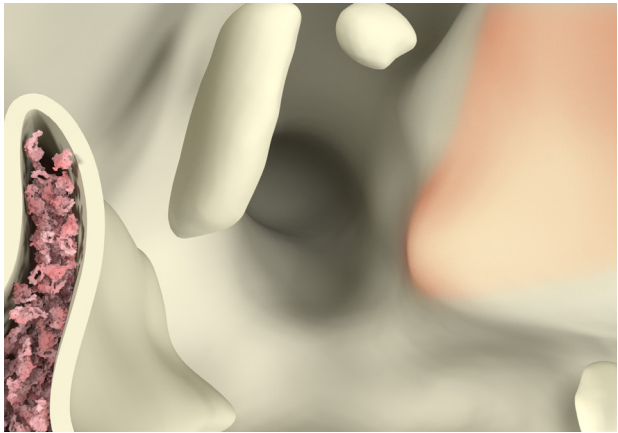
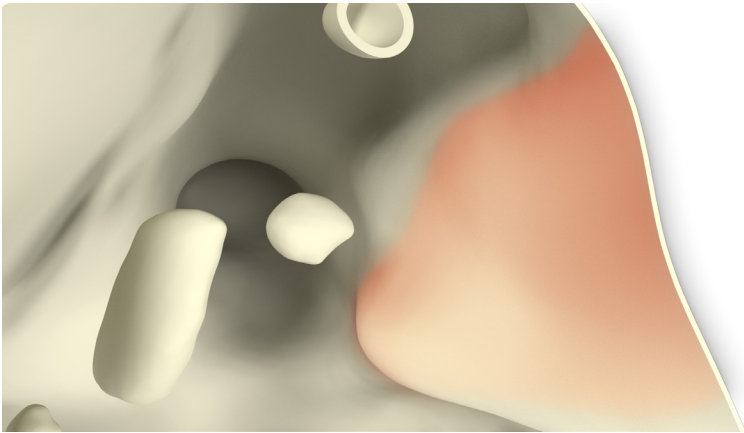
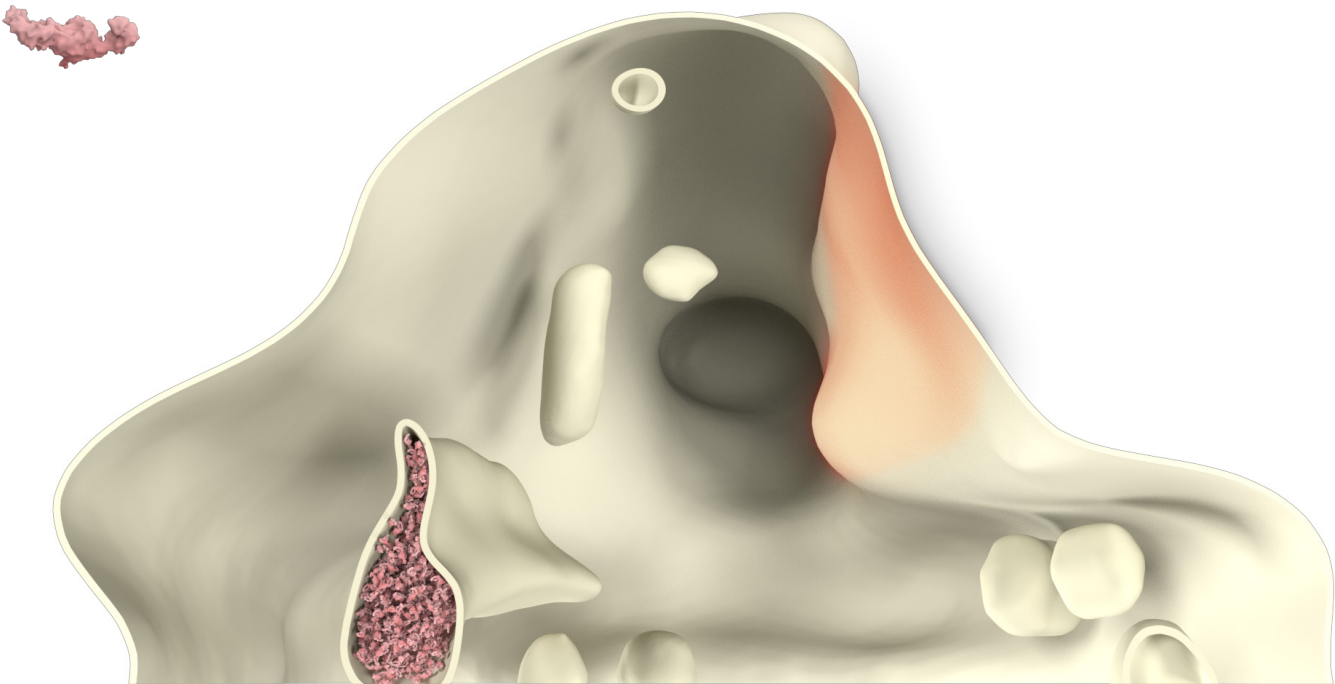


Whole cell copy number	24658920.2 ± 2226817.7	
Spine copy number	2222.9 ± 673.6	
Function	Organelles	
	Mushroom	Stubby
Spine copy number	1479.3 ± 448.3	3126.5 ± 947.4
% of total protein	0.3 ± 0.1%	0.6 ± 0.2%
Molarity (μM)	18.8 ± 5.7	29.5 ± 9.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1479.3 ± 448.3	$0.3 \pm 0.1\%$	18.8 ± 5.7	0 ± 0.0
Stubby	3126.5 ± 947.4	$0.6 \pm 0.2\%$	29.5 ± 9.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1479.3 ± 448.3	$0.3 \pm 0.1\%$	18.8 ± 5.7	0 ± 0.0
Stubby	3126.5 ± 947.4	$0.6 \pm 0.2\%$	29.5 ± 9.0	0 ± 0.0



References

Antibody: Cell Signaling 12238

PDB Identifier: 1hhn, 3o0v

Literature:

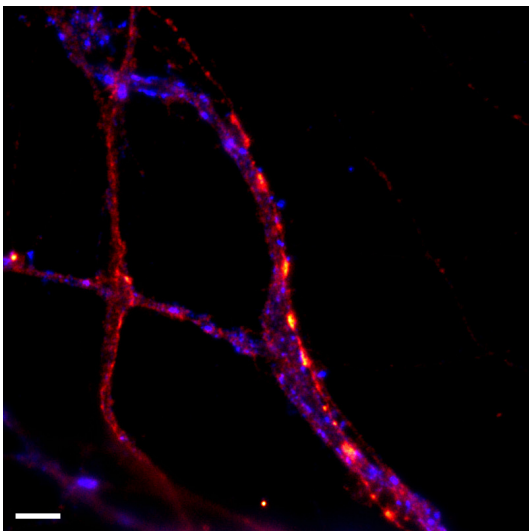
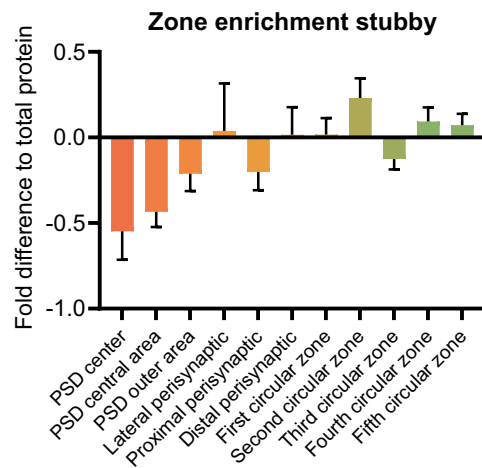
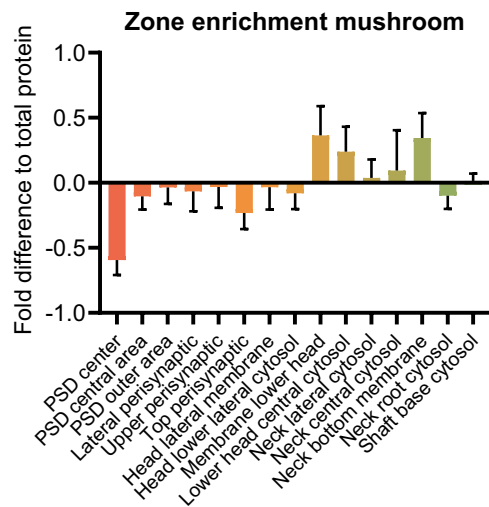
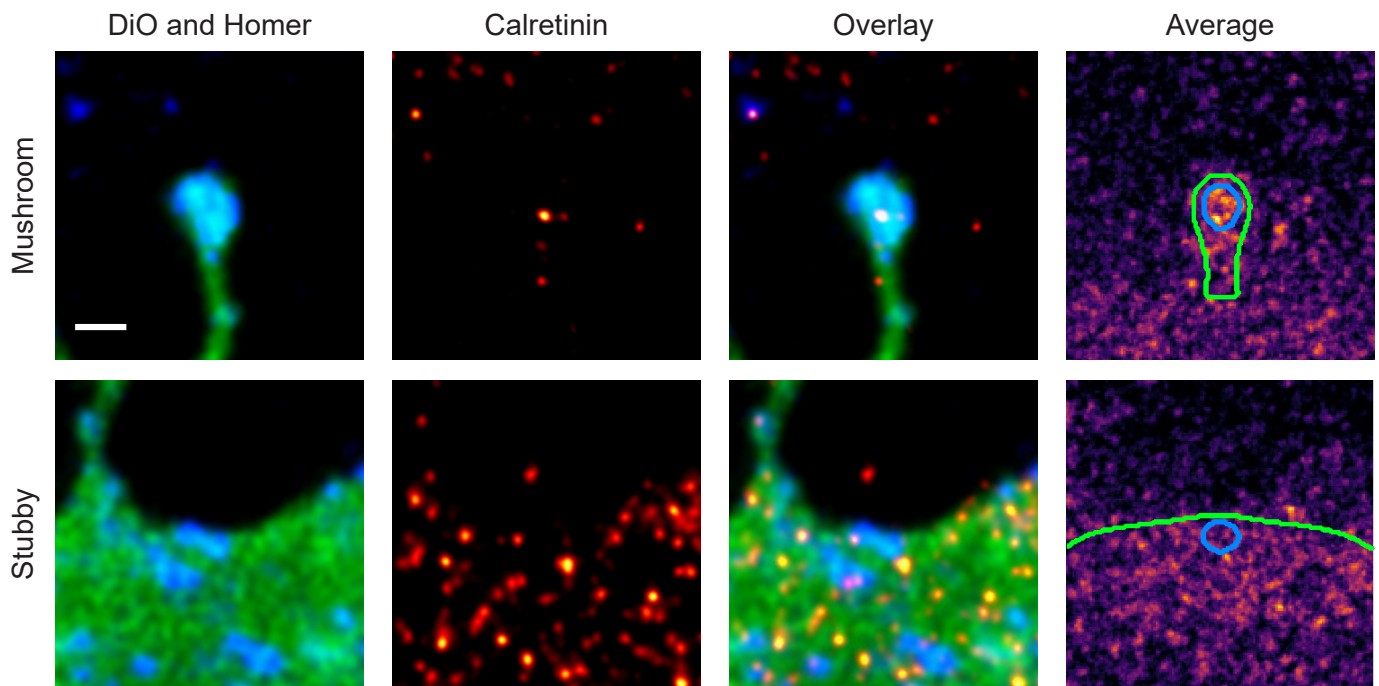
Bedard et al., 2005, Int. Rev. Cytol.
Hebert and Molinari, 2007, Physiol Rev.
Nakamura et al., 2001, J. Cell. Biol.

Calretinin (Gene: Calb2, Uniprot ID: P47728)

Known function: Calcium binding protein

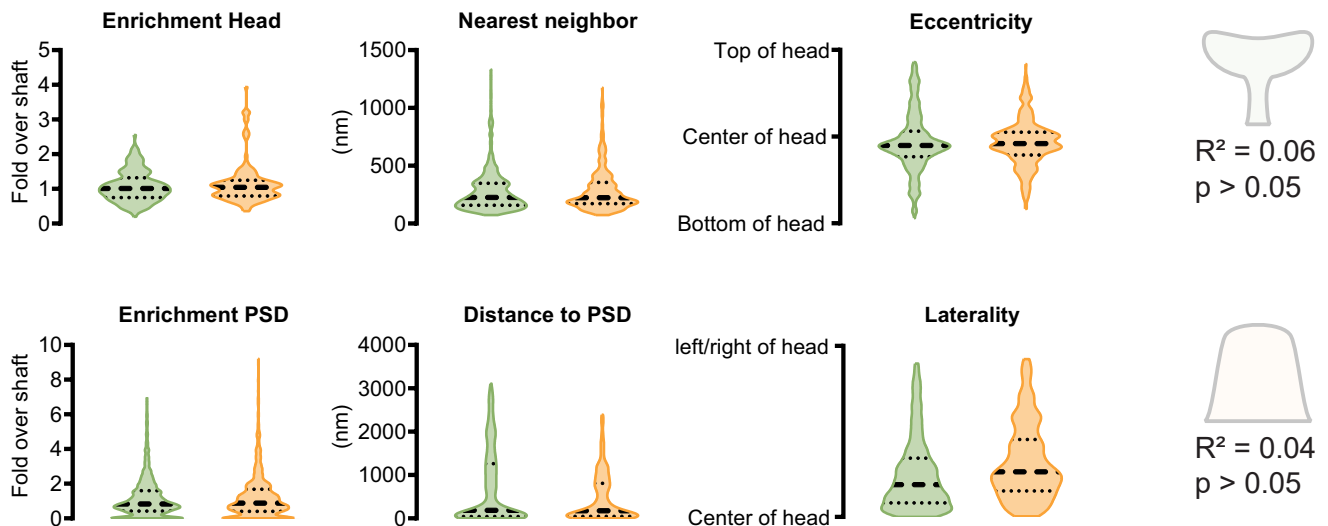
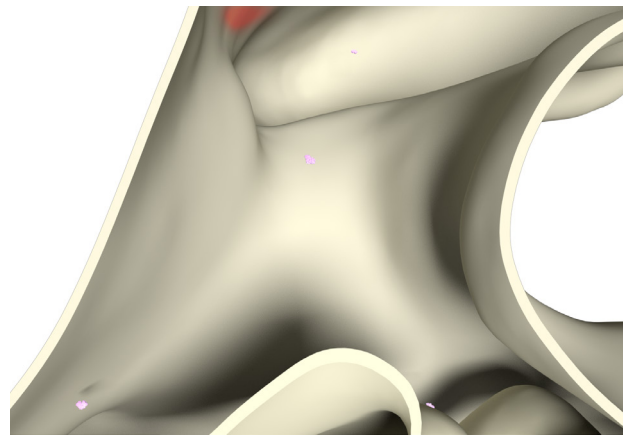
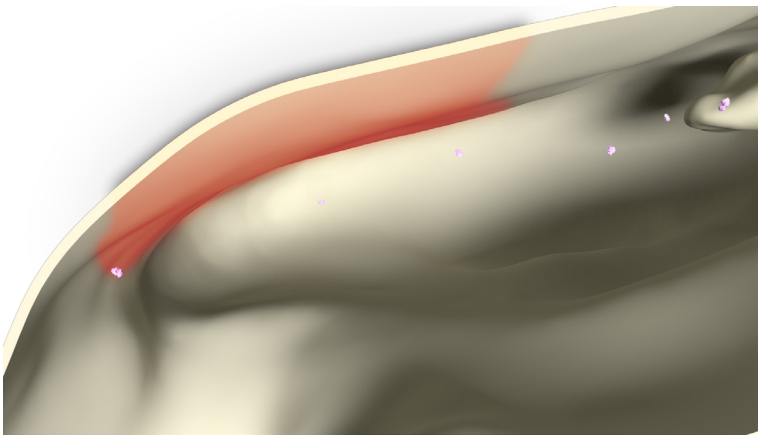
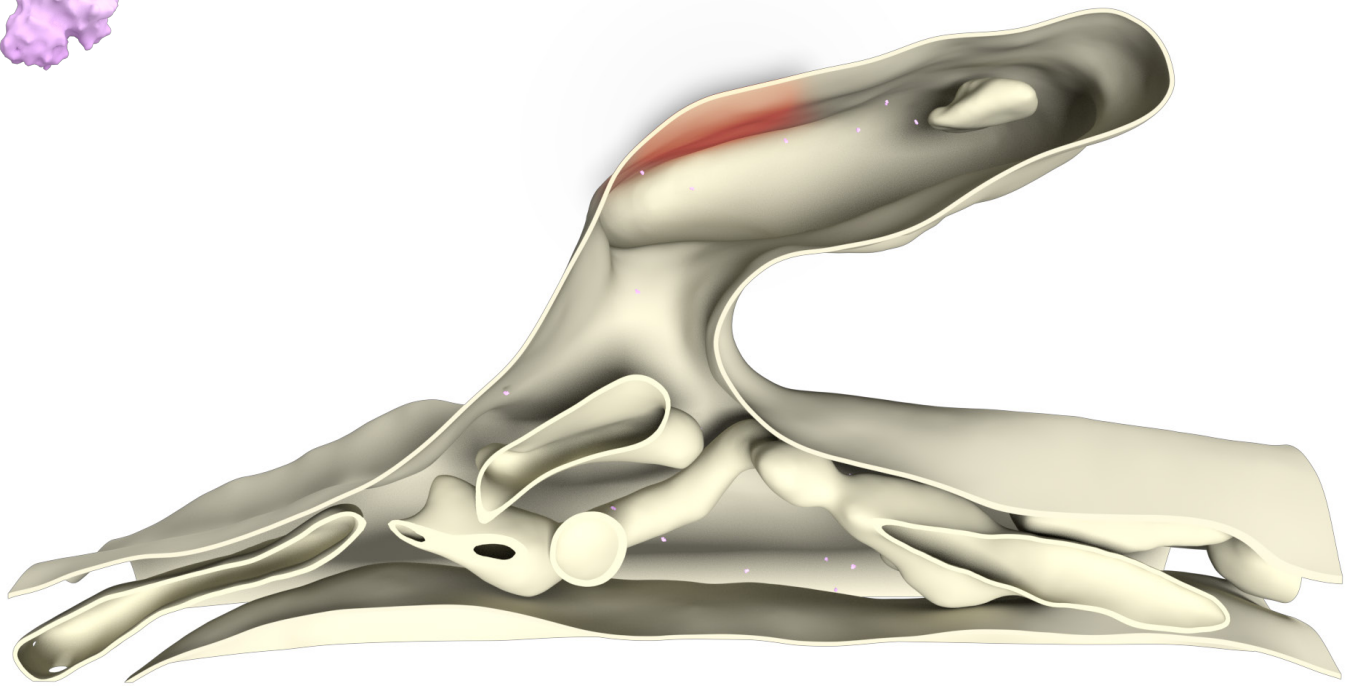
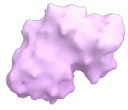
Known organization: Cytosolic

Known Interactions: Ca_v2.1

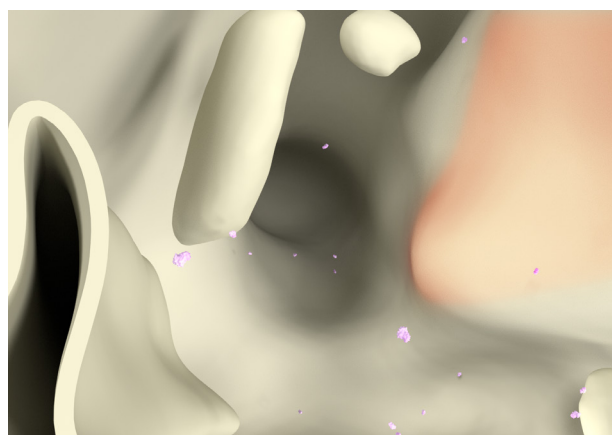
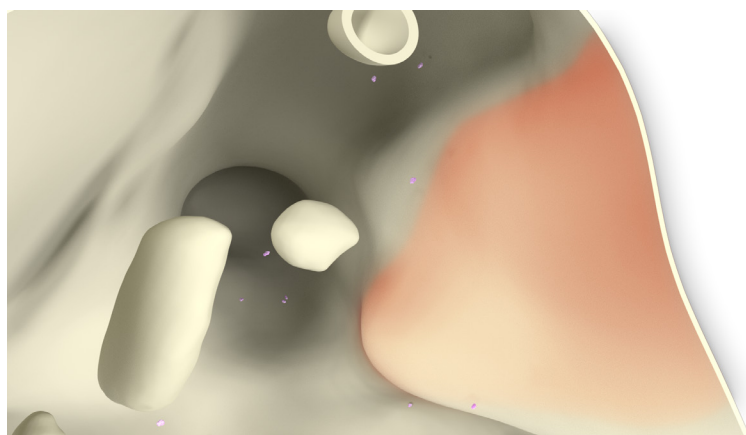
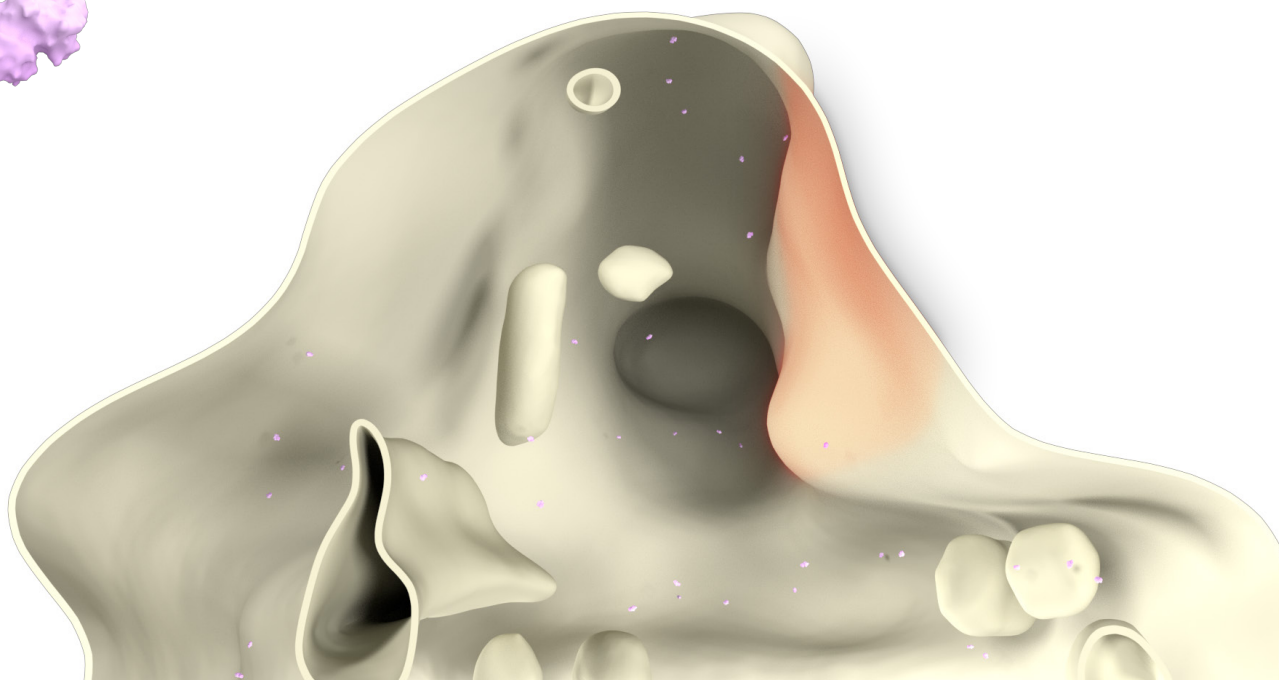
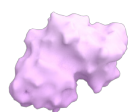


Whole cell copy number	914295.6 ± 370757.9	
Spine copy number	66.2 ± 34.4	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	59.0 ± 30.7	73.2 ± 38.1
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.7 ± 0.4	0.7 ± 0.4
PSD copy number	12 ± 6.2	4 ± 2.1
% in PSD	20.3 ± 10.6%	10.6 ± 5.5%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	59.0 ± 30.7	$0.0 \pm 0.0\%$	0.7 ± 0.4	12 ± 6.2
Stubby	73.2 ± 38.1	$0.0 \pm 0.0\%$	0.7 ± 0.4	4 ± 2.1



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	59.0 ± 30.7	$0.0 \pm 0.0\%$	0.7 ± 0.4	12 ± 6.2
Stubby	73.2 ± 38.1	$0.0 \pm 0.0\%$	0.7 ± 0.4	4 ± 2.1



References

Antibody: Novus Biologicals NBP1-88220

PDB Identifier: Modelled with I-TASSER

Literature:

Christel et al., 2012, J. Biol. Chem.

Dargan et al., 2004, J. Physiol.

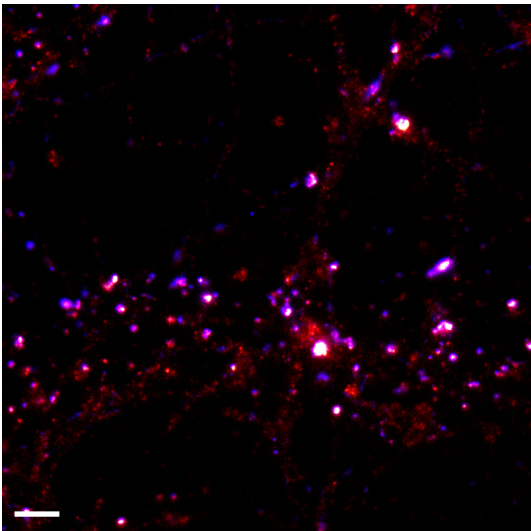
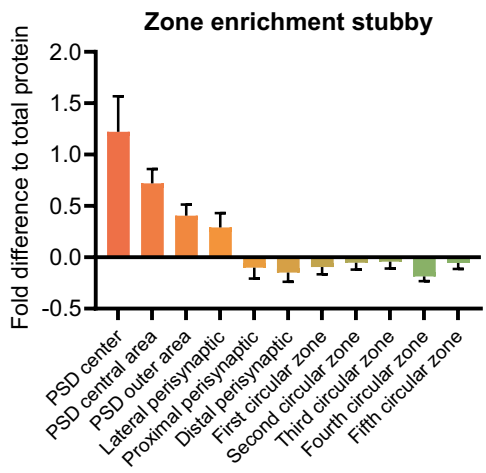
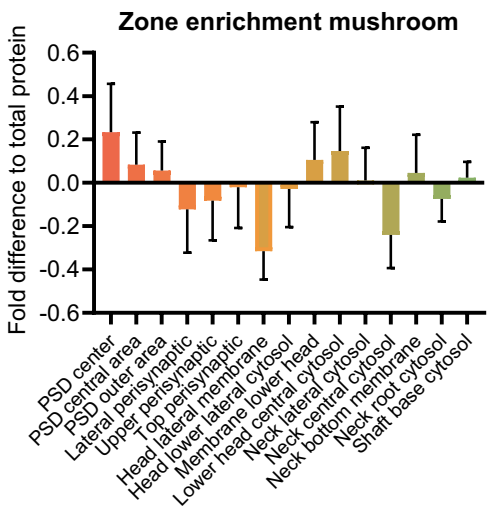
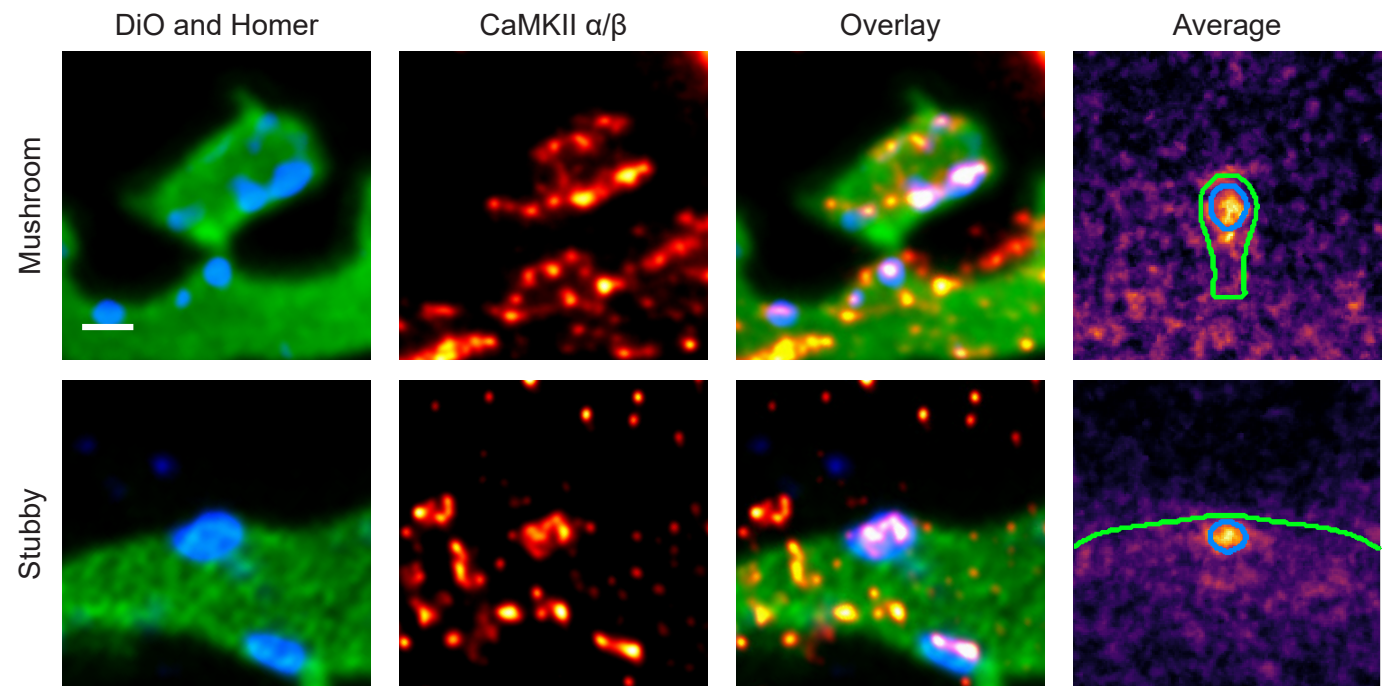
Molgaard et al., 2014, F1000Res.

CaMKII α/β (Genes: Camk2a, Camk2b Uniprot ID: P11275, P08413)

Known function: Central kinase in dendritic spines, Involved in synaptic plasticity

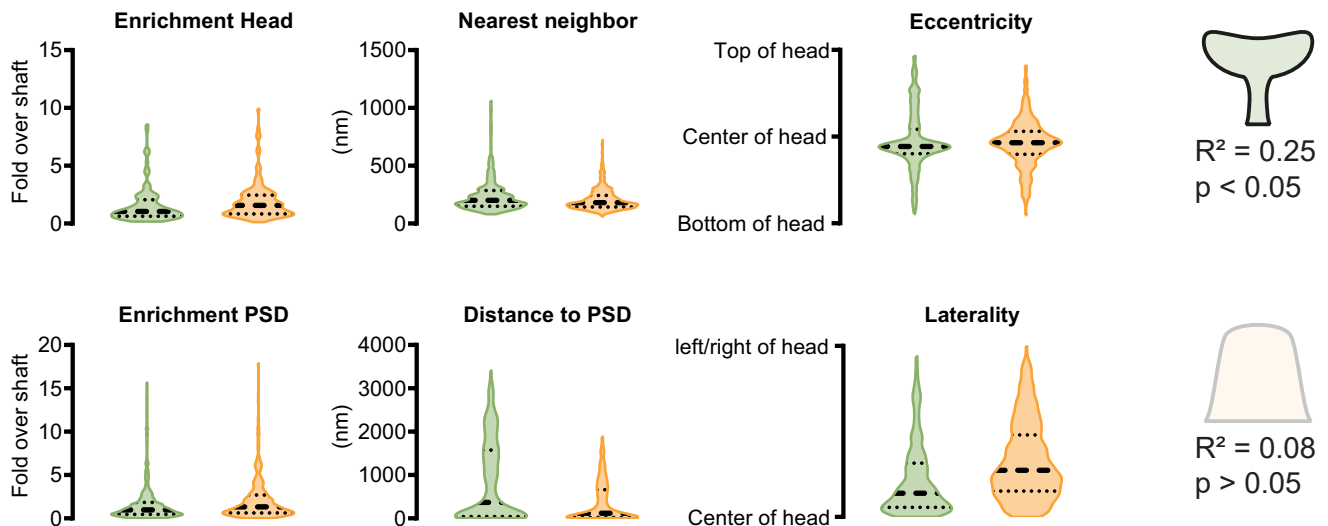
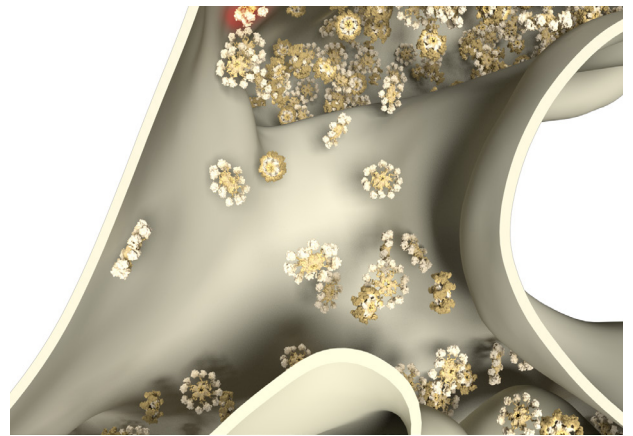
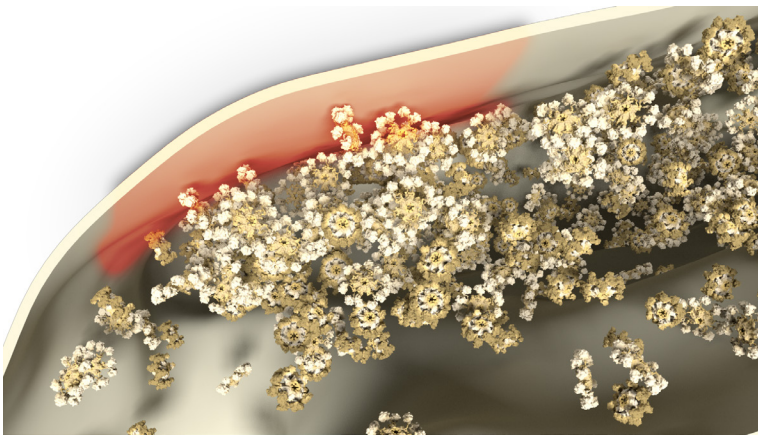
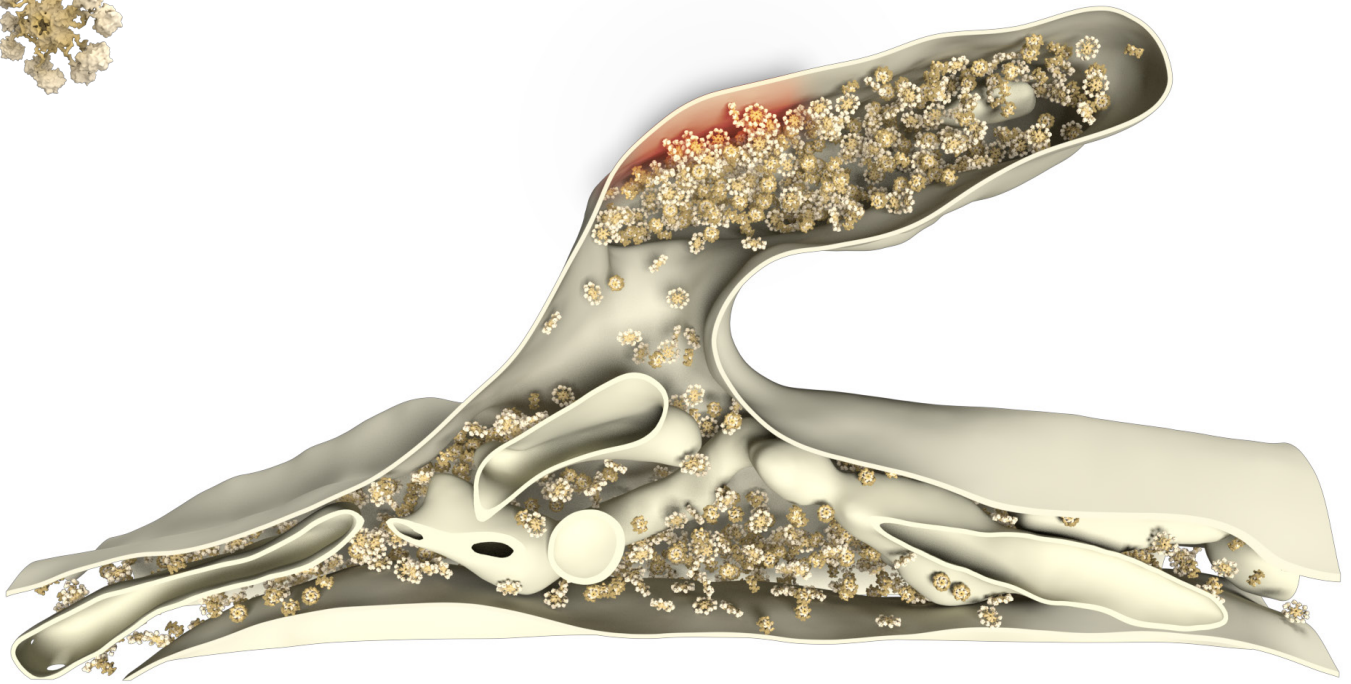
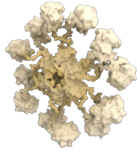
Known organization: Cytosolic, Forms dodecamer

Known Interactions: AMPA receptors, Calmodulin, Ca_v2.1, CDC42, GluN2B, Homer proteins, PSD95, F-actin

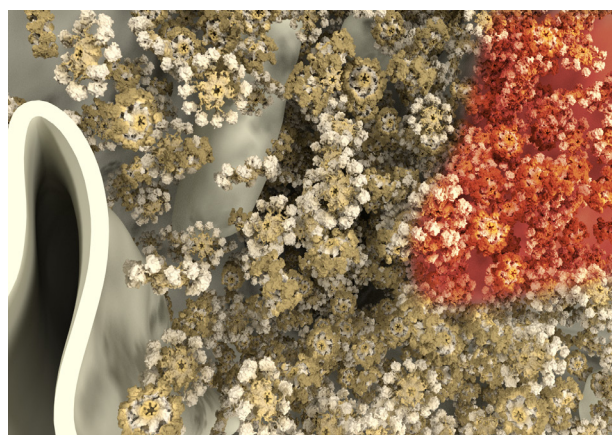
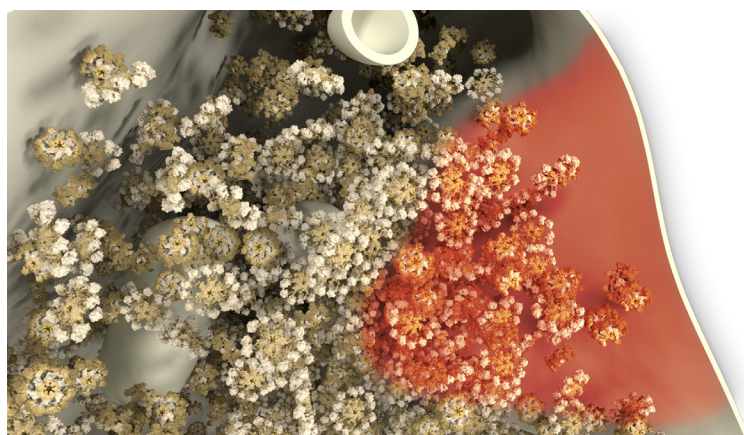
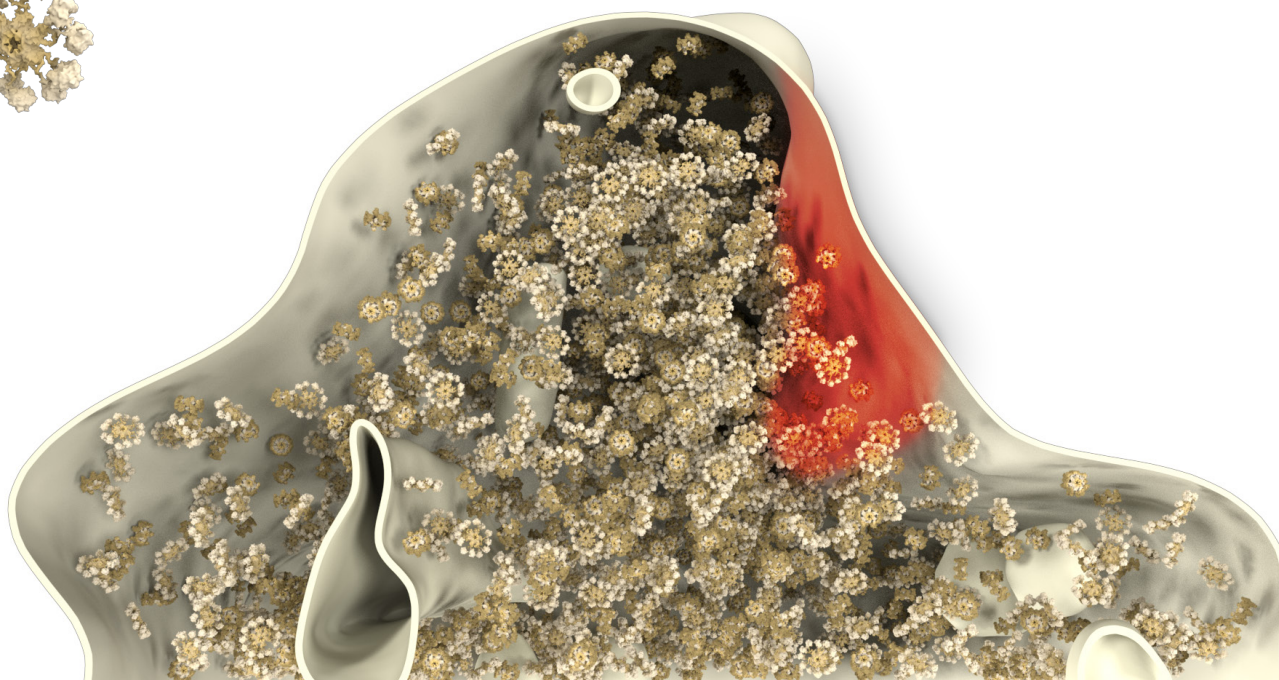
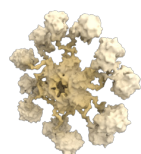


Whole cell copy number	40160274.0 \pm 3071548.5	
Spine copy number	32336.3 \pm 4031.2	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	25863.6 \pm 3224.3	42099.6 \pm 5248.3
% of total protein	7.9 \pm 1.0%	11.0 \pm 1.4%
Molarity (μ M)	328.5 \pm 40.9	397.9 \pm 49.6
PSD copy number	7337 \pm 914.7	19450 \pm 2424.7
% in PSD	28.4 \pm 3.5%	46.2 \pm 5.8%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	25863.6 ± 3224.3	$7.9 \pm 1.0\%$	328.5 ± 40.9	7337 ± 914.7
Stubby	42099.6 ± 5248.3	$11.0 \pm 1.4\%$	397.9 ± 49.6	19450 ± 2424.7



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	25863.6 ± 3224.3	$7.9 \pm 1.0\%$	328.5 ± 40.9	7337 ± 914.7
Stubby	42099.6 ± 5248.3	$11.0 \pm 1.4\%$	397.9 ± 49.6	19450 ± 2424.7



References

Antibody: Abnova MAB6627

PDB Identifier: 5u6y

Literature:

Barria et al., 1997, Science

Braun and Schulman, 1995, Annu. Rev. Physiol.

Chao et al., 2011, Cell

Colbran and Brown, 2004, Curr. Opin. Neurobiol.

Fink et al., 2003, Neuron

Gardoni et al., 2006, Eur. J. Neurosci.

Halt et al., 2012, EMBO J.

Hell, 2014, Neuron

Jiang et al., 2008,, Proc. Natl. Acad. Sci. U S A

Matsuzaki et al., 2004, Nature

McGlade-McCulloh et al., 1993, Nature

Mizutani et al., 2008, J. Neurosci.

Murakoshi et al., 2011, Nature

Shen and Meyer, 1999, Science

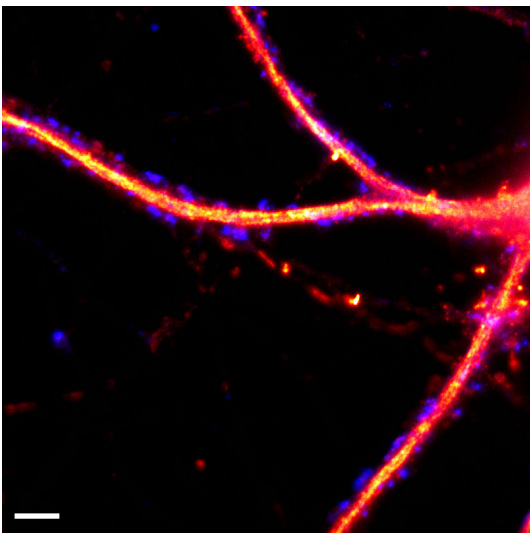
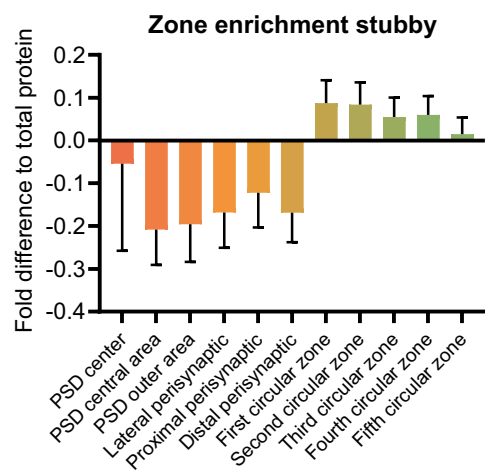
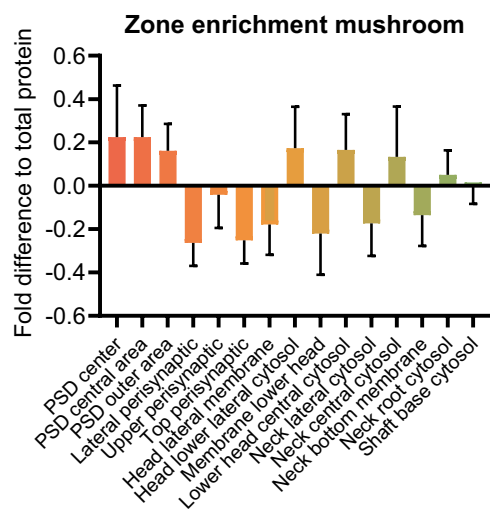
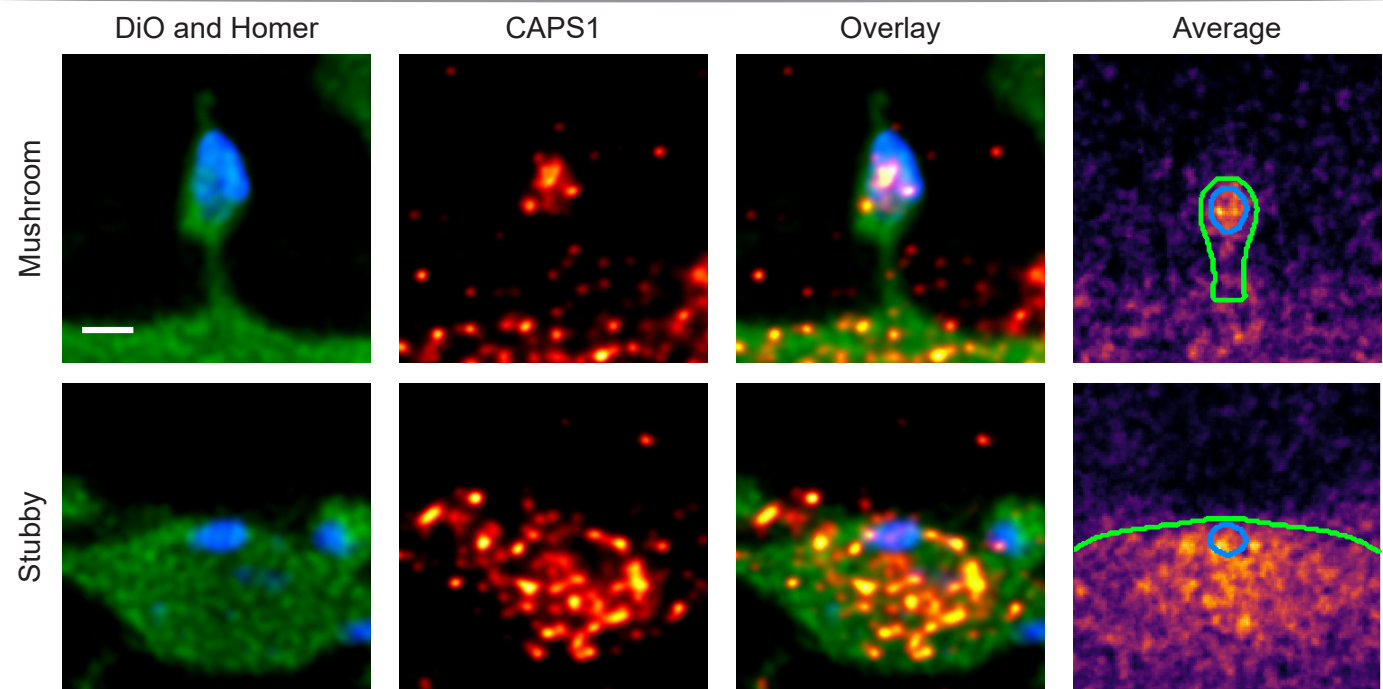
Zhou et al., 2007, J. Neurosci.

CAPS1 (Gene: Cadps, Uniprot ID: Q62717)

Known function: Regulates LDCV and secretory granule exocytosis

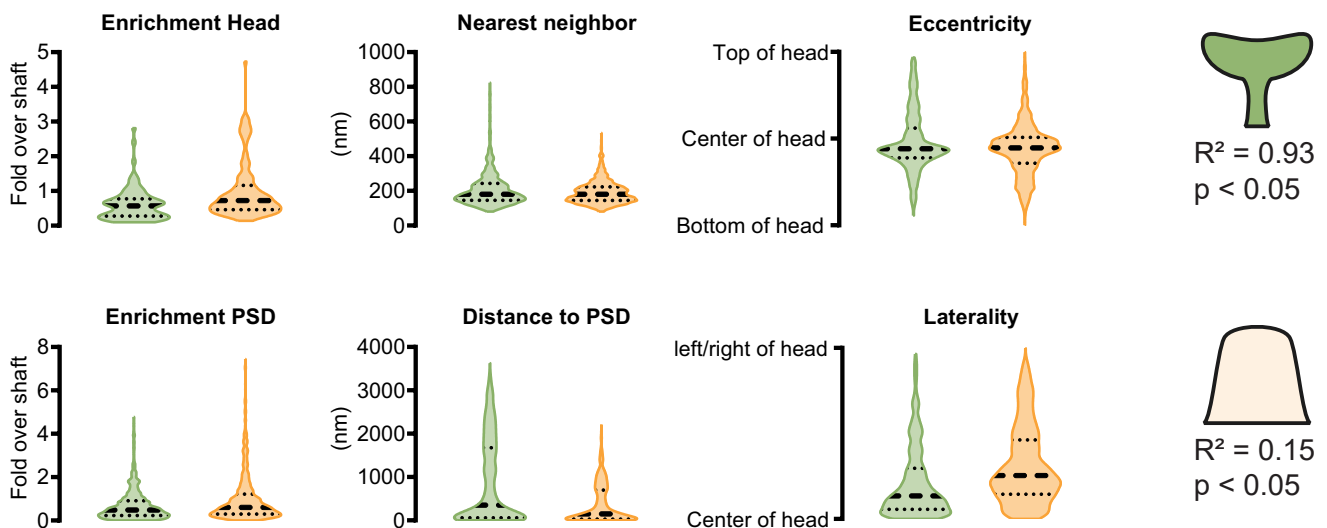
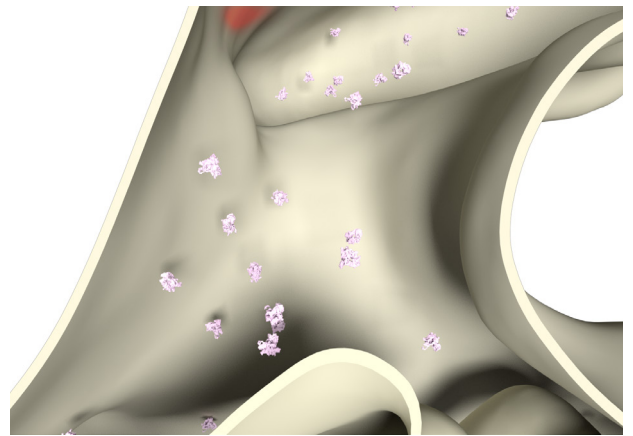
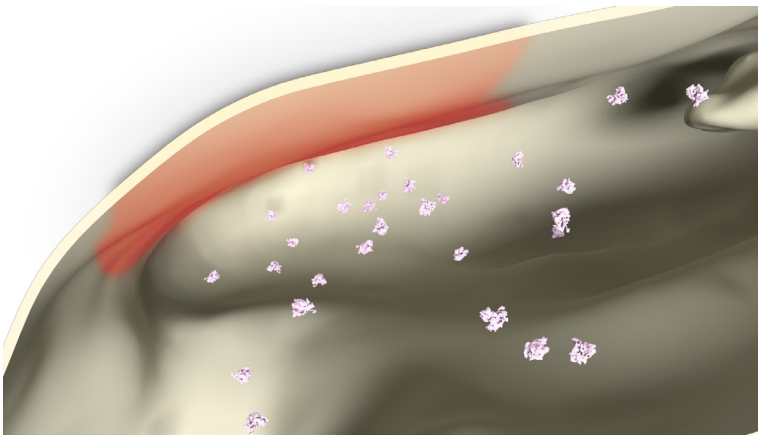
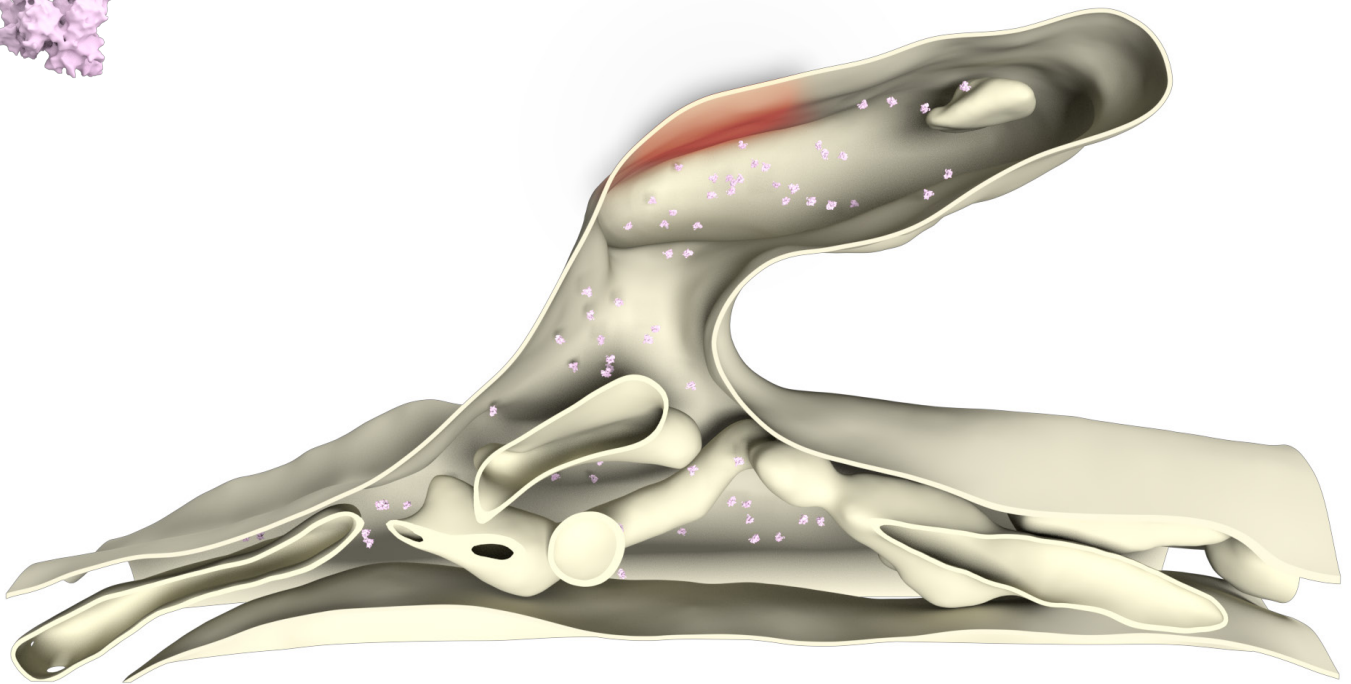
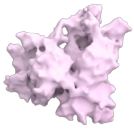
Known organization: Cytosolic

Known Interactions: None

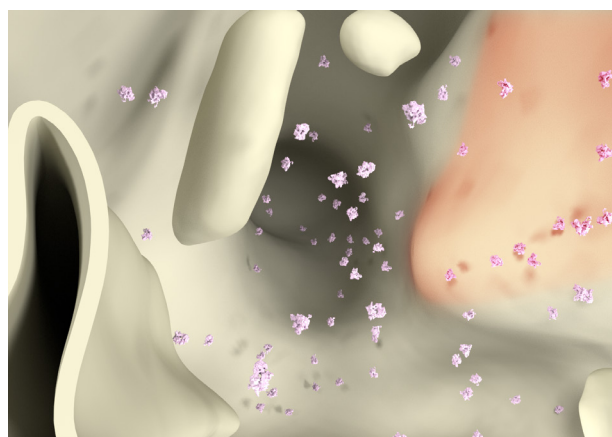
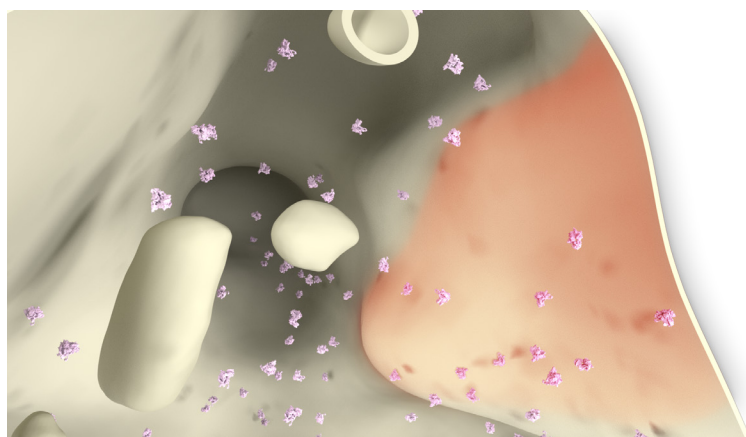
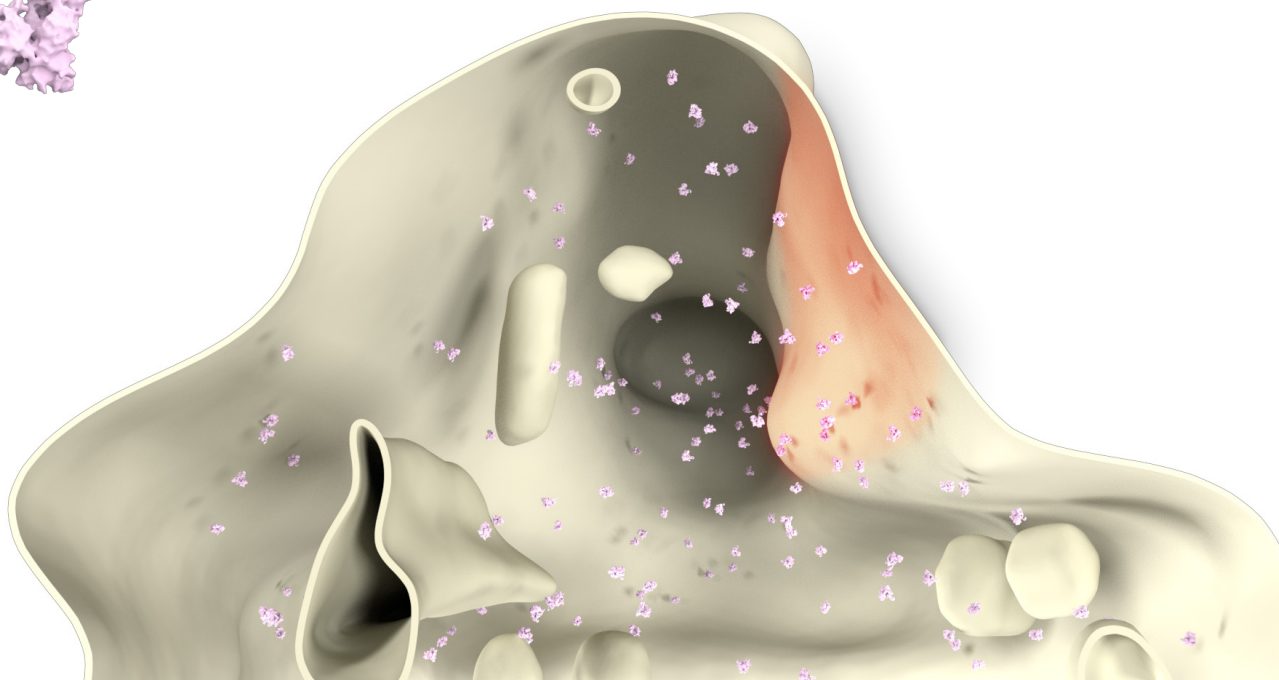
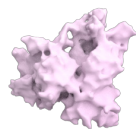


Whole cell copy number	571879.4 ± 18123.2	
Spine copy number	218.8 ± 35.4	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	179.6 ± 29.1	290.2 ± 47.0
% of total protein	0.1 ± 0.0%	0.2 ± 0.0%
Molarity (μM)	2.3 ± 0.4	2.7 ± 0.4
PSD copy number	52 ± 8.4	35 ± 5.7
% in PSD	29.0 ± 4.7%	12.1 ± 2.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	179.6 ± 29.1	$0.1 \pm 0.0\%$	2.3 ± 0.4	52 ± 8.4
Stubby	290.2 ± 47.0	$0.2 \pm 0.0\%$	2.7 ± 0.4	35 ± 5.7



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	179.6 ± 29.1	$0.1 \pm 0.0\%$	2.3 ± 0.4	52 ± 8.4
Stubby	290.2 ± 47.0	$0.2 \pm 0.0\%$	2.7 ± 0.4	35 ± 5.7



References

Antibody: Abcam ab69797

PDB Identifier: Modelled with I-TASSER

Literature:

Eckenstaler et al., 2016, J. Cell. Sci.

Farina et al., 2015, Elife

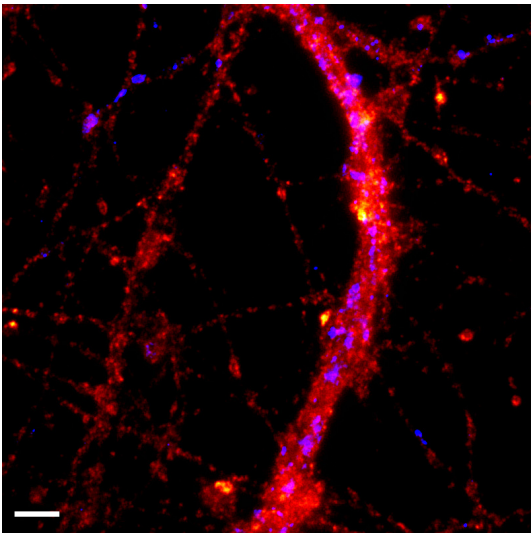
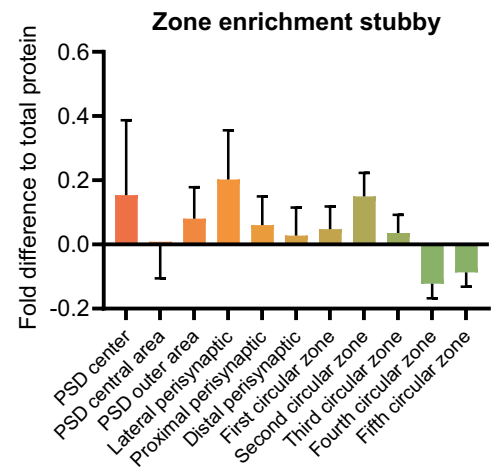
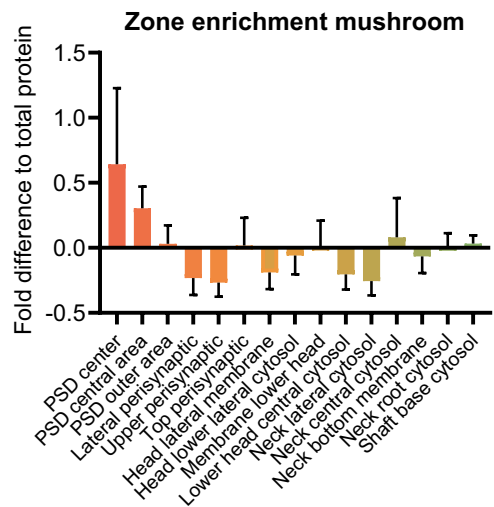
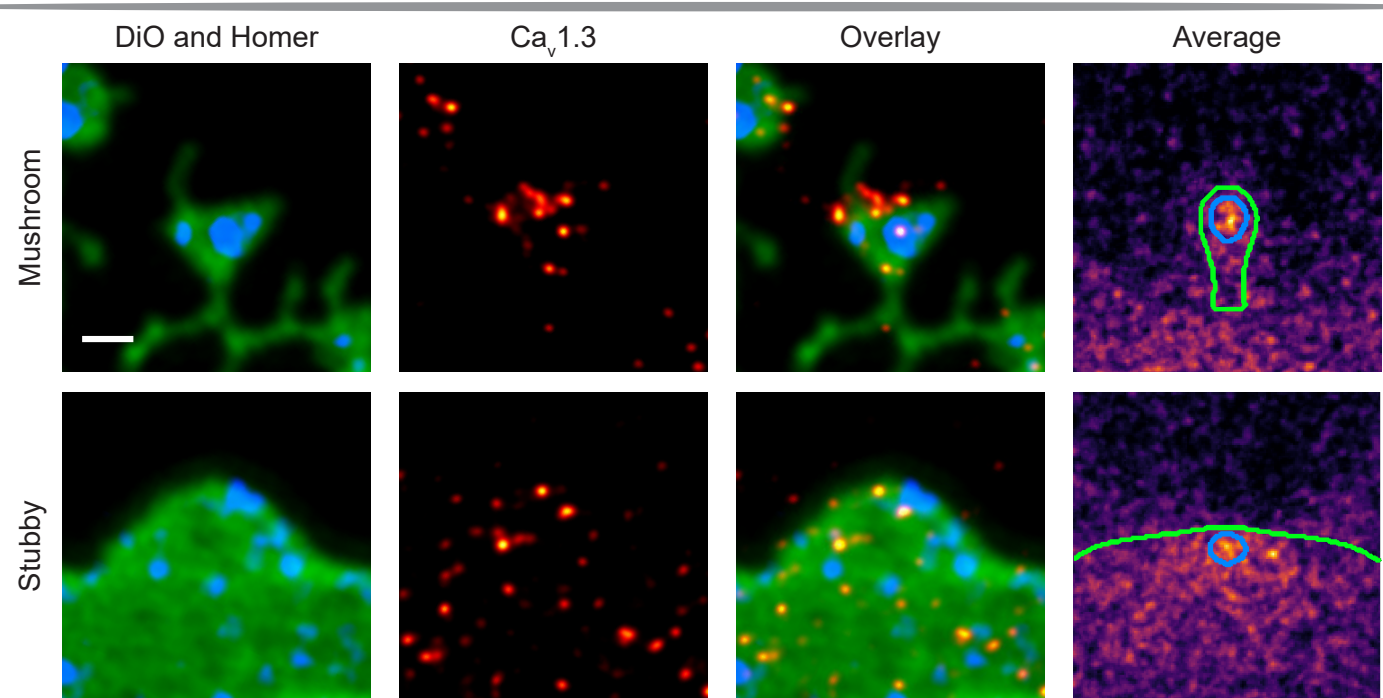
Sadakata et al., 2013, J. Neurosci.

Ca_v1.3 (Gene: Cacna1d, Uniprot ID: P27732)

Known function: Calcium channel, Involved in plasticity, scaling and spine morphology.

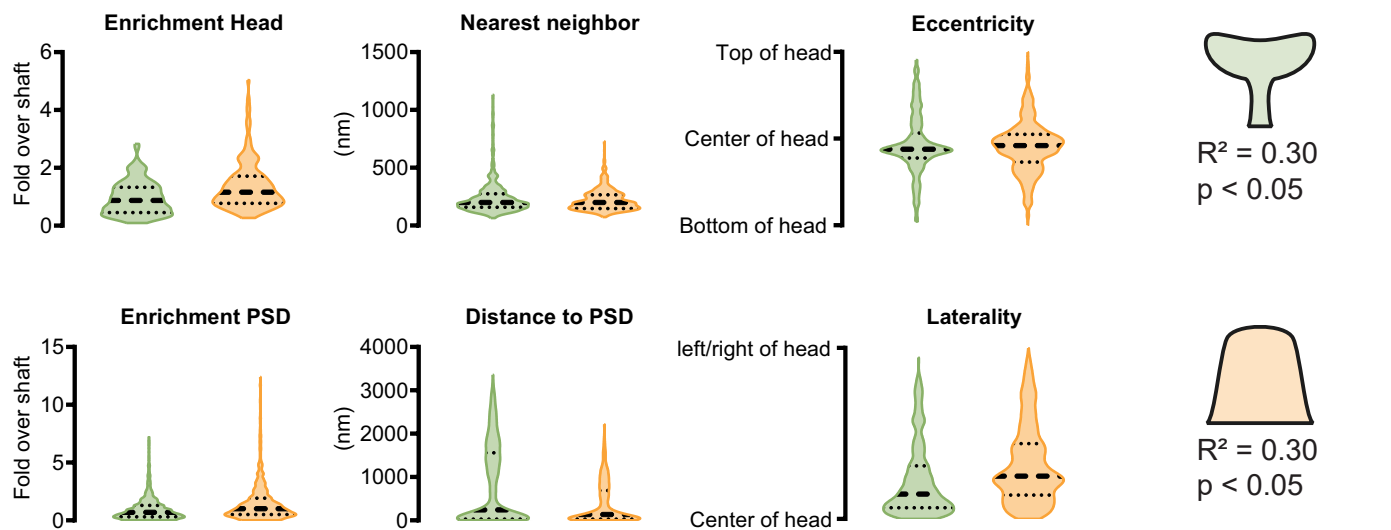
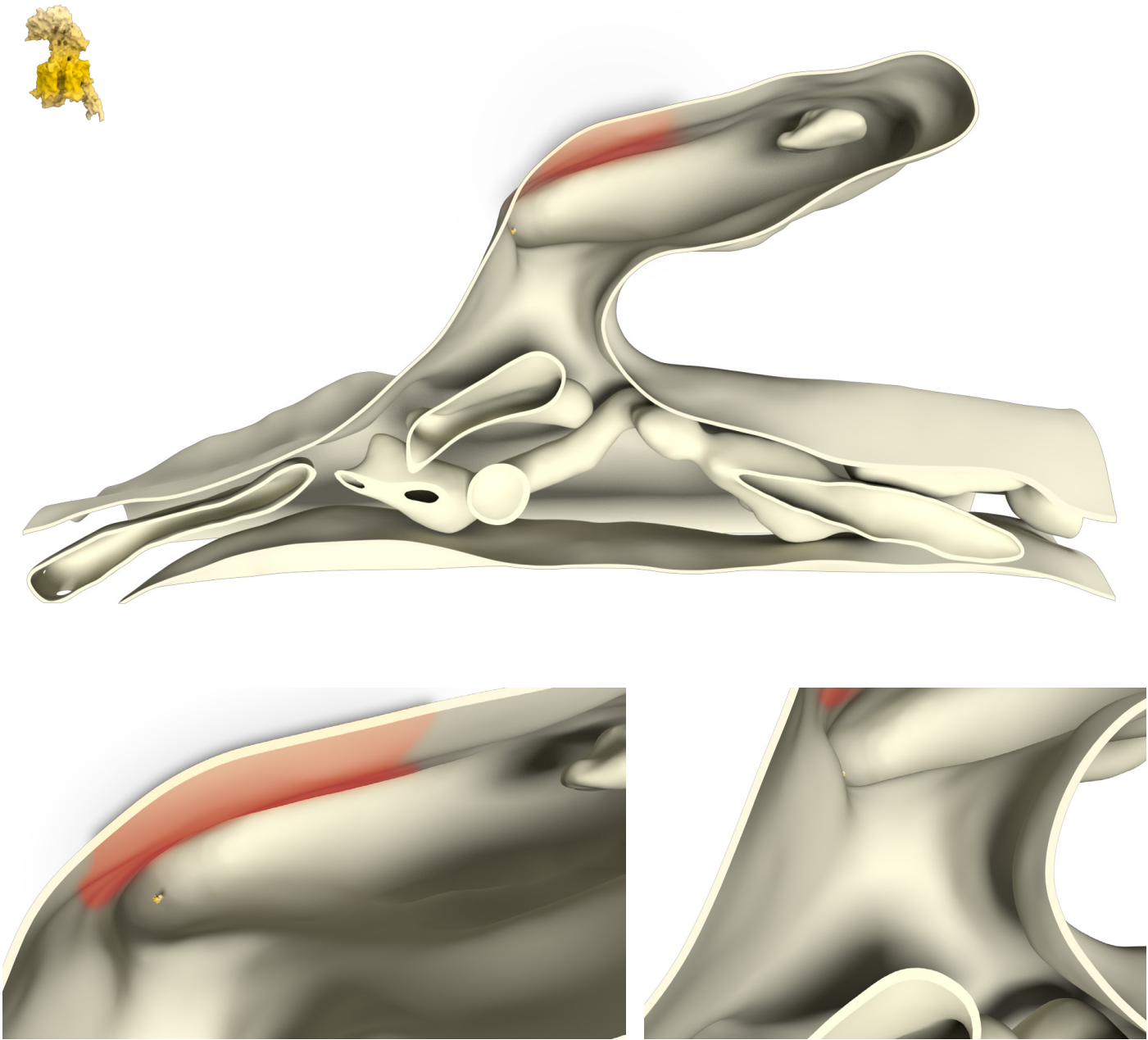
Known organization: Transmembrane protein

Known Interactions: Shank1

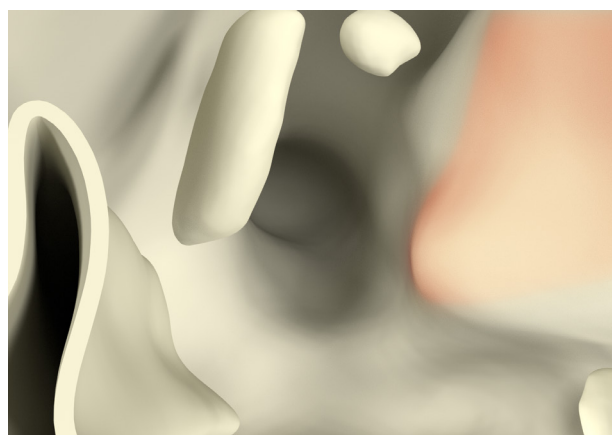
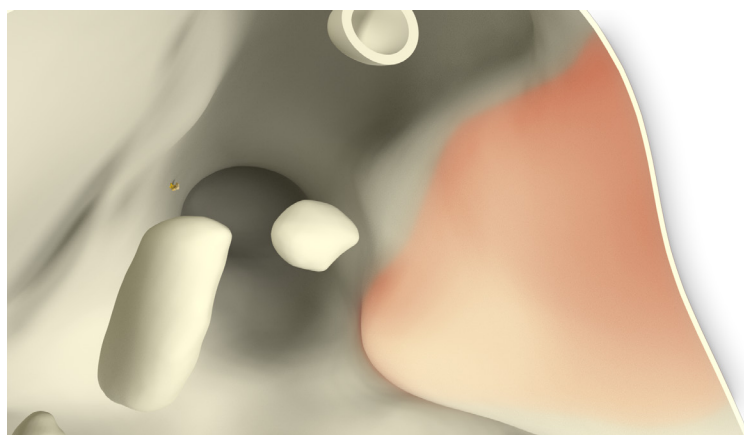
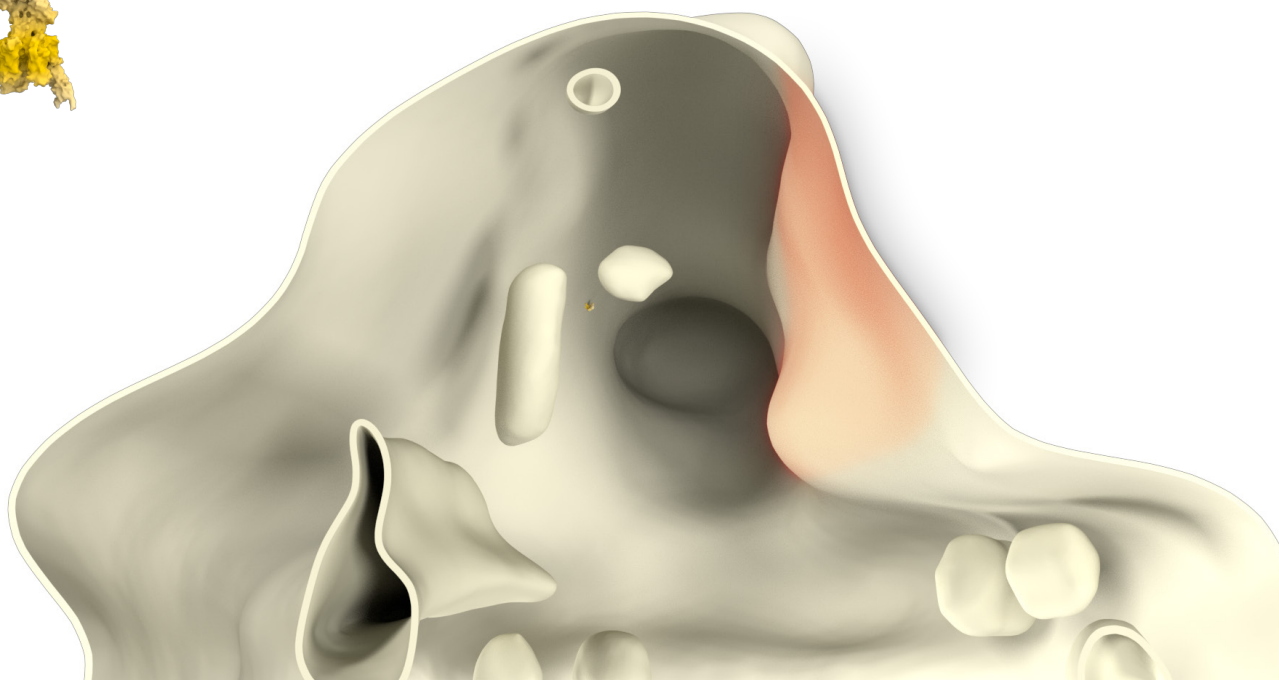


Whole cell copy number	1623.0 ± 491.1	
Spine copy number	0.5 ± 0.2	
Function	Ion Channels	
	Mushroom	Stubby
Spine copy number	0.4 ± 0.1	0.6 ± 0.2
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.0 ± 0.0	0.0 ± 0.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	0.4 ± 0.1	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	0.6 ± 0.2	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	0.4 ± 0.1	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	0.6 ± 0.2	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



References

Antibody: Alomone labs ACC-311

PDB Identifier: 5gjlw

Literature:

Greer and Greenberg, 2008, Neuron

Ibata et al., 2008, Neuron

Jenkins et al., 2010, J. Neurosci.

Moosmang et al., 2005, J. Neurosci.

Stanika et al., 2016, Sci. Rep.

Wang et al., 2017, J. Neurosci.

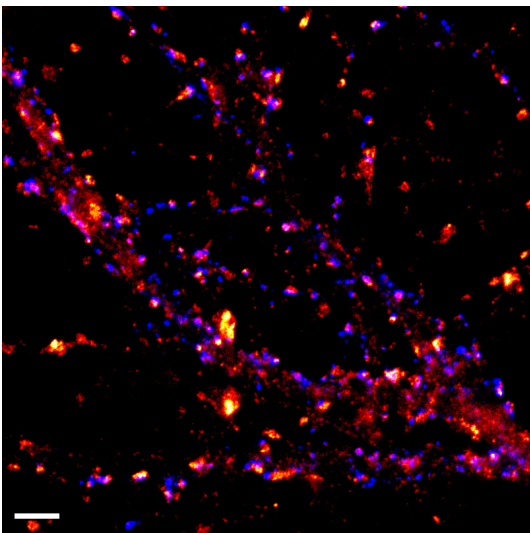
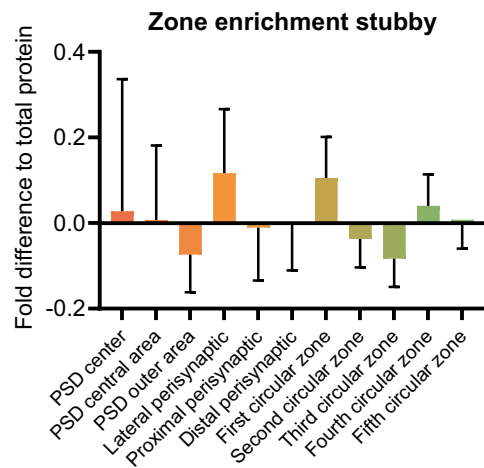
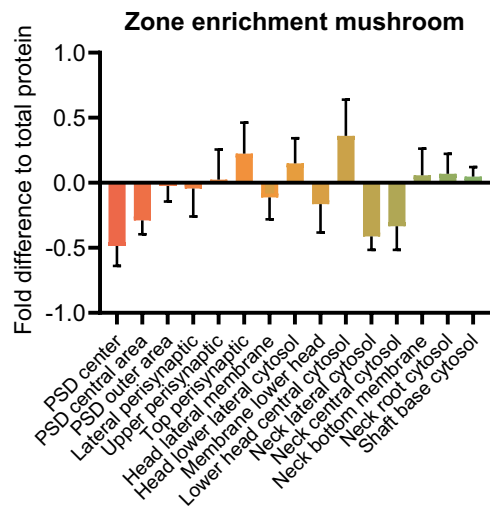
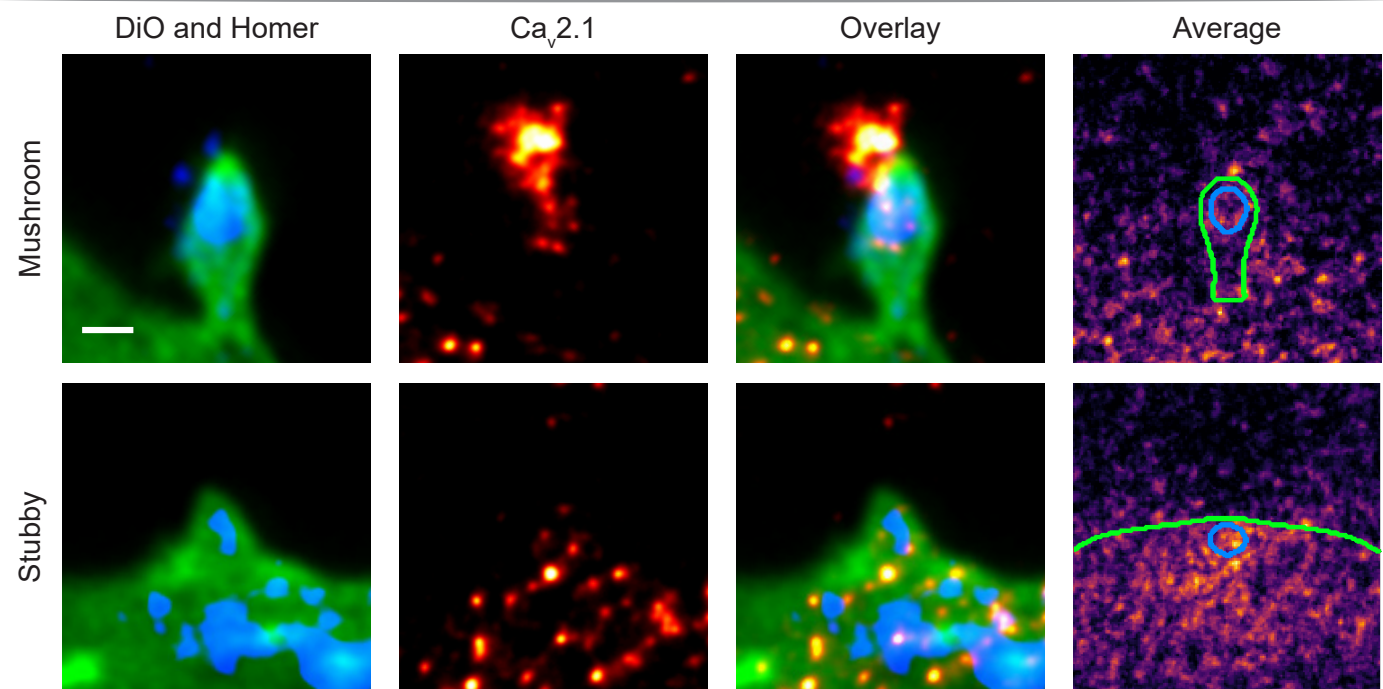
Zhang et al., 2005, J. Neurosci.

Ca_v2.1 (Gene: Cacna1a, Uniprot ID: P54282)

Known function: Calcium channel, Involved in LTP

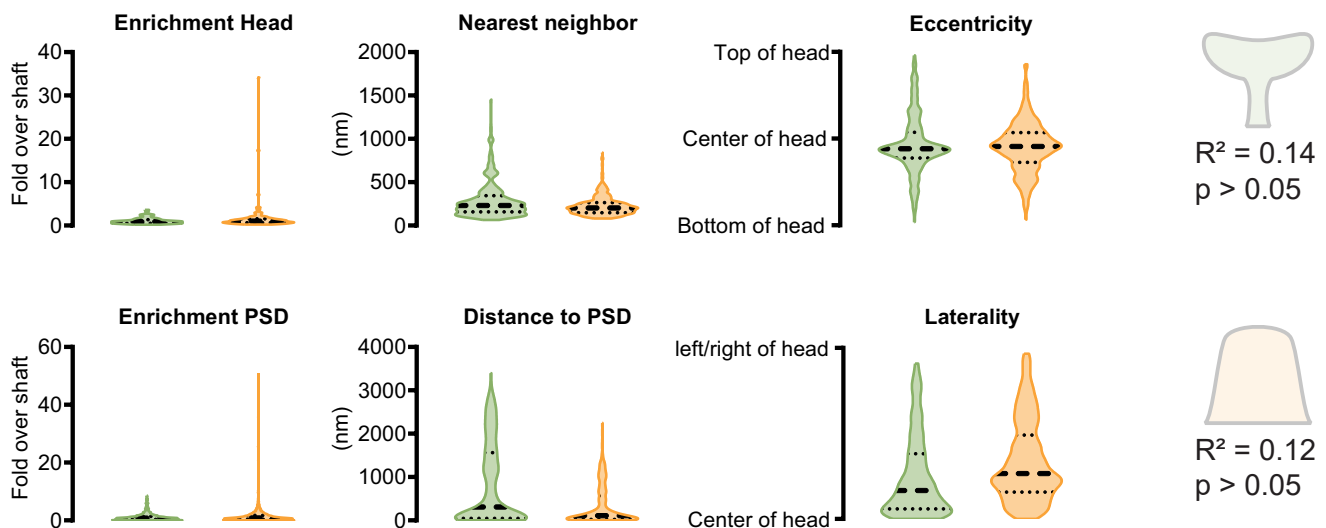
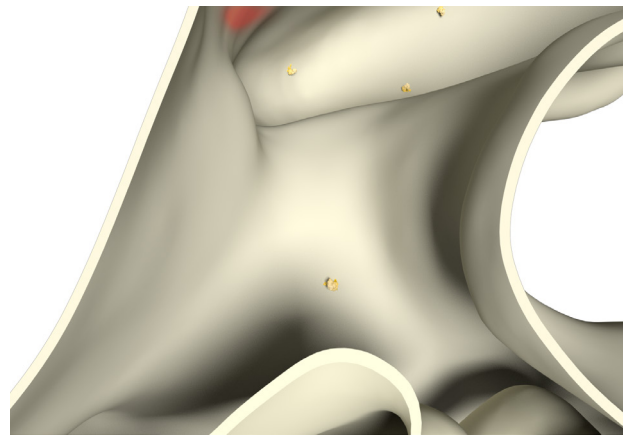
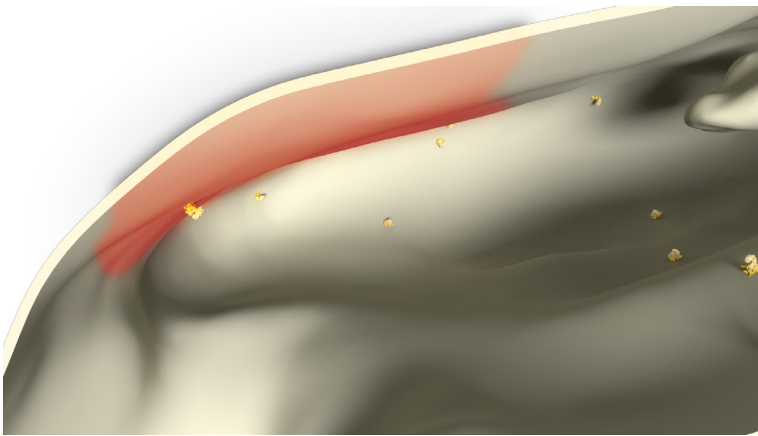
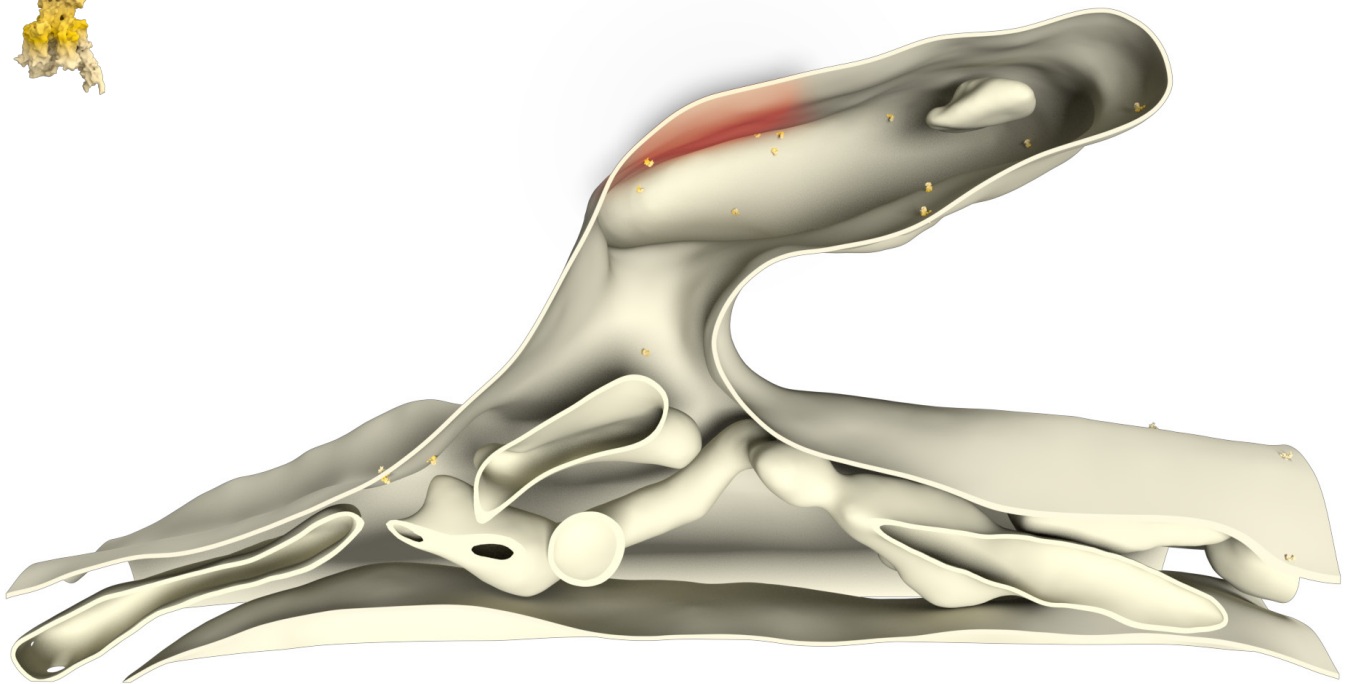
Known organization: Transmembrane protein

Known Interactions: CaMKII

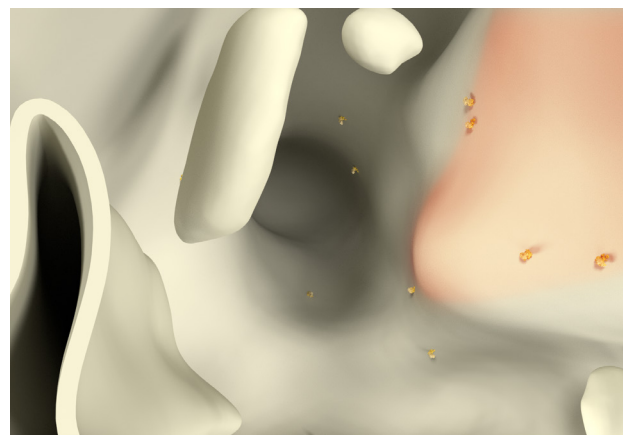
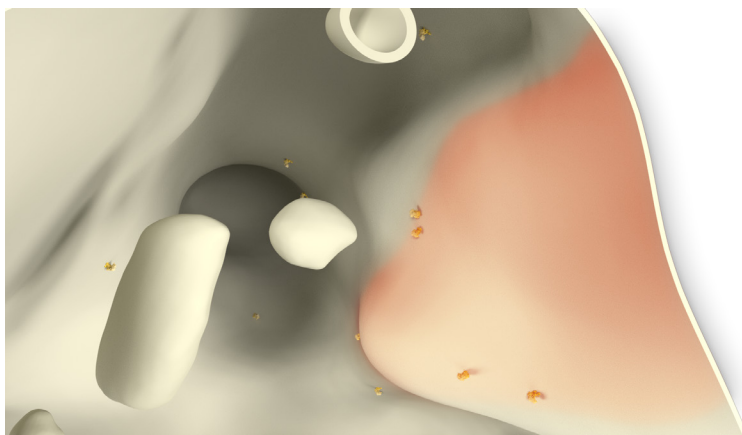
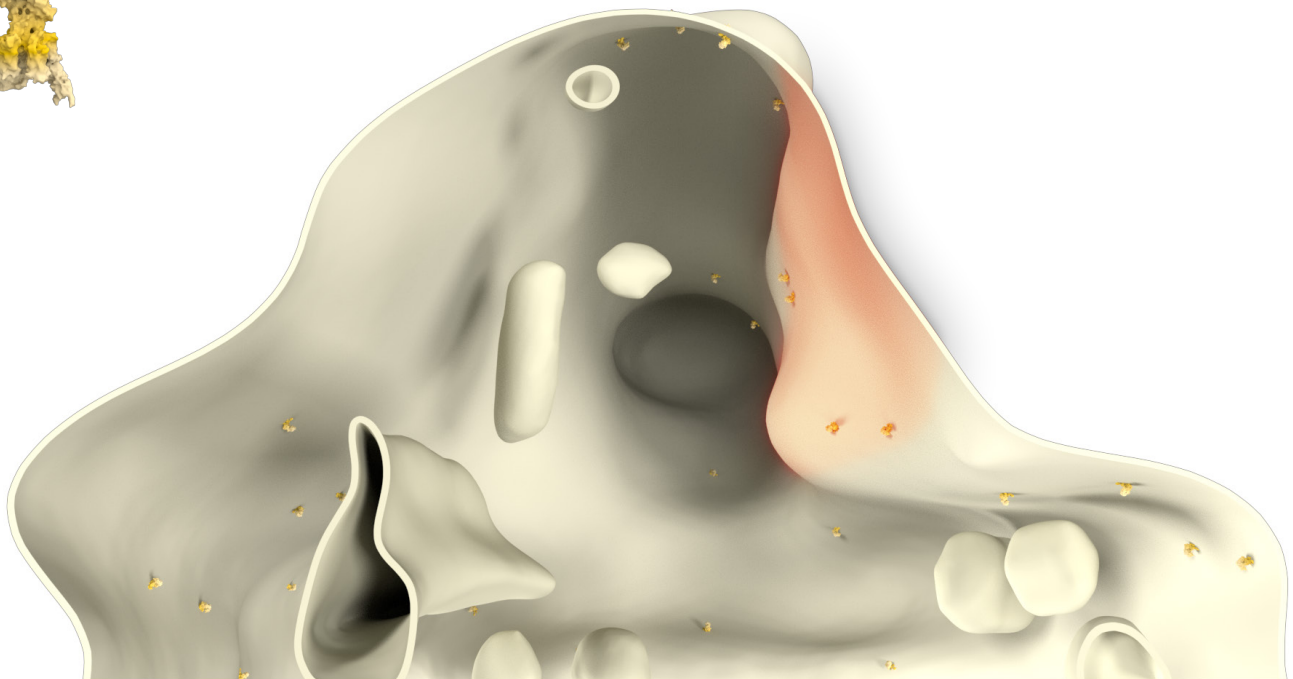
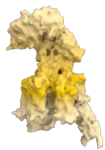


Whole cell copy number	188693.9 ± 68885.8 (extrapolated)	
Spine copy number	42.2 ± 12.4	
Function	Ion Channels	
	Mushroom	Stubby
Spine copy number	32.5 ± 9.6	54.8 ± 16.1
% of total protein	0.0 ± 0.0%	0.1 ± 0.0%
Molarity (μM)	0.4 ± 0.1	0.5 ± 0.2
PSD copy number	2 ± 0.6	7 ± 2.1
% in PSD	6.2 ± 1.8%	12.8 ± 3.8%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	32.5 ± 9.6	$0.0 \pm 0.0\%$	0.4 ± 0.1	2 ± 0.6
Stubby	54.8 ± 16.1	$0.1 \pm 0.0\%$	0.5 ± 0.2	7 ± 2.1



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	32.5 ± 9.6	$0.0 \pm 0.0\%$	0.4 ± 0.1	2 ± 0.6
Stubby	54.8 ± 16.1	$0.1 \pm 0.0\%$	0.5 ± 0.2	7 ± 2.1



References

Antibody: Synaptic Systems 152 203

PDB Identifier: modified Cav1.3

Literature:

Jiang et al., 2008,, Proc. Natl. Acad. Sci. U S A

Magupalli et al., 2013, J. Biol. Chem.

Nanou et al., 2016, Proc. Natl. Acad. Sci. U S A

Westenbroek et al., 1995, J. Neurosci.

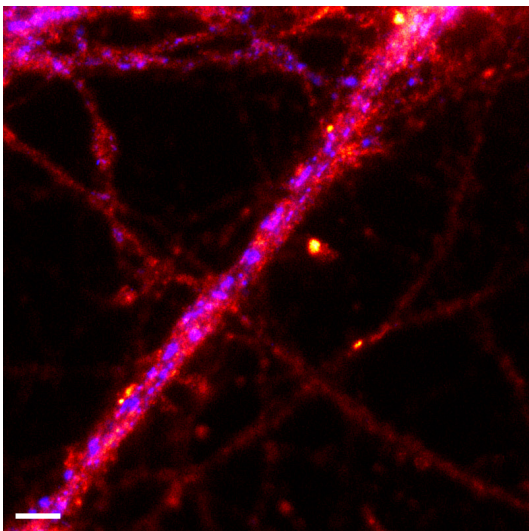
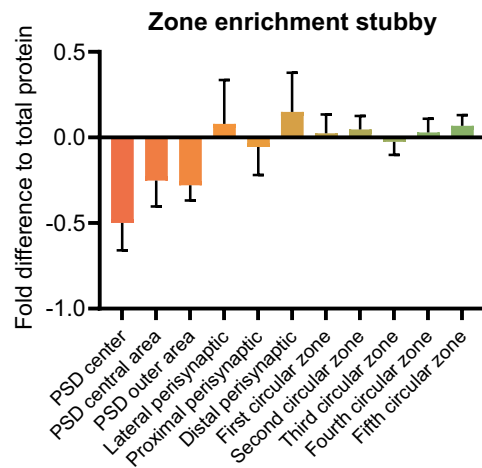
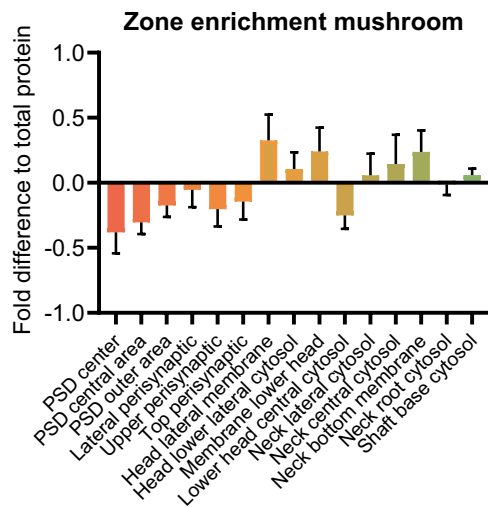
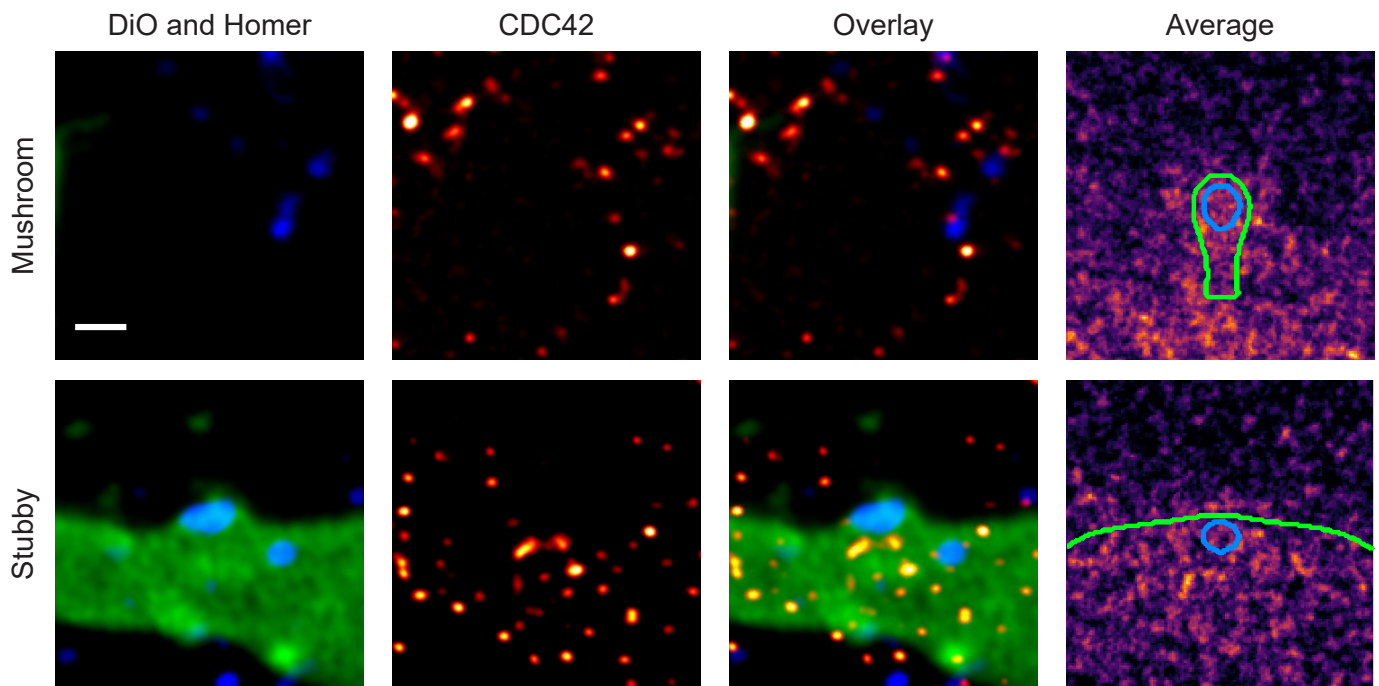
Wu et al., 1999, J. Neurosci.

CDC42 (Gene: Cdc42, Uniprot ID: Q8CFN2)

Known function: Rho type GTPase, Regulates actin cytoskeleton

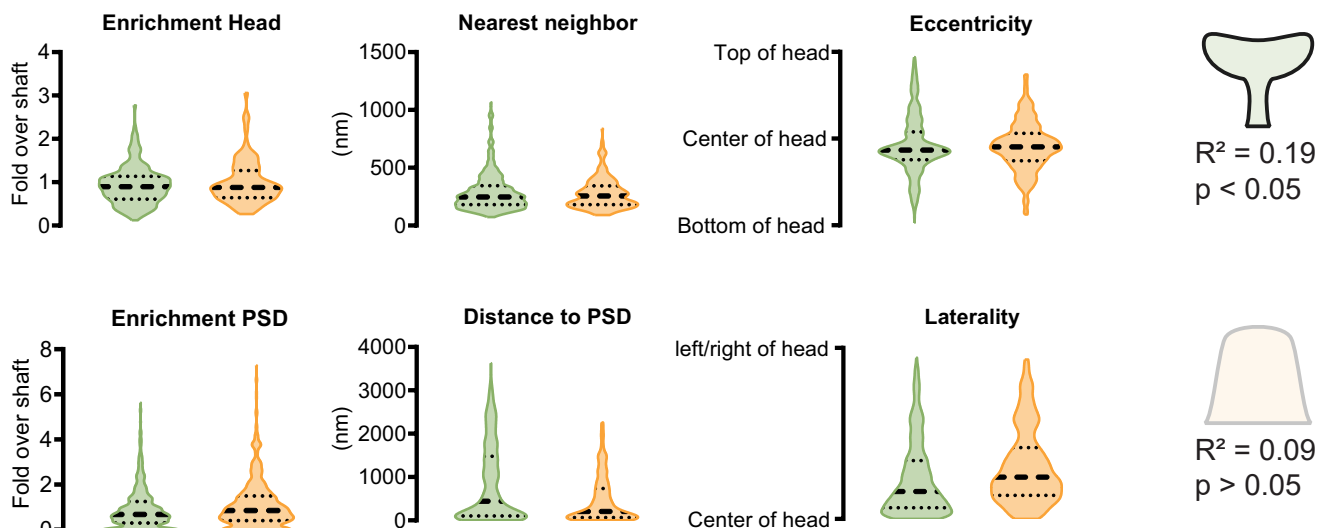
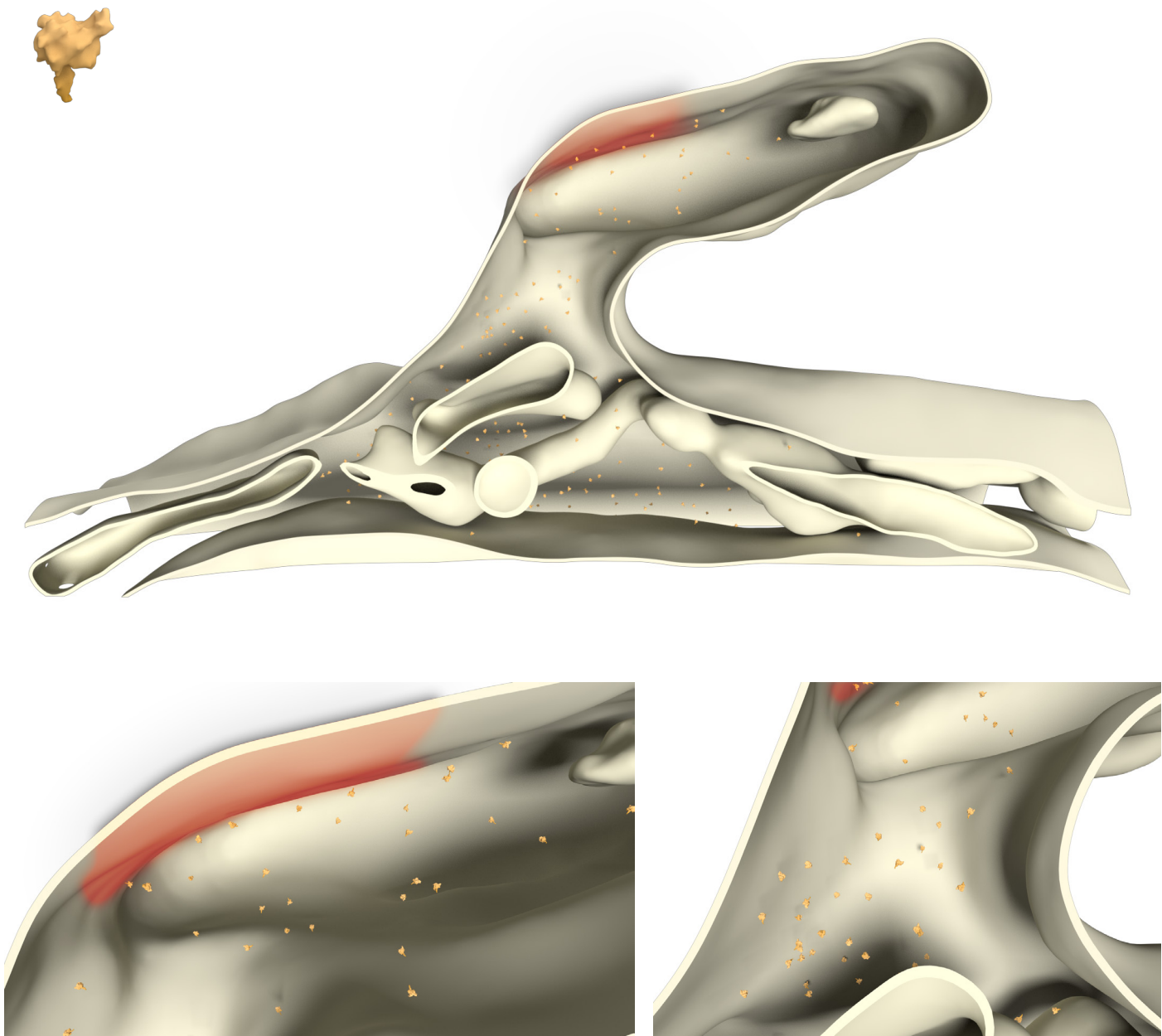
Known organization: Cytosolic

Known Interactions: CaMKII, Homer2

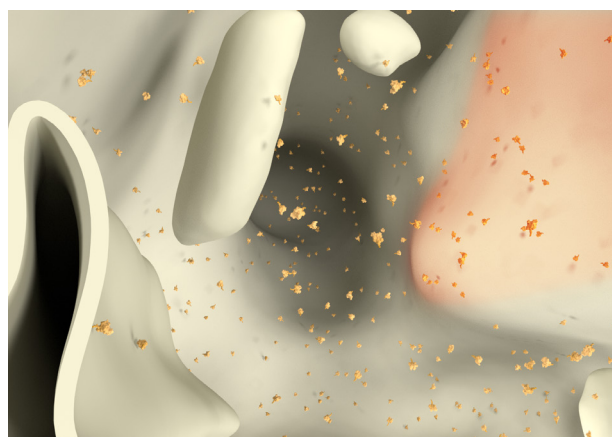
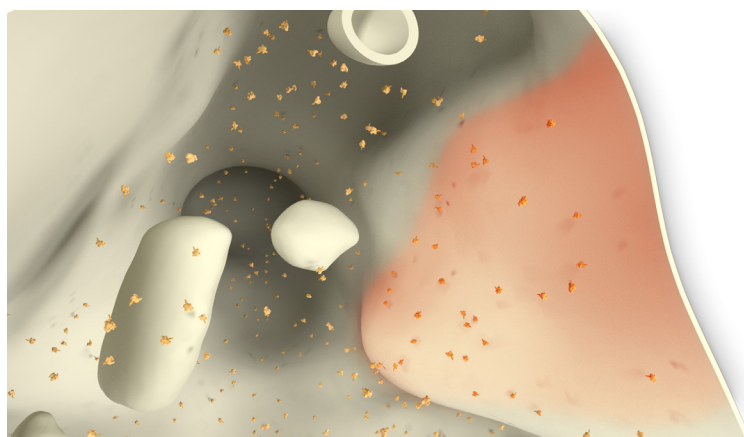
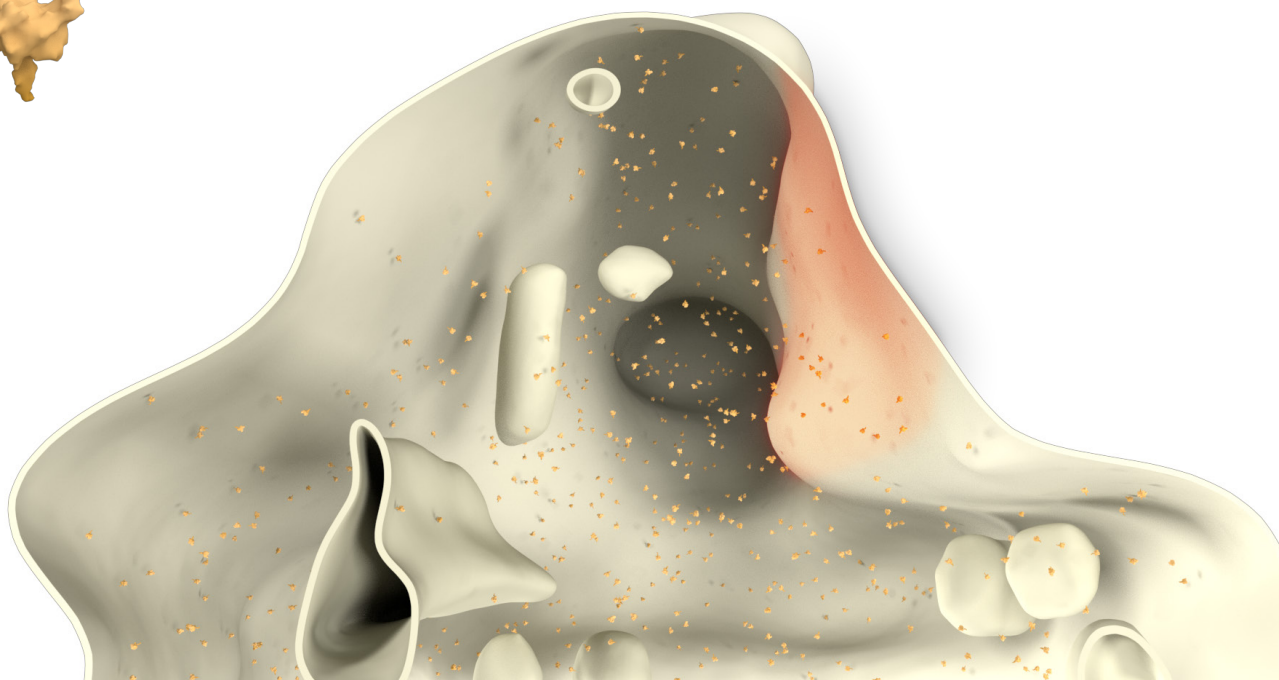


Whole cell copy number	19193307.9 ± 1363601.0	
Spine copy number	897.0 ± 877.5	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	727.6 ± 711.8	1139.6 ± 1114.8
% of total protein	0.1 ± 0.1%	0.1 ± 0.1%
Molarity (μM)	9.2 ± 9.0	10.8 ± 10.5
PSD copy number	75 ± 73.4	67 ± 65.5
% in PSD	10.3 ± 10.1%	5.9 ± 5.8%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	727.6 ± 711.8	$0.1 \pm 0.1\%$	9.2 ± 9.0	75 ± 73.4
Stubby	1139.6 ± 1114.8	$0.1 \pm 0.1\%$	10.8 ± 10.5	67 ± 65.5



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	727.6 ± 711.8	$0.1 \pm 0.1\%$	9.2 ± 9.0	75 ± 73.4
Stubby	1139.6 ± 1114.8	$0.1 \pm 0.1\%$	10.8 ± 10.5	67 ± 65.5



References

Antibody: Thermo Scientific PA1-092

PDB Identifier: 1ki1

Literature:

Choi et al., 2005, J. Neurosci.

Murakoshi et al., 2011, Nature

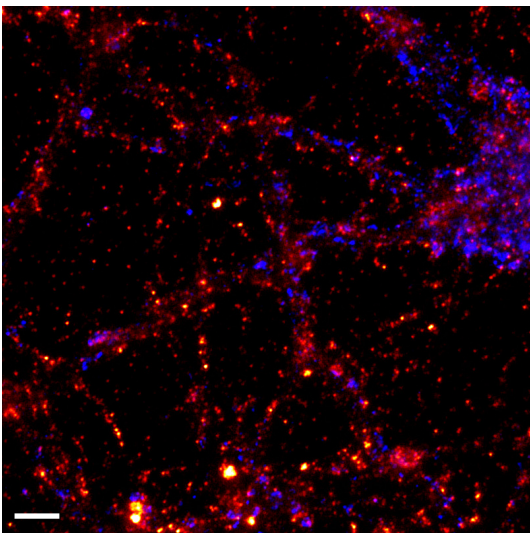
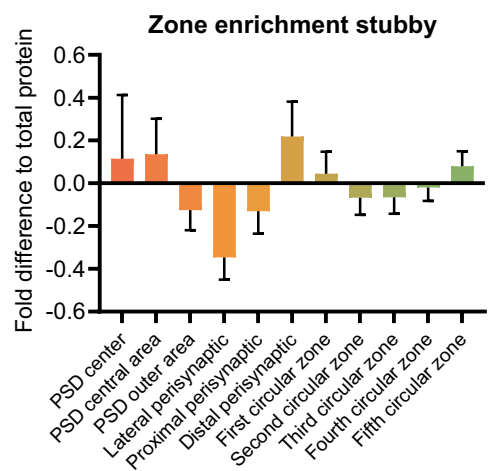
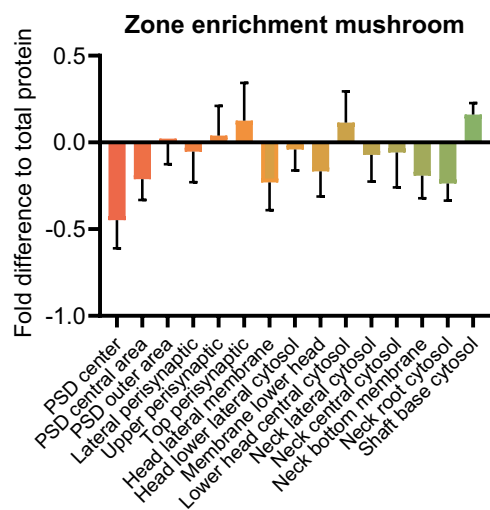
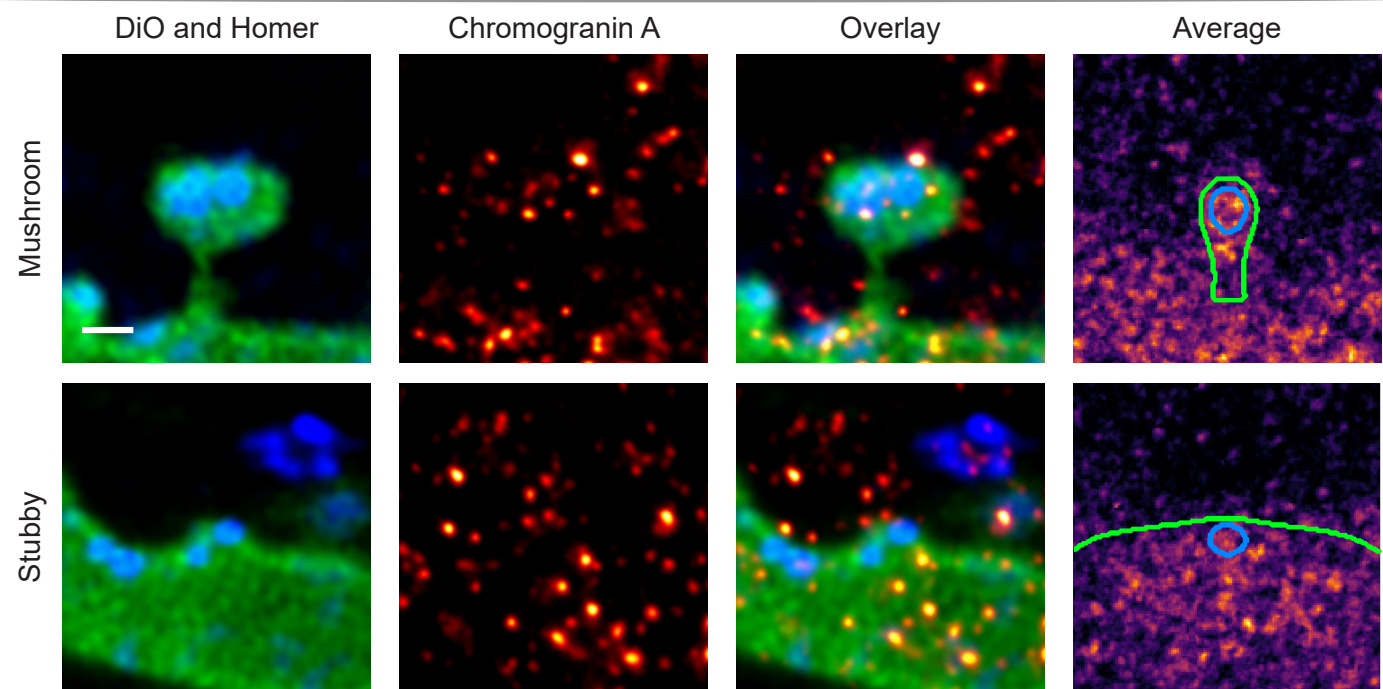
Shiraishi-Yamaguchi et al., 2009, BMC Neurosci.

Chromogranin A (Beta-granin, Gene: Chga, Uniprot ID: P10354)

Known function: Acts as pro-hormone, Involved in LDCV biogenesis

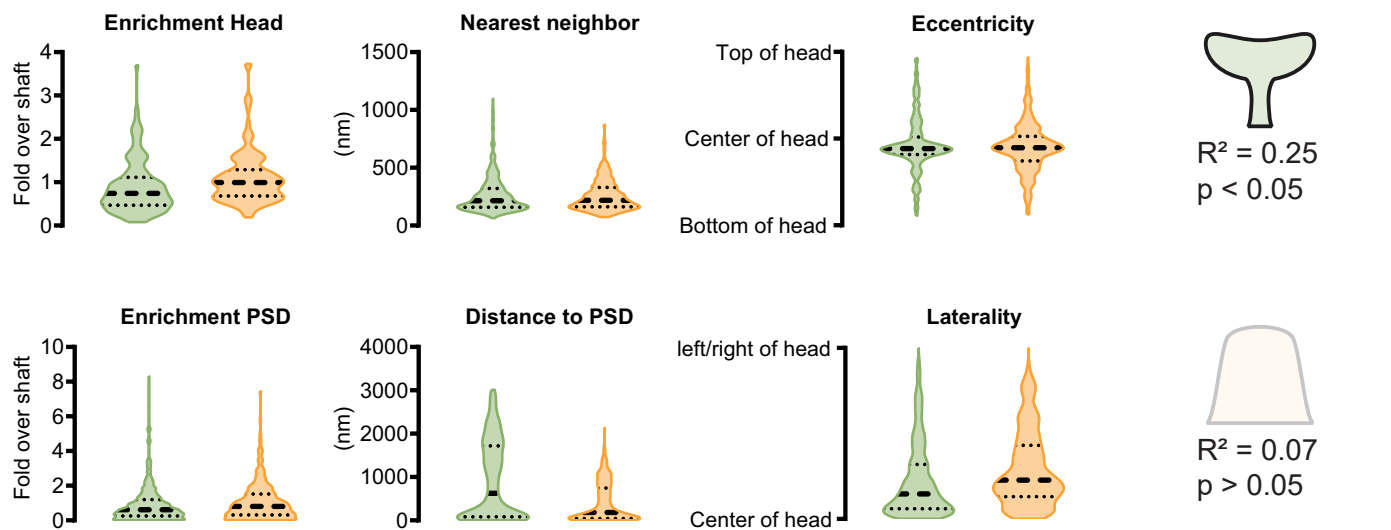
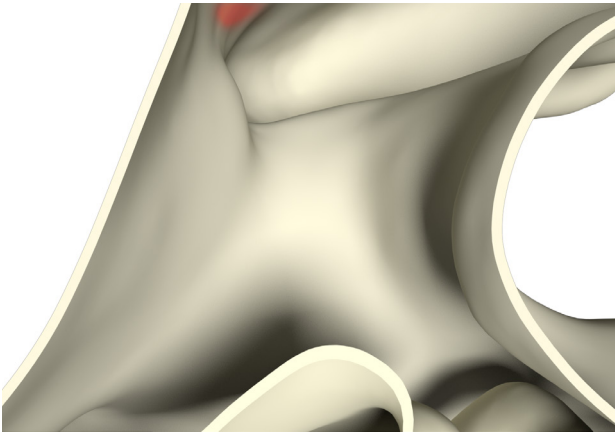
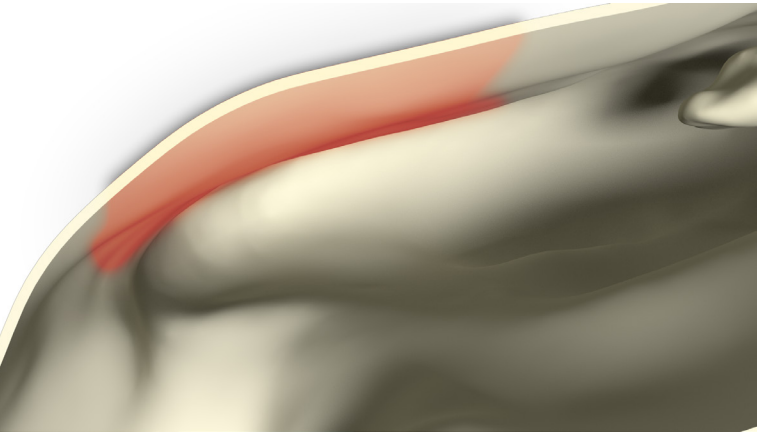
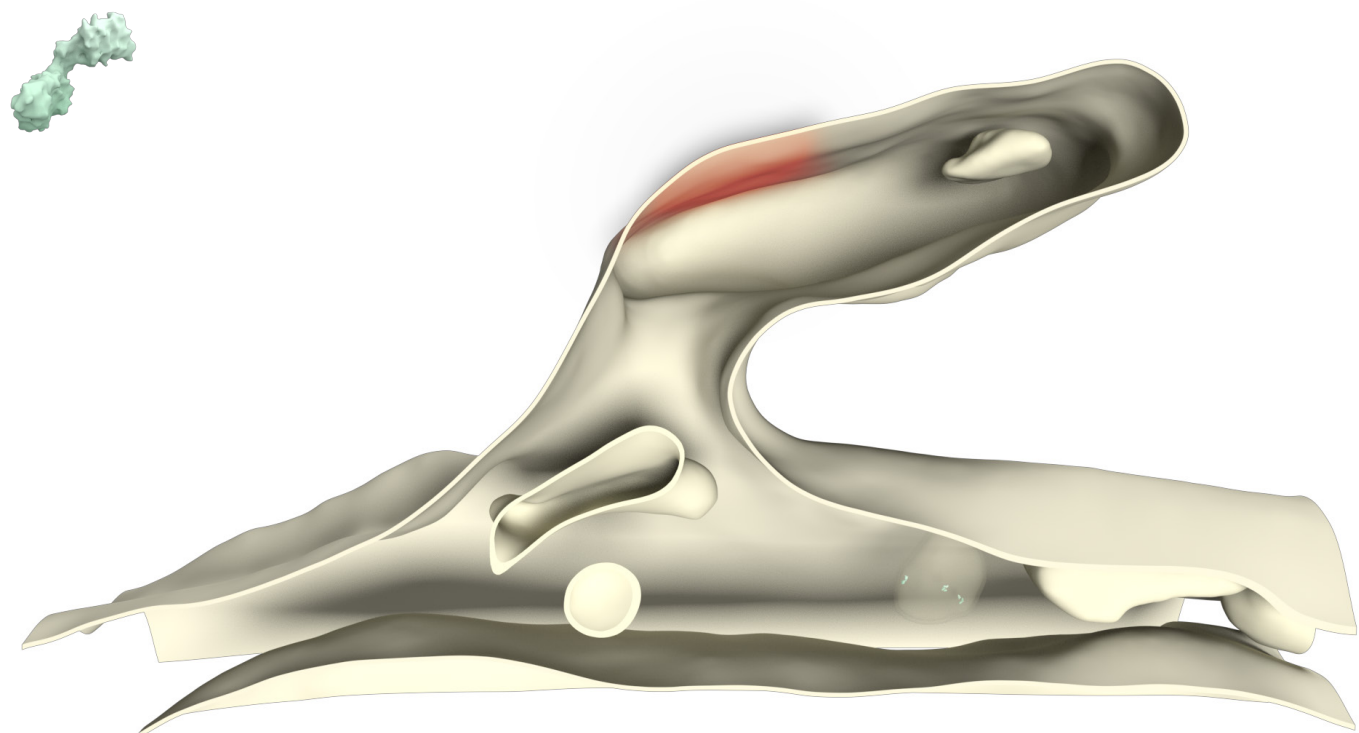
Known organization: In LDCV lumen

Known Interactions: Chromogranin B

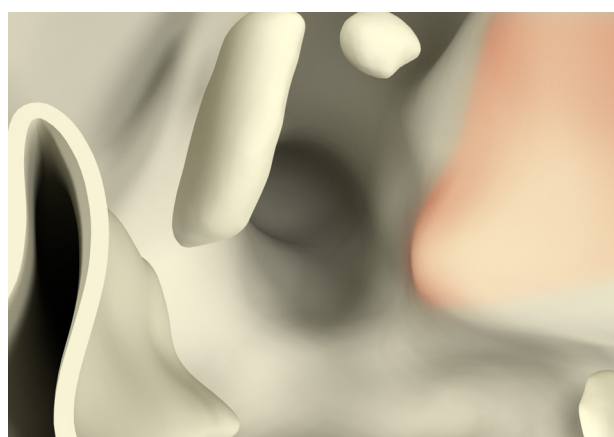
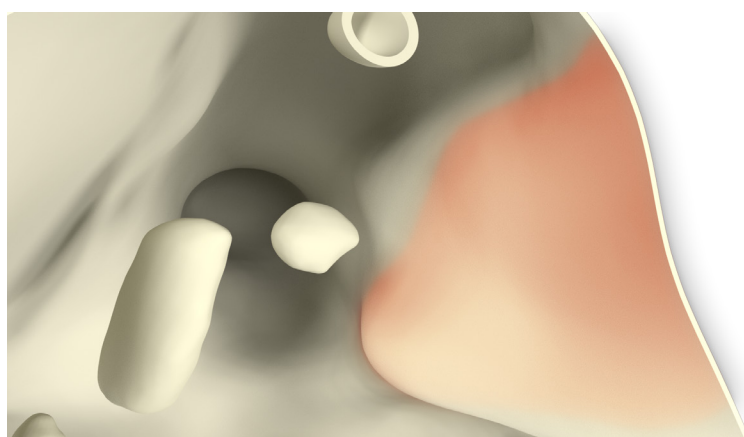
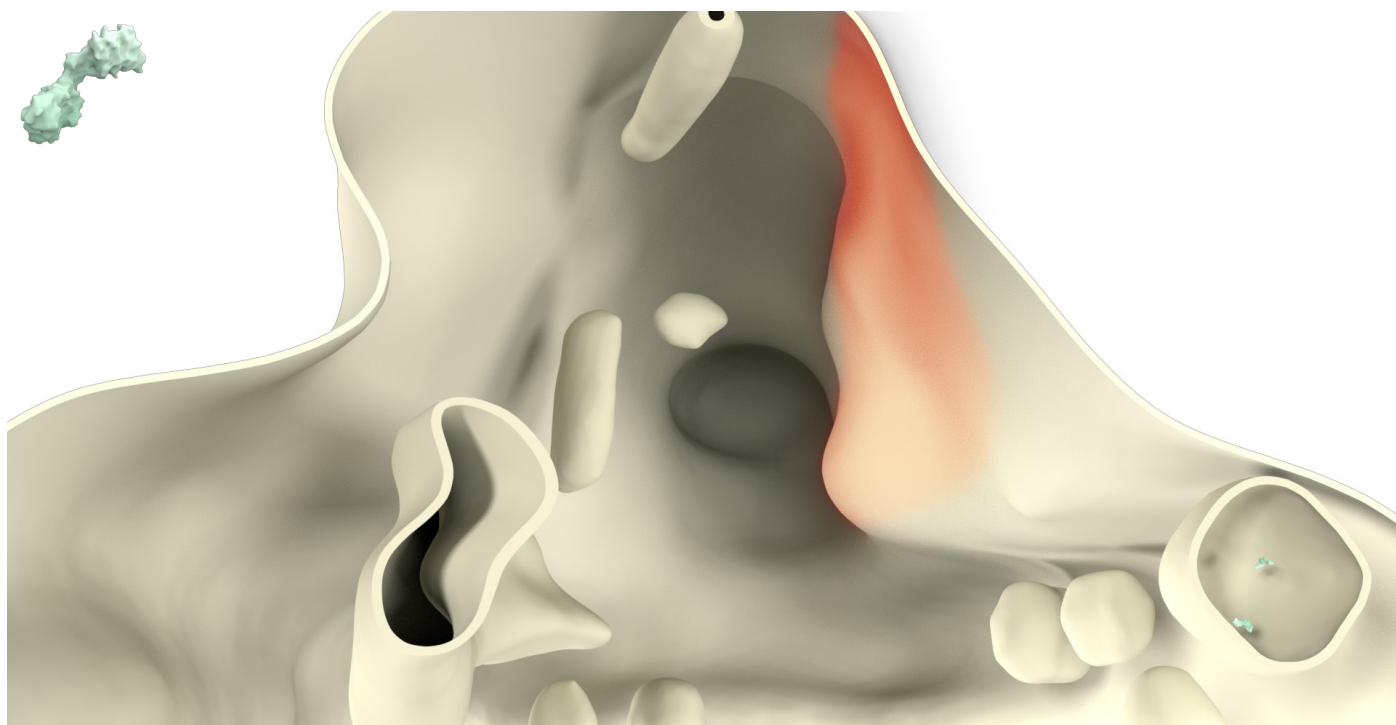


Whole cell copy number	23006.7 ± 5194.7	
Spine copy number	3.6 ± 1.2	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	3.3 ± 1.1	4.1 ± 1.4
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.0 ± 0.0	0.0 ± 0.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	3.3 ± 1.1	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	4.1 ± 1.4	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	3.3 ± 1.1	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	4.1 ± 1.4	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



References

Antibody: Synaptic Systems 259 003

PDB Identifier: Modelled with I-TASSER

Literature:

Krömer et al., 1998, J. Cell. Biol.

Montero-Hadjadje et al., 2009, J. Biol. Chem.

Natori and Huttner, 1996, Proc. Natl. Acad. Sci. USA

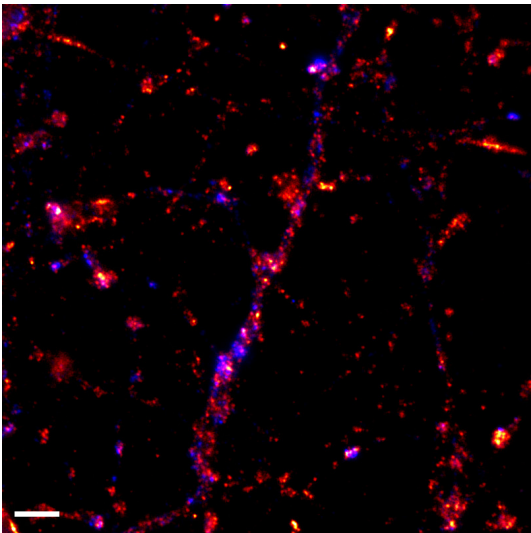
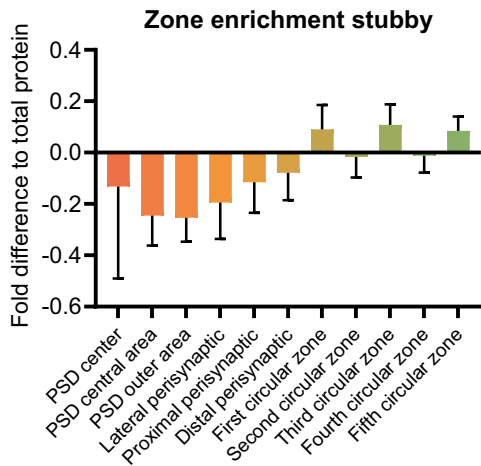
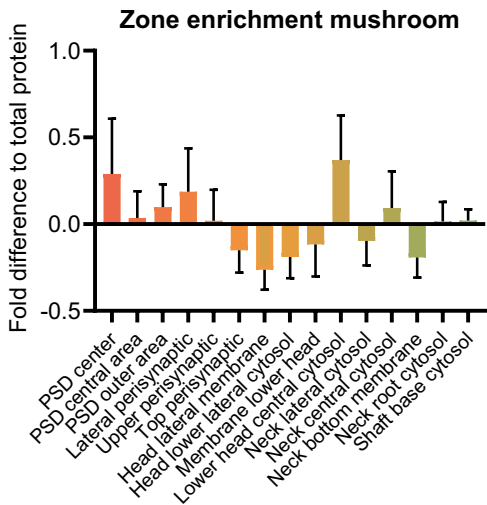
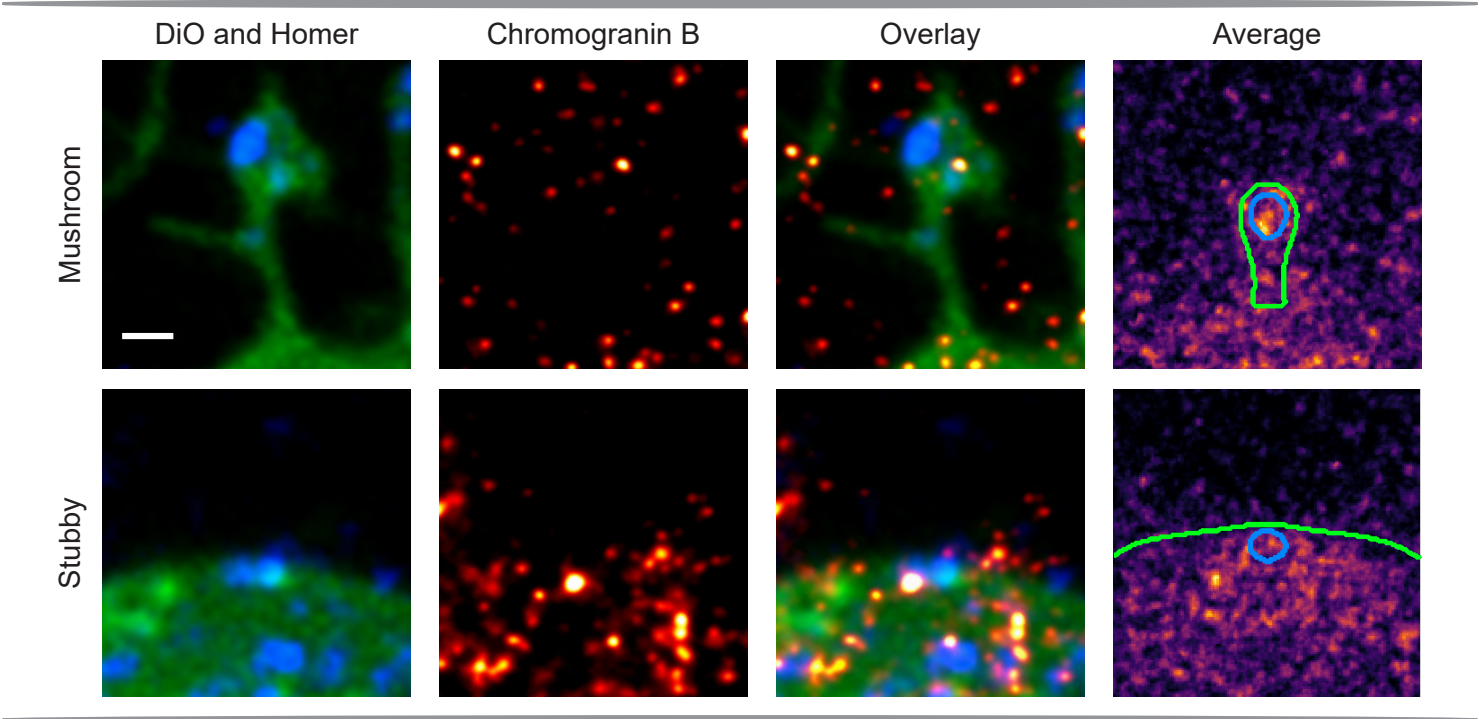
Sun et al., 2013, Traffic

Chromogranin B (Secretogranin I, Gene: Chgb, Uniprot ID: O35314)

Known function: Acts as pro-hormone, Involved in LDCV biogenesis

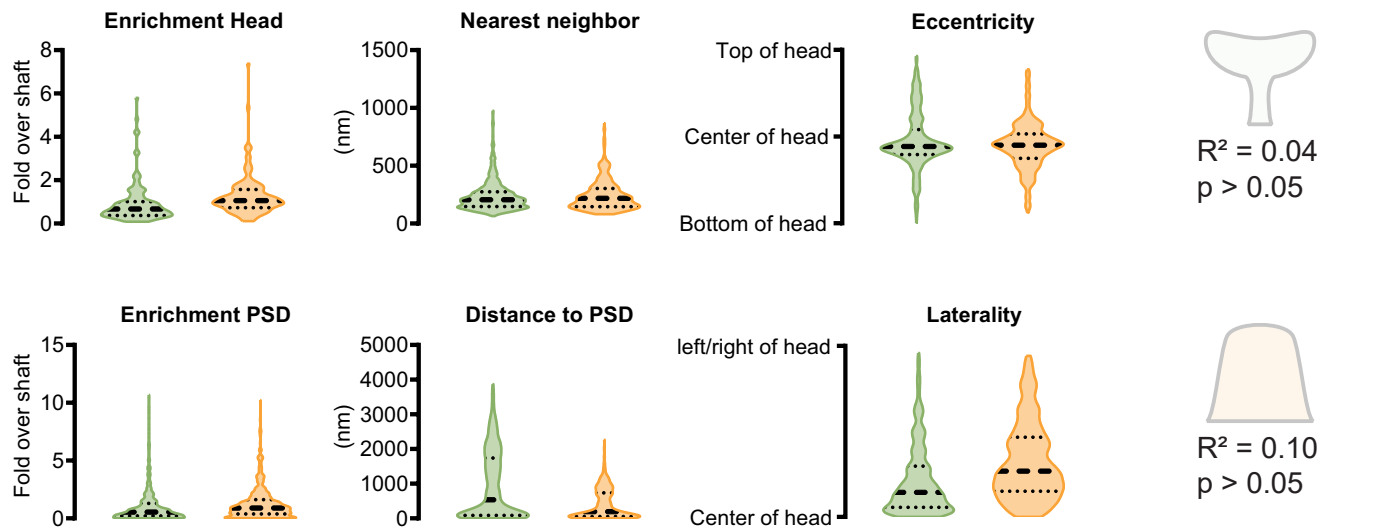
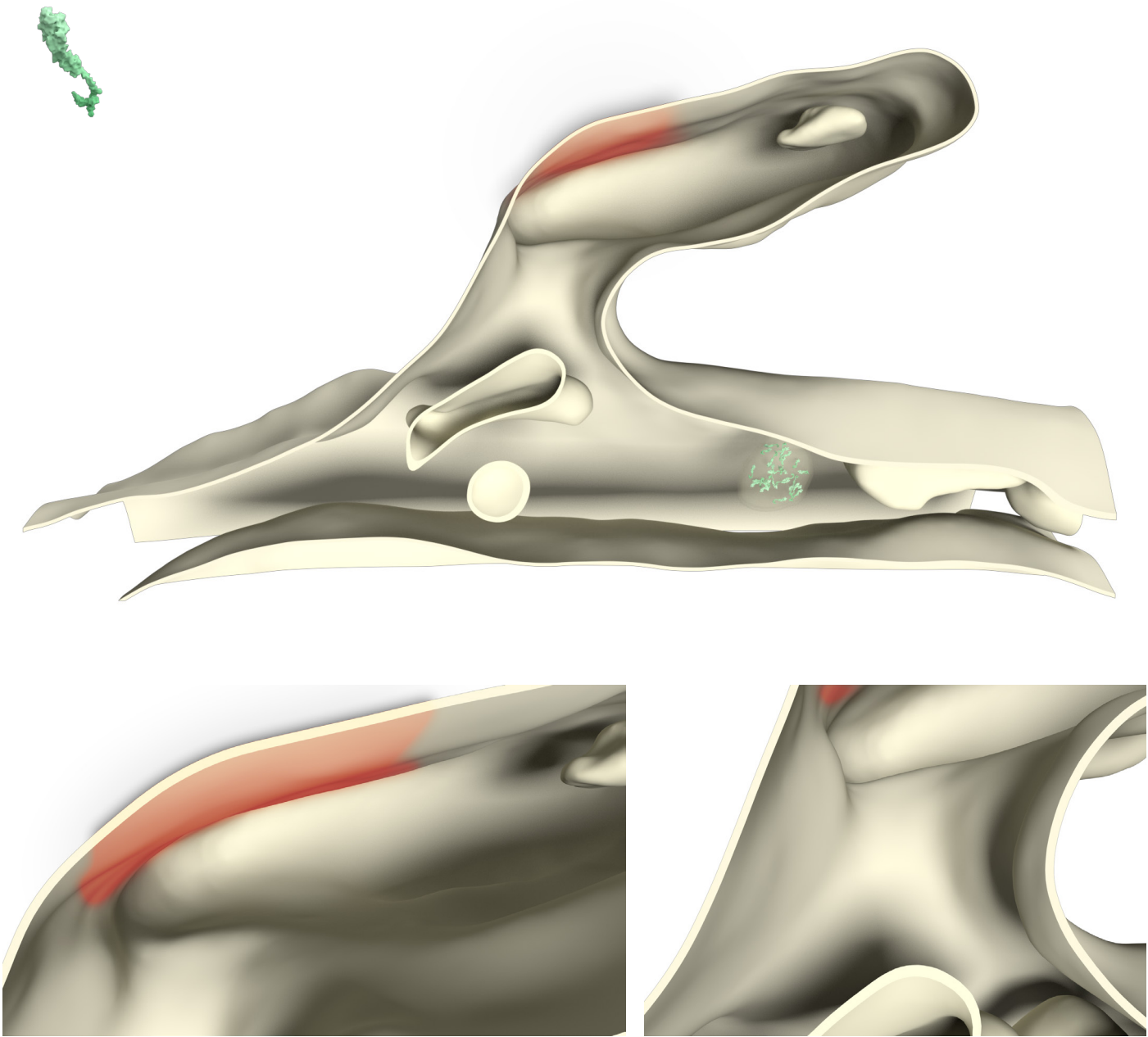
Known organization: In LDCV lumen

Known Interactions: Chromogranin A

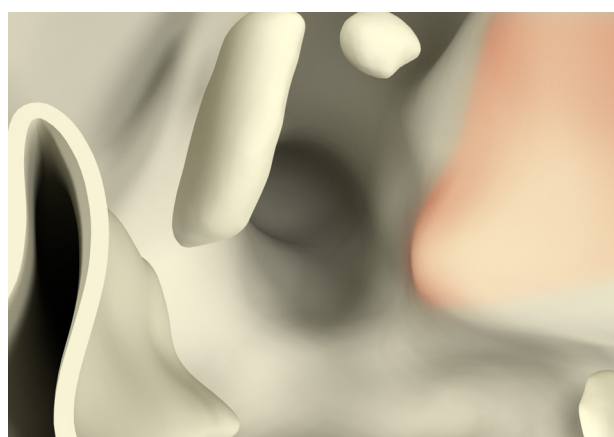
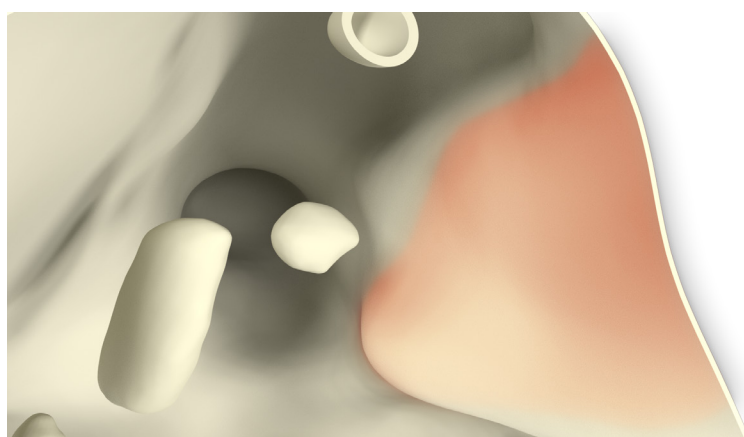
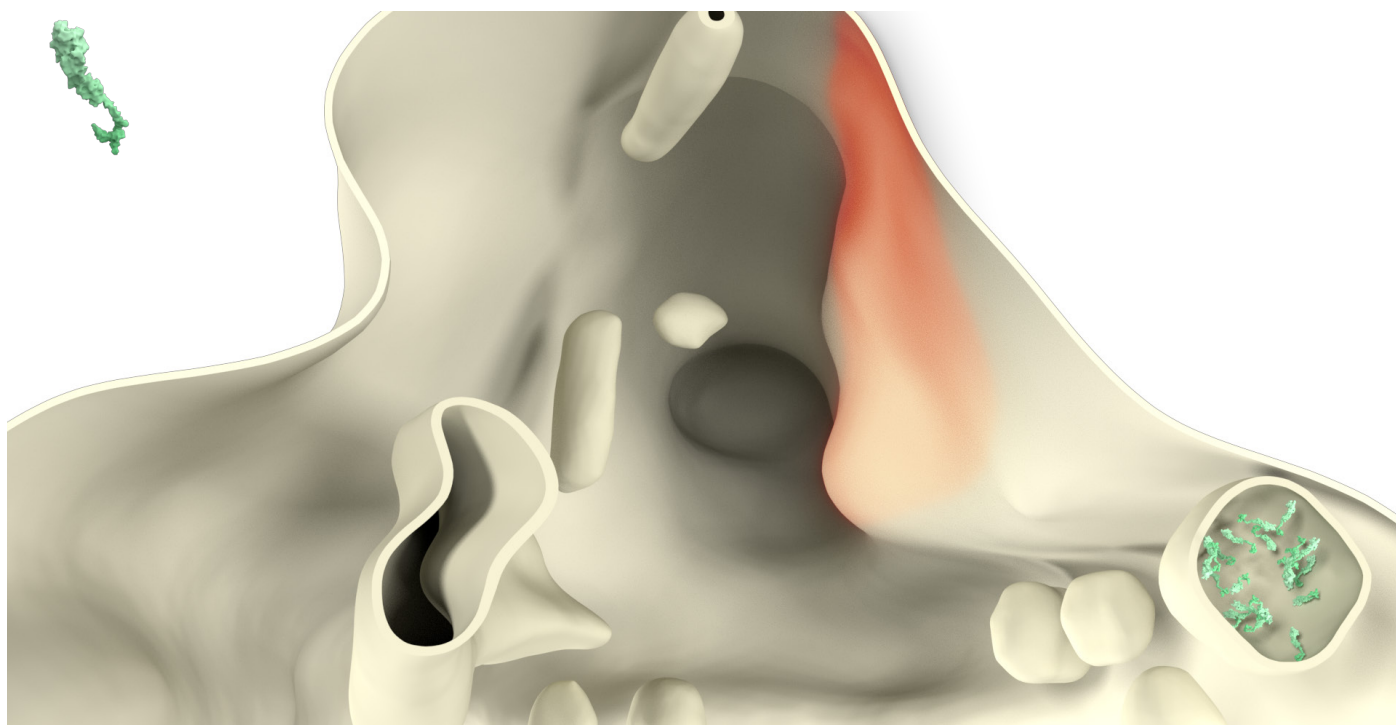


Whole cell copy number	137429.7 ± 19202.2	
Spine copy number	28.1 ± 7.0	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	28.3 ± 7.0	31.4 ± 7.8
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (µM)	0.4 ± 0.1	0.3 ± 0.1
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	28.3 ± 7.0	$0.0 \pm 0.0\%$	0.4 ± 0.1	0 ± 0.0
Stubby	31.4 ± 7.8	$0.0 \pm 0.0\%$	0.3 ± 0.1	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	28.3 ± 7.0	$0.0 \pm 0.0\%$	0.4 ± 0.1	0 ± 0.0
Stubby	31.4 ± 7.8	$0.0 \pm 0.0\%$	0.3 ± 0.1	0 ± 0.0



References

Antibody: Synaptic Systems 259 103

PDB Identifier: Modelled with I-TASSER

Literature:

Krömer et al., 1998, J. Cell. Biol.

Montero-Hadjadje et al., 2009, J. Biol. Chem.

Natori and Huttner, 1996, Proc. Natl. Acad. Sci. USA

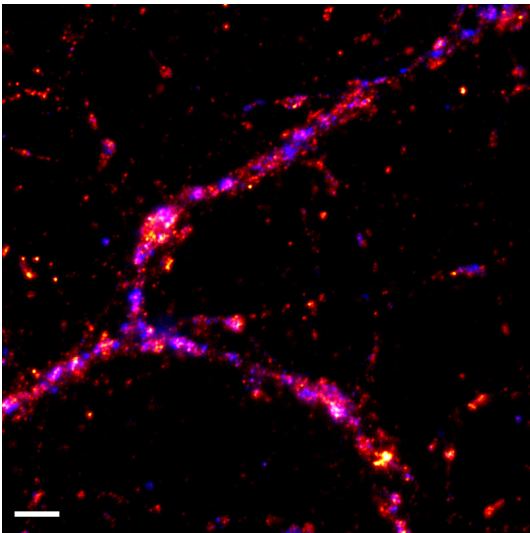
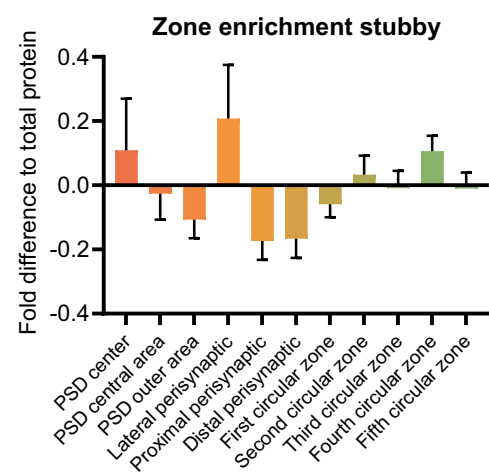
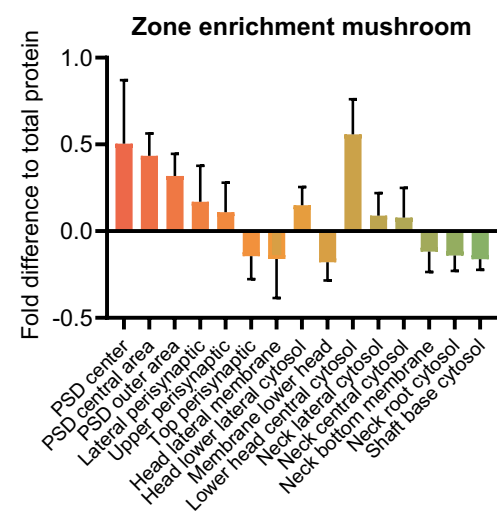
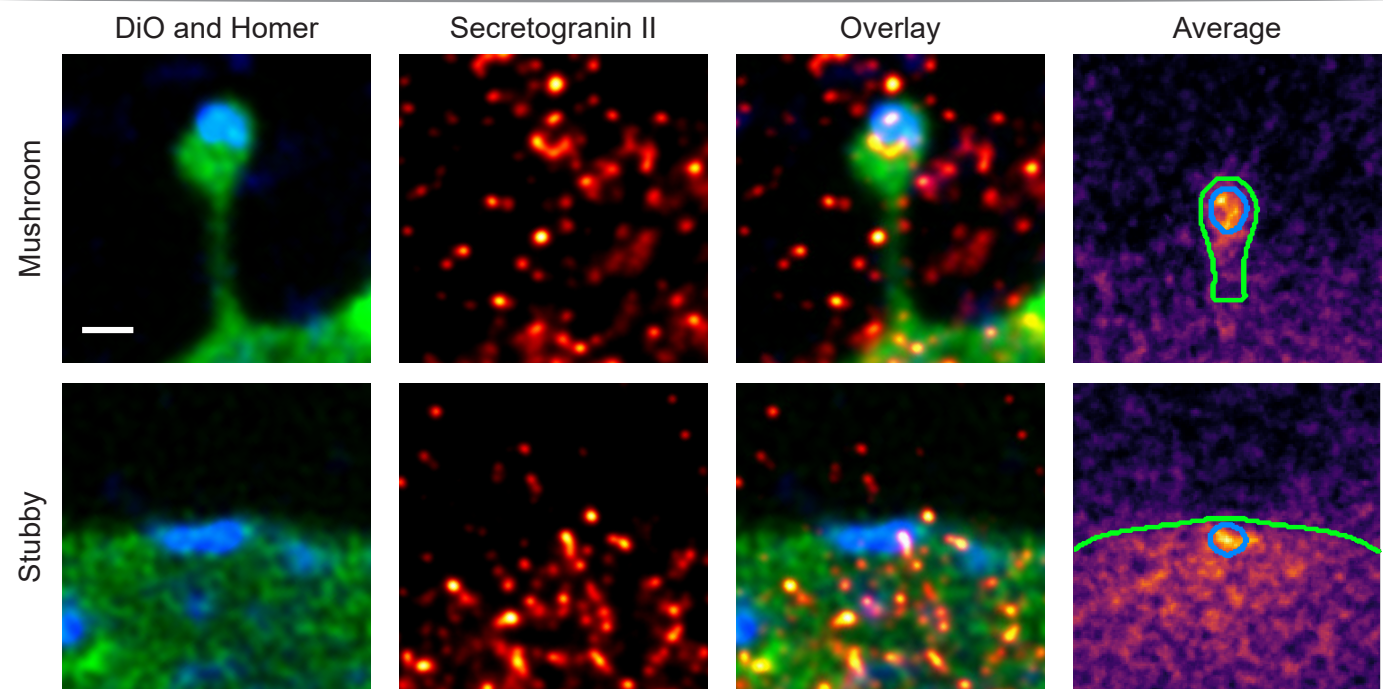
Sun et al., 2013, Traffic

Chromogranin C (Secretogranin II, Gene: Scg2, Uniprot ID: P10362)

Known function: Acts as pro-hormone, Involved in LDCV biogenesis

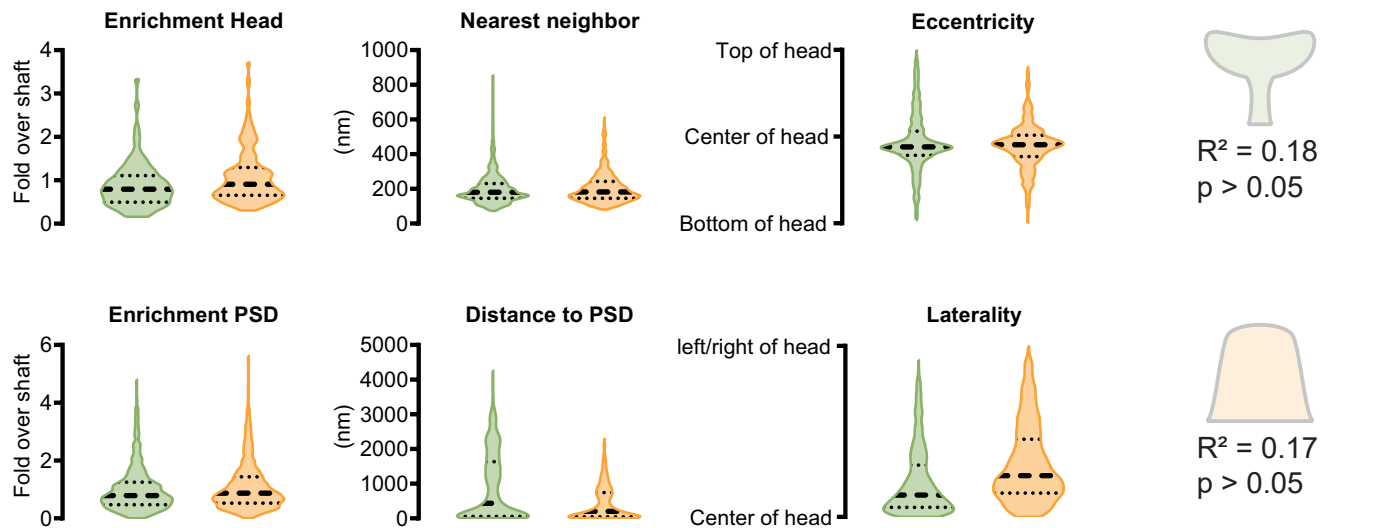
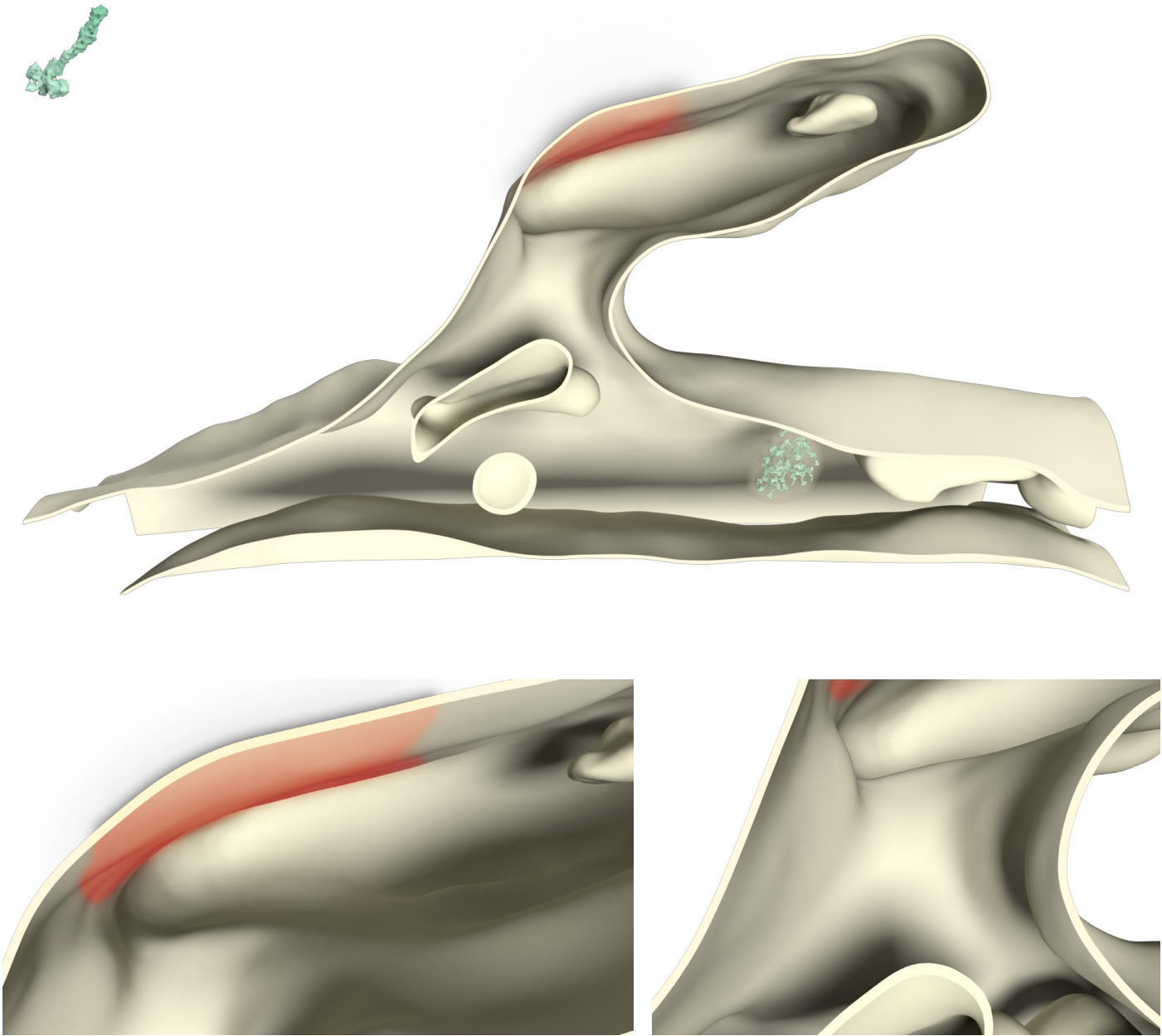
Known organization: In LDCV lumen

Known Interactions: None

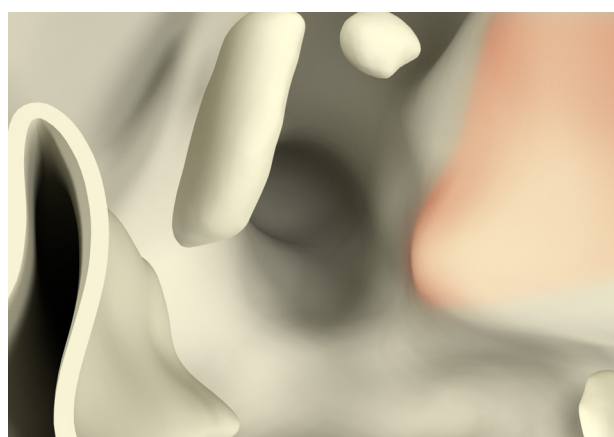
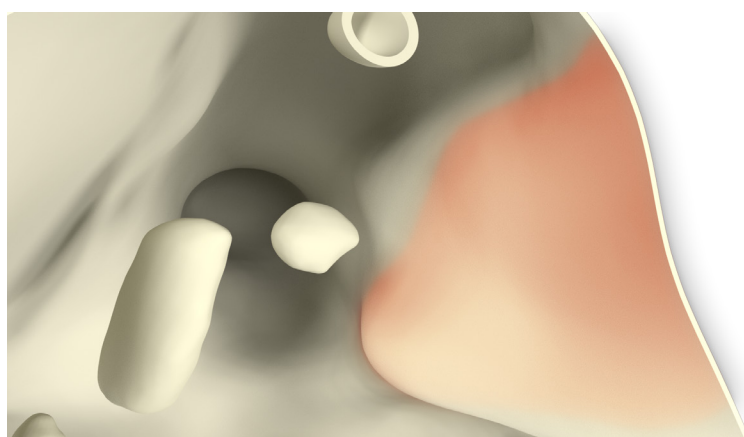
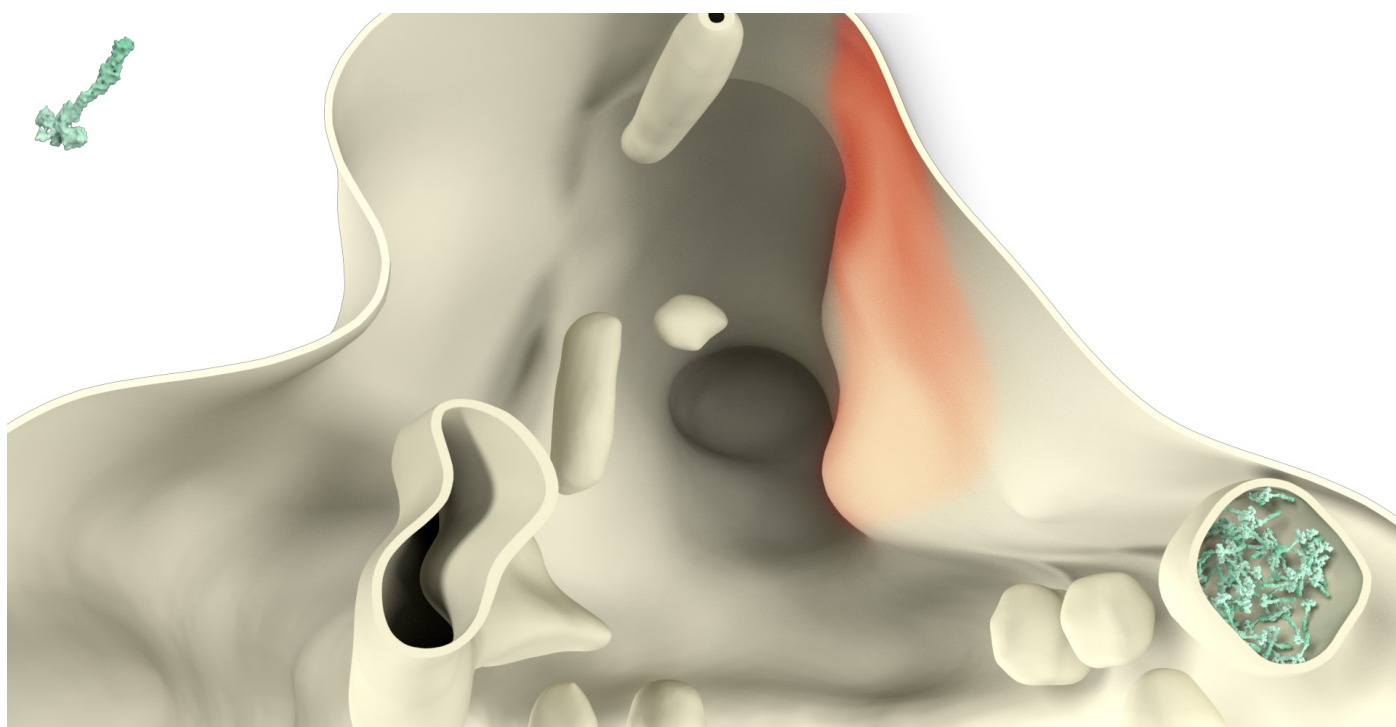


Whole cell copy number	163866.0 ± 29059.1	
Spine copy number	76.1 ± 16.3	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	65.3 ± 14.0	97.7 ± 21.0
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (µM)	0.8 ± 0.2	0.9 ± 0.2
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	65.3 ± 14.0	$0.0 \pm 0.0\%$	0.8 ± 0.2	0 ± 0.0
Stubby	97.7 ± 21.0	$0.0 \pm 0.0\%$	0.9 ± 0.2	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	65.3 ± 14.0	$0.0 \pm 0.0\%$	0.8 ± 0.2	0 ± 0.0
Stubby	97.7 ± 21.0	$0.0 \pm 0.0\%$	0.9 ± 0.2	0 ± 0.0



References

Antibody: Abcam ab12241

PDB Identifier: Modelled with I-Tasser

Literature:

Courel et al., 2010, J. Biol. Chem.

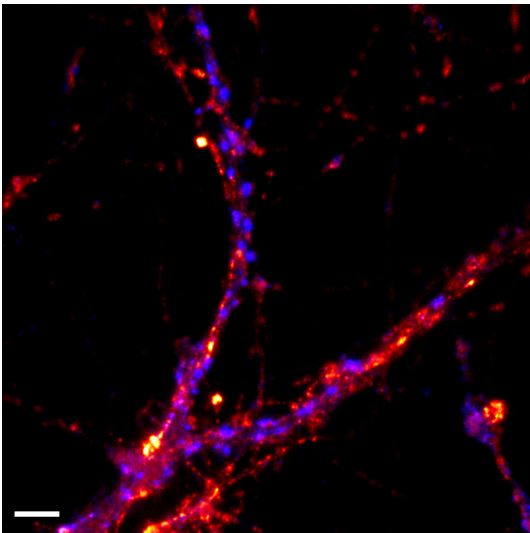
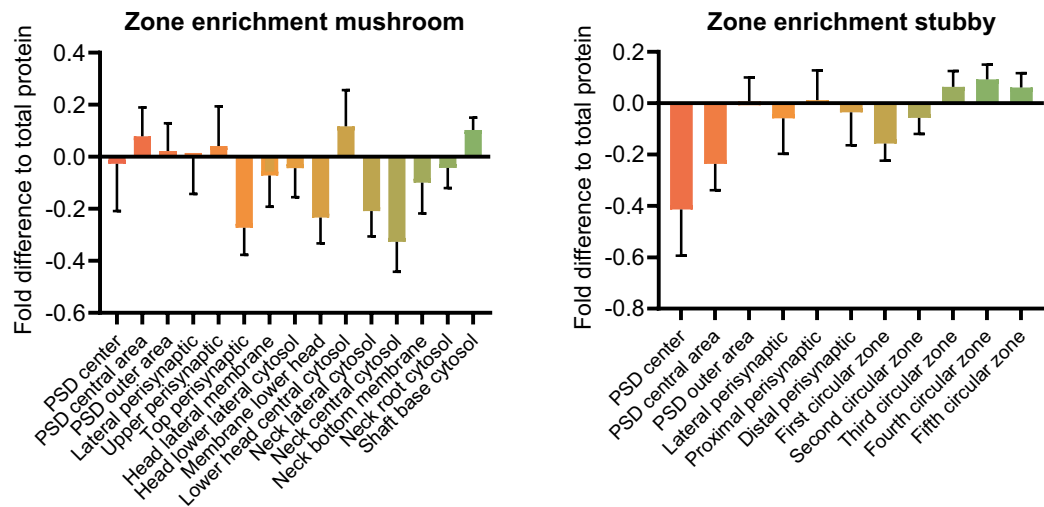
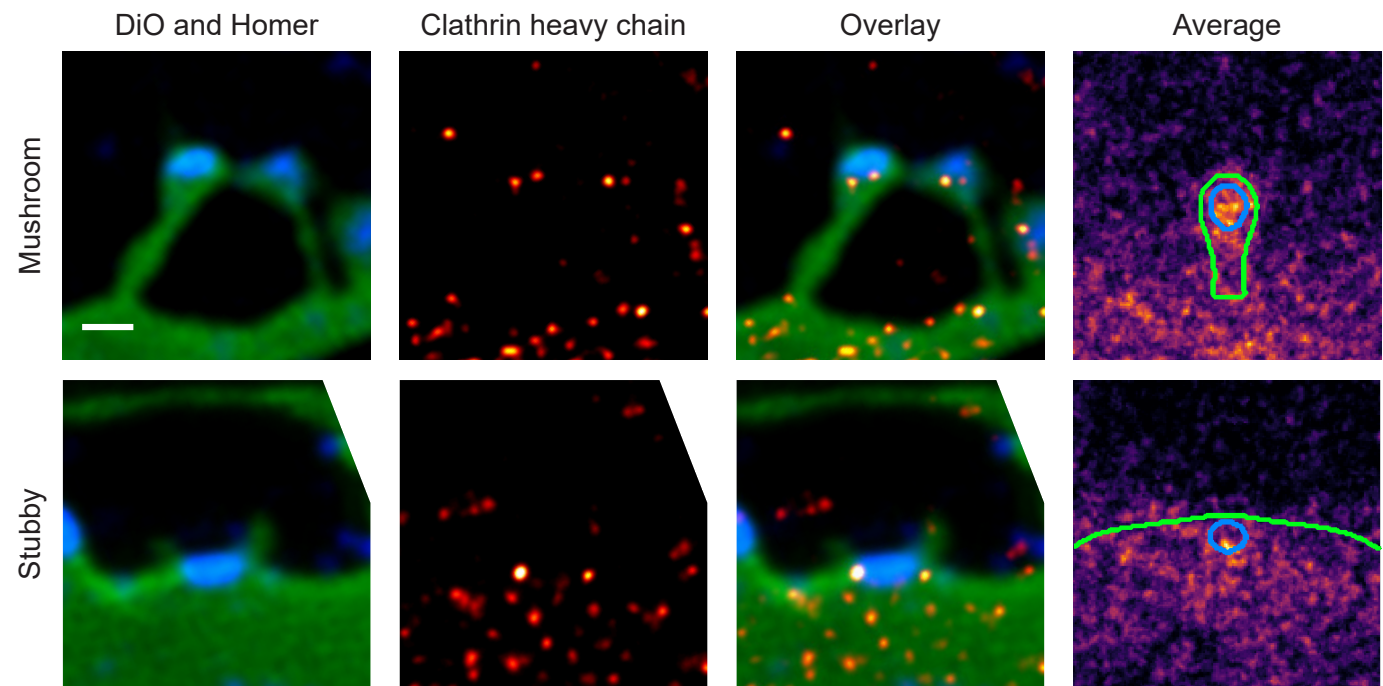
Fischer-Colbrie et al., 1995, Prog. Neurobiol.

Clathrin heavy chain (Gene: Cltc, Uniprot ID: Q05140)

Known function: Endocytosis

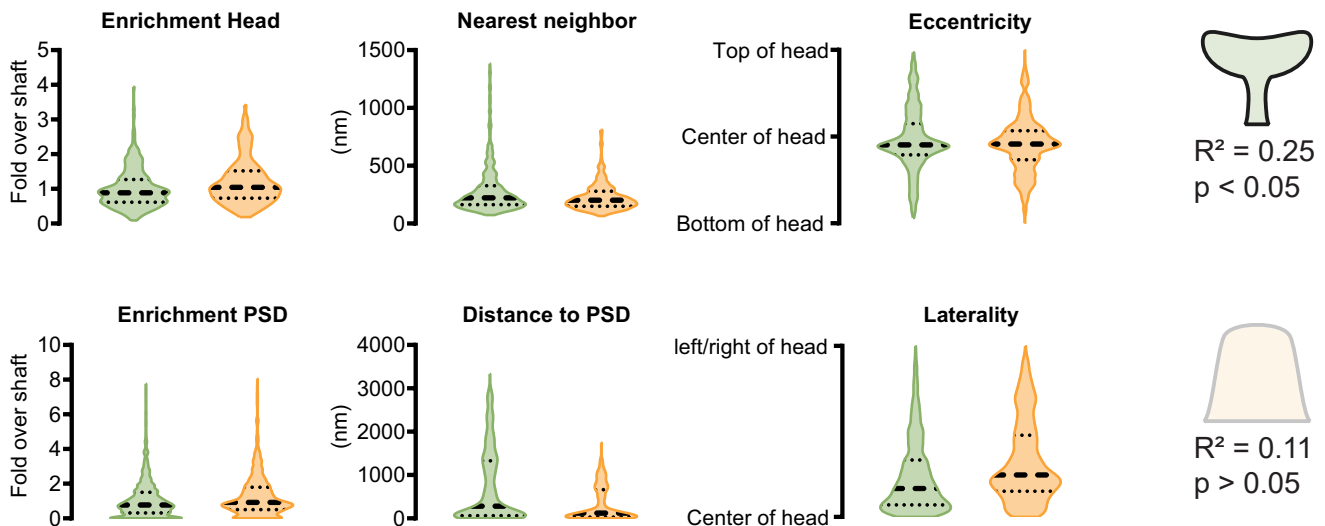
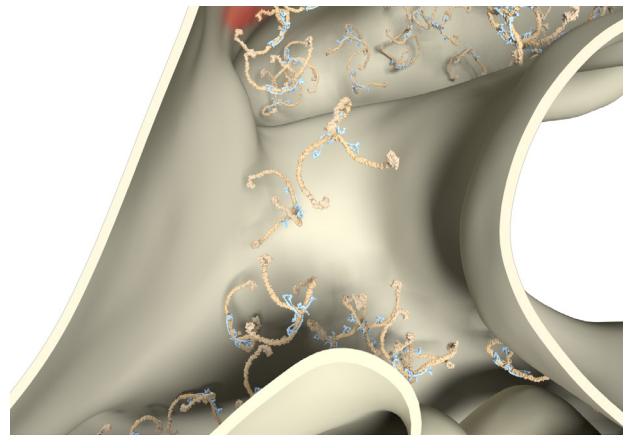
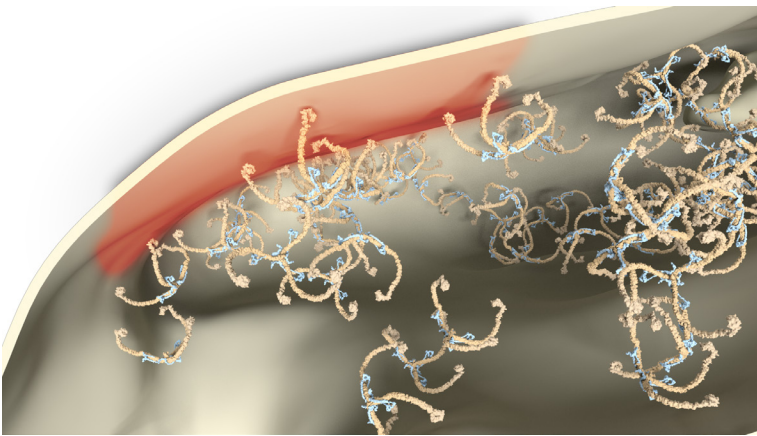
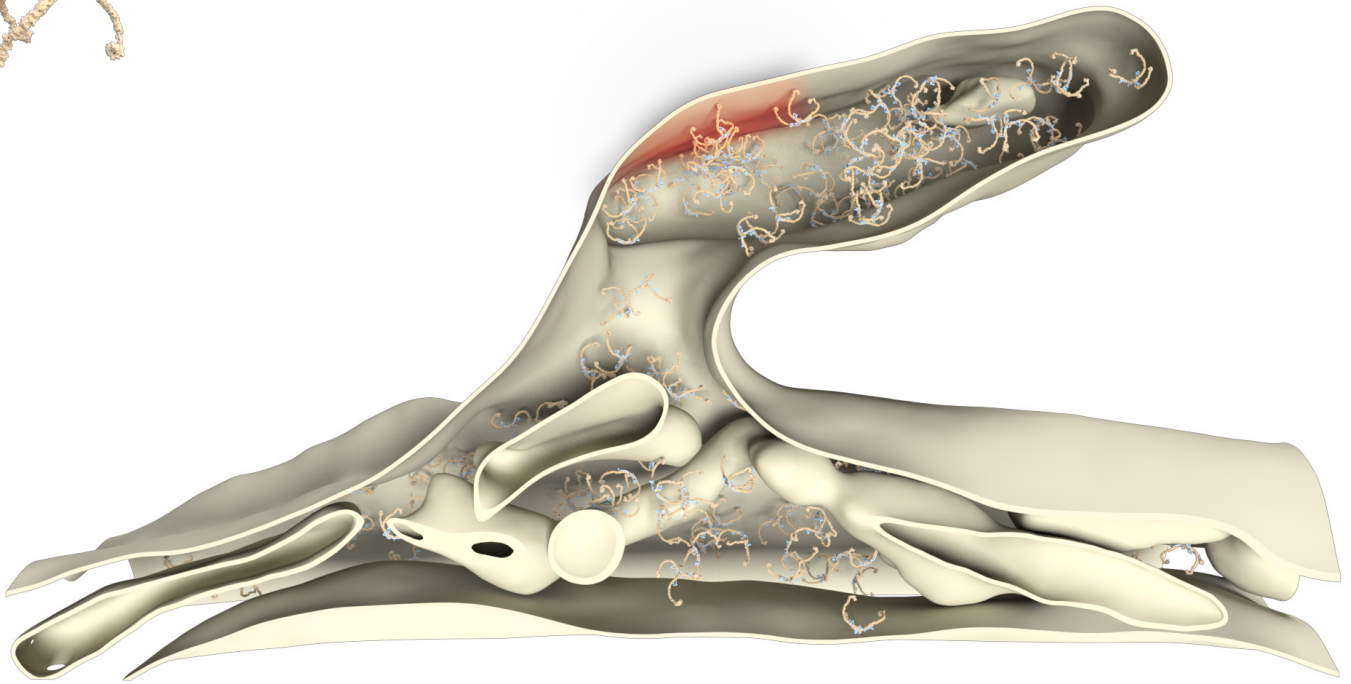
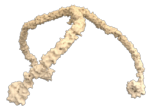
Known organization: Cytosolic or membrane-associated, Forms triskelia together with clathrin light chains, Endocytic zones lateral to PSD or on shaft

Known Interactions: Clathrin light chains, Adaptor proteins

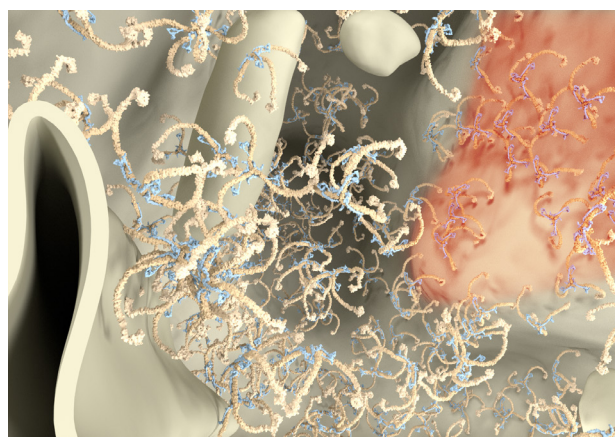
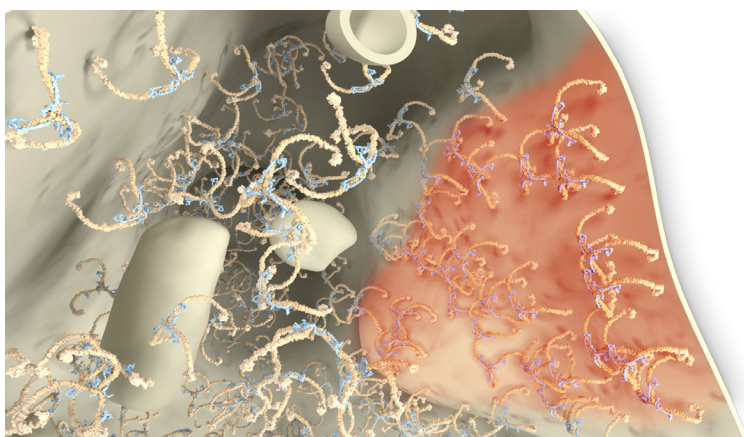
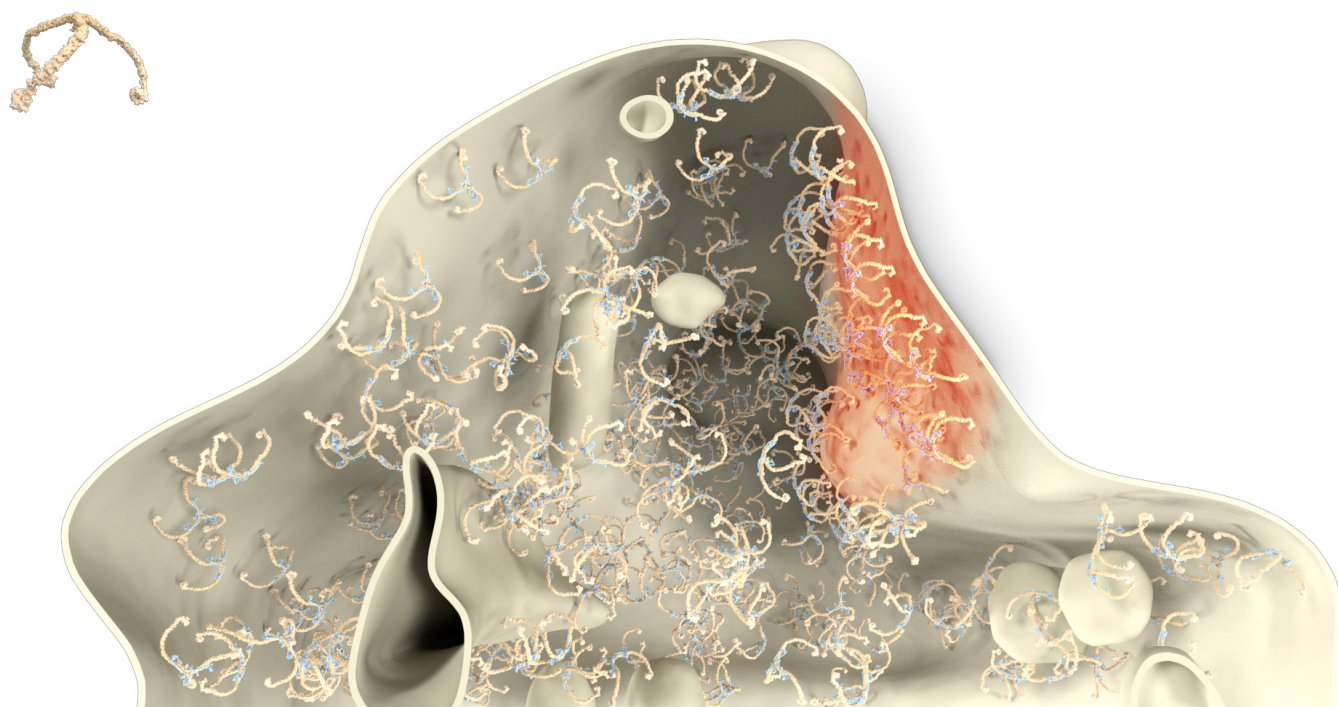


Whole cell copy number	5246065.6 ± 725934.0	
Spine copy number	1102.0 ± 239.7	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	848.5 ± 184.5	1384.3 ± 301.1
% of total protein	0.8 ± 0.2%	1.1 ± 0.2%
Molarity (µM)	10.8 ± 2.3	13.1 ± 2.8
PSD copy number	178 ± 38.7	203 ± 44.2
% in PSD	21.0 ± 4.6%	14.7 ± 3.2%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	848.5 ± 184.5	$0.8 \pm 0.2\%$	10.8 ± 2.3	178 ± 38.7
Stubby	1384.3 ± 301.1	$1.1 \pm 0.2\%$	13.1 ± 2.8	203 ± 44.2



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	848.5 ± 184.5	$0.8 \pm 0.2\%$	10.8 ± 2.3	178 ± 38.7
Stubby	1384.3 ± 301.1	$1.1 \pm 0.2\%$	13.1 ± 2.8	203 ± 44.2



References

Antibody: BD Biosciences 610499

PDB Identifier: 1xi4

Literature:

Blanpied et al., 2002, Neuron

Boehm et al., 2006, Neuron

Cheng et al., 2007, J. Mol. Biol.

Cooney et al., 2002, J. Neurosci.

Loebrich et al., 2013, Proc. Natl. Acad. Sci. U S A

Lu et al., 2007, Neuron

Musacchio et al., 1999, Mol. Cell.

Park et al., 2006, Neuron

Rácz et al., 2004, Nat. Neurosci.

Rosendale et al., 2017, Cell. Rep.

Tao-Cheng et al., 2011, J. Neurosci.

Ungewickell and Branton, 1981, Nature

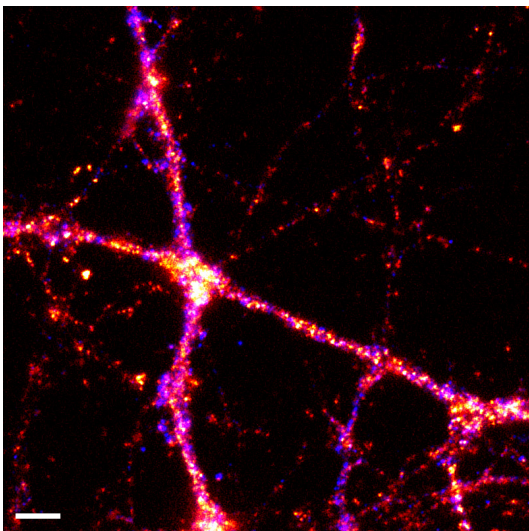
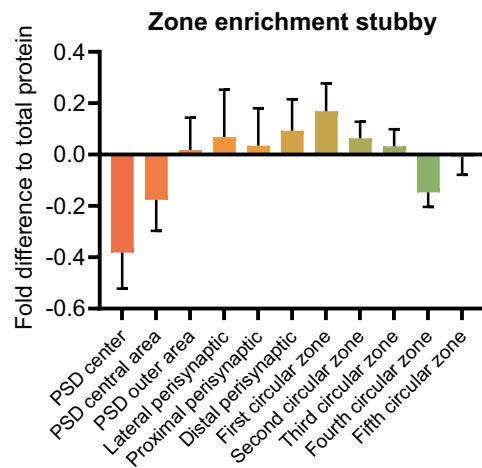
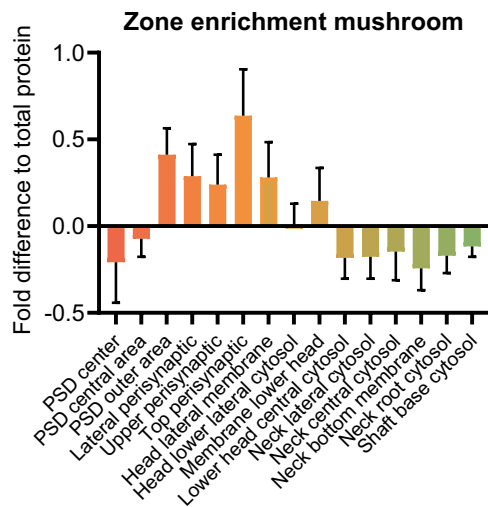
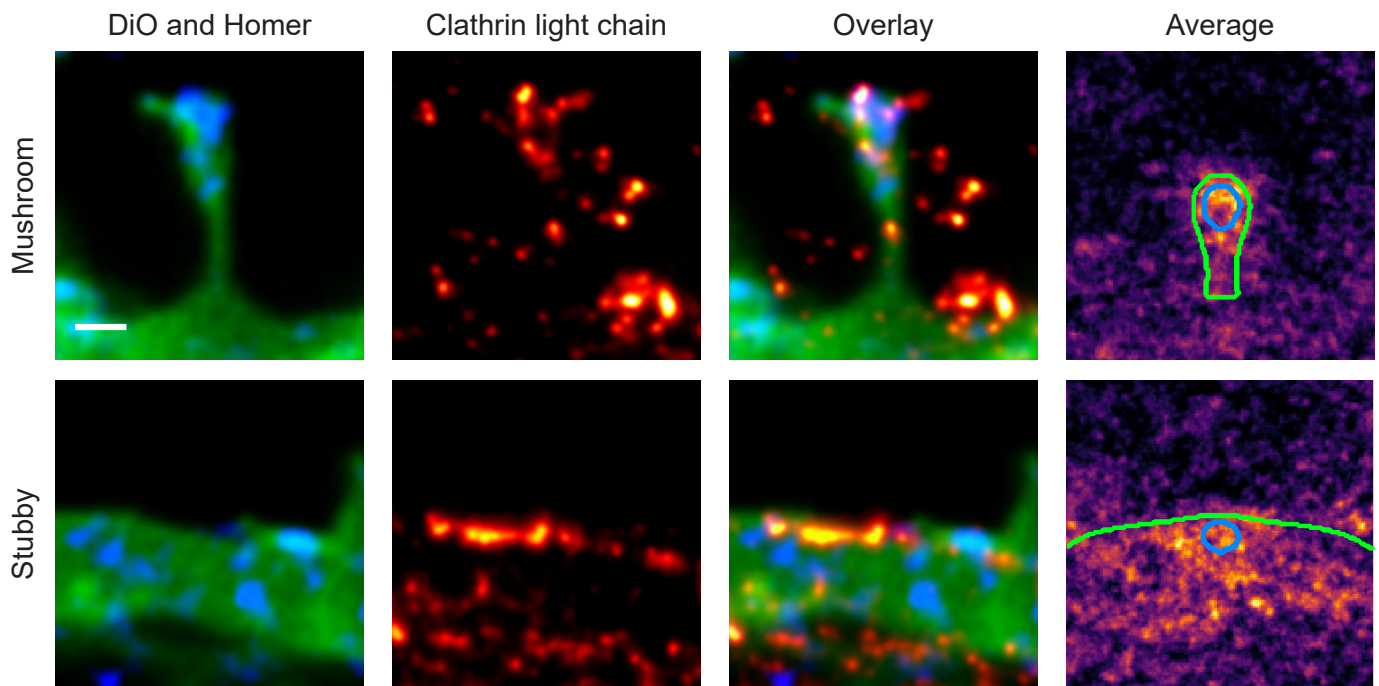
Yudowski et al., 2007, J. Neurosci.

Clathrin light chain a & b (Genes: Clta & Cltb , Uniprot IDs: P08081 & P08082)

Known function: Endocytosis

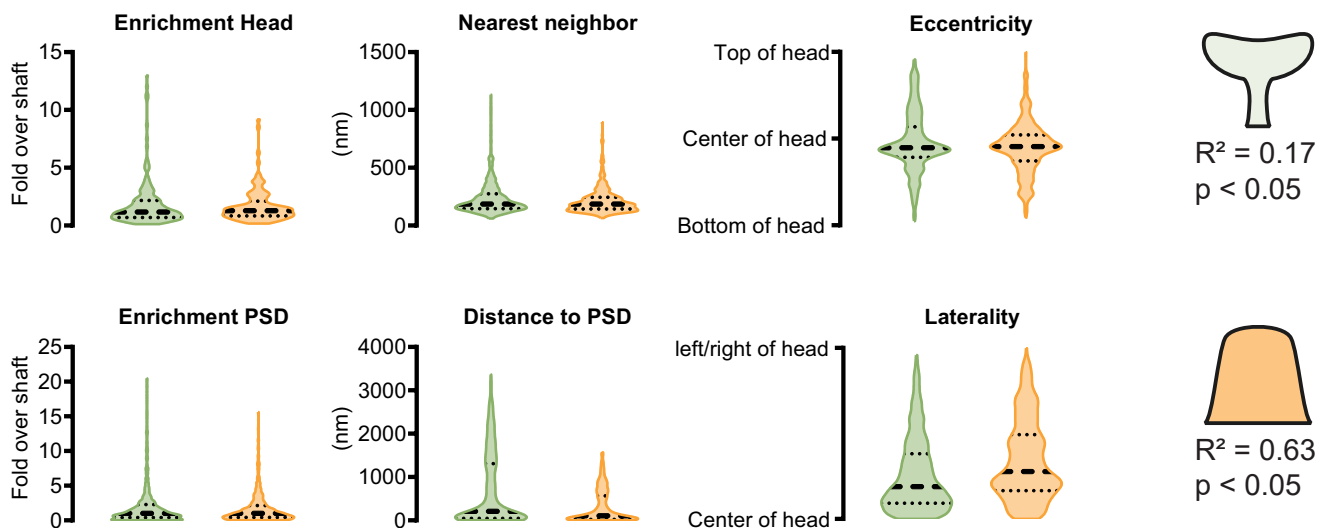
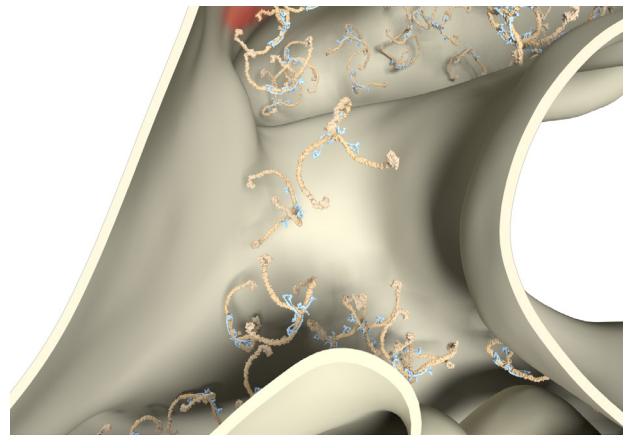
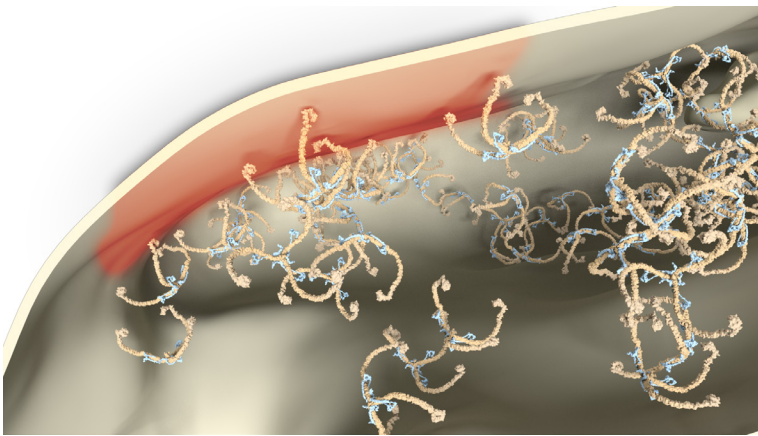
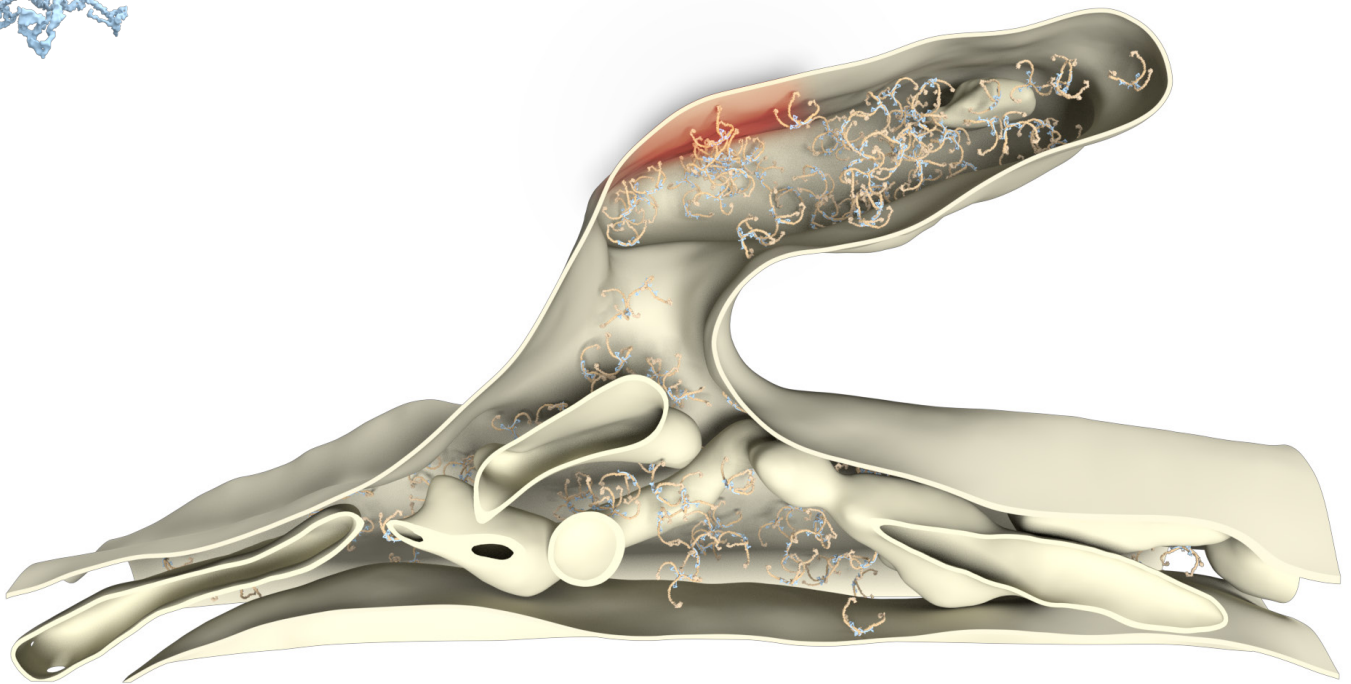
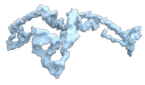
Known organization: Cytosolic or membrane-associated, Forms triskelia together with clathrin heavy hains, On endocytic zones lateral to PSD or on shaft

Known Interactions: Clathrin light chains, Adaptor proteins

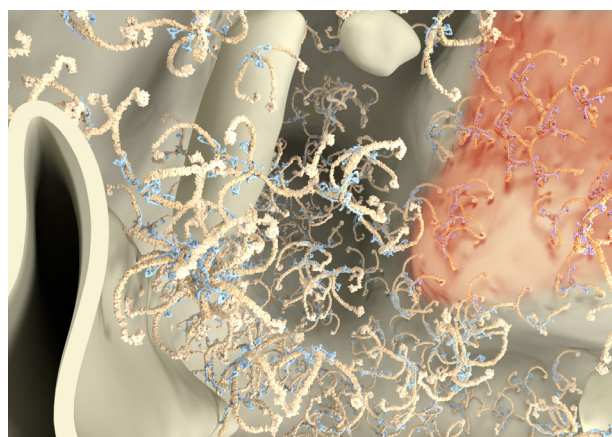
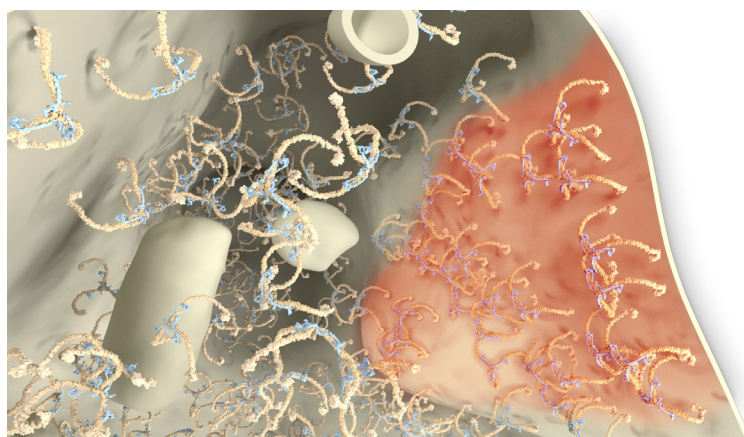
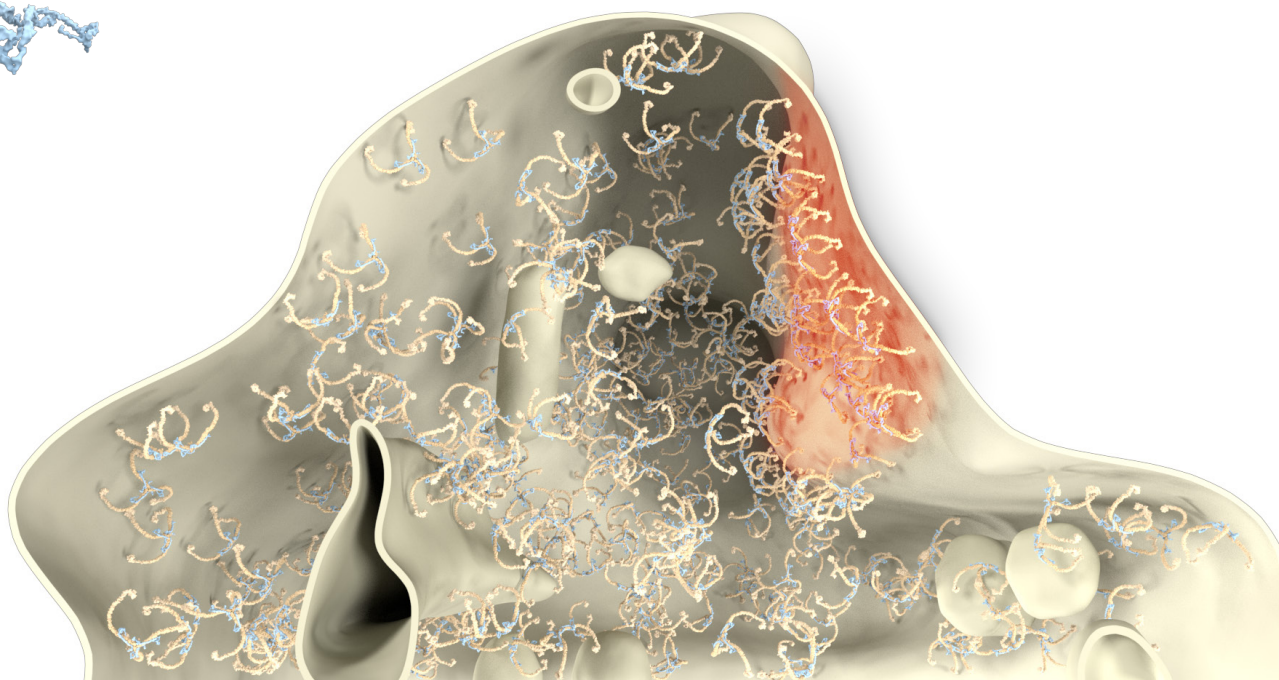


Whole cell copy number	37063124.7 ± 3129866.2	
Spine copy number	11708.3 ± 2349.5	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	10105.7 ± 2027.9	13270.1 ± 2662.9
% of total protein	1.2 ± 0.3%	1.4 ± 0.3%
Molarity (μM)	128.3 ± 25.8	125.4 ± 25.2
PSD copy number	2654 ± 532.6	1424 ± 285.7
% in PSD	26.3 ± 5.3%	10.7 ± 2.2%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	10105.7 ± 2027.9	$1.2 \pm 0.3\%$	128.3 ± 25.8	2654 ± 532.6
Stubby	13270.1 ± 2662.9	$1.4 \pm 0.3\%$	125.4 ± 25.2	1424 ± 285.7



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	10105.7 ± 2027.9	$1.2 \pm 0.3\%$	128.3 ± 25.8	2654 ± 532.6
Stubby	13270.1 ± 2662.9	$1.4 \pm 0.3\%$	125.4 ± 25.2	1424 ± 285.7



References

Antibody: Synaptic Systems 113 011

PDB Identifier: 1xi4

Literature:

Blanpied et al., 2002, Neuron

Boehm et al., 2006, Neuron

Cheng et al., 2007, J. Mol. Biol.

Cooney et al., 2002, J. Neurosci.

Loebrich et al., 2013, Proc. Natl. Acad. Sci. U S A

Lu et al., 2007, Neuron

Musacchio et al., 1999, Mol. Cell.

Park et al., 2006, Neuron

Rácz et al., 2004, Nat. Neurosci.

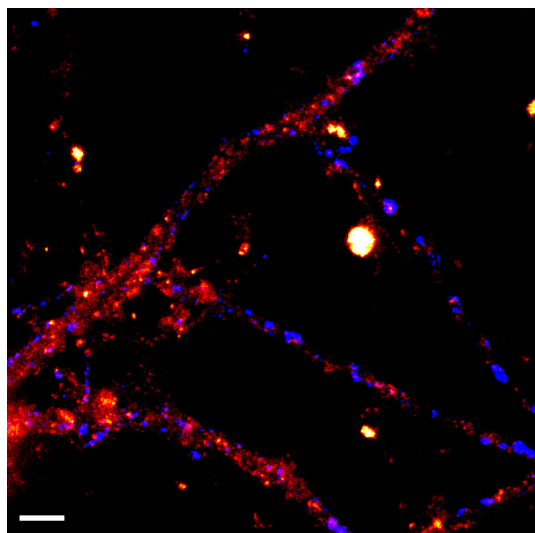
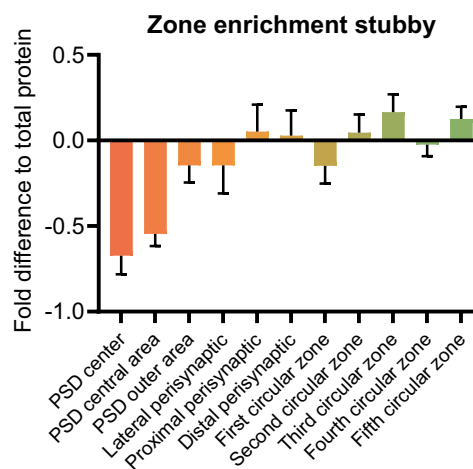
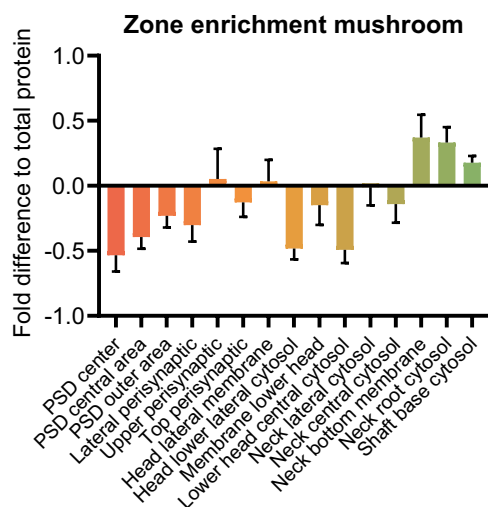
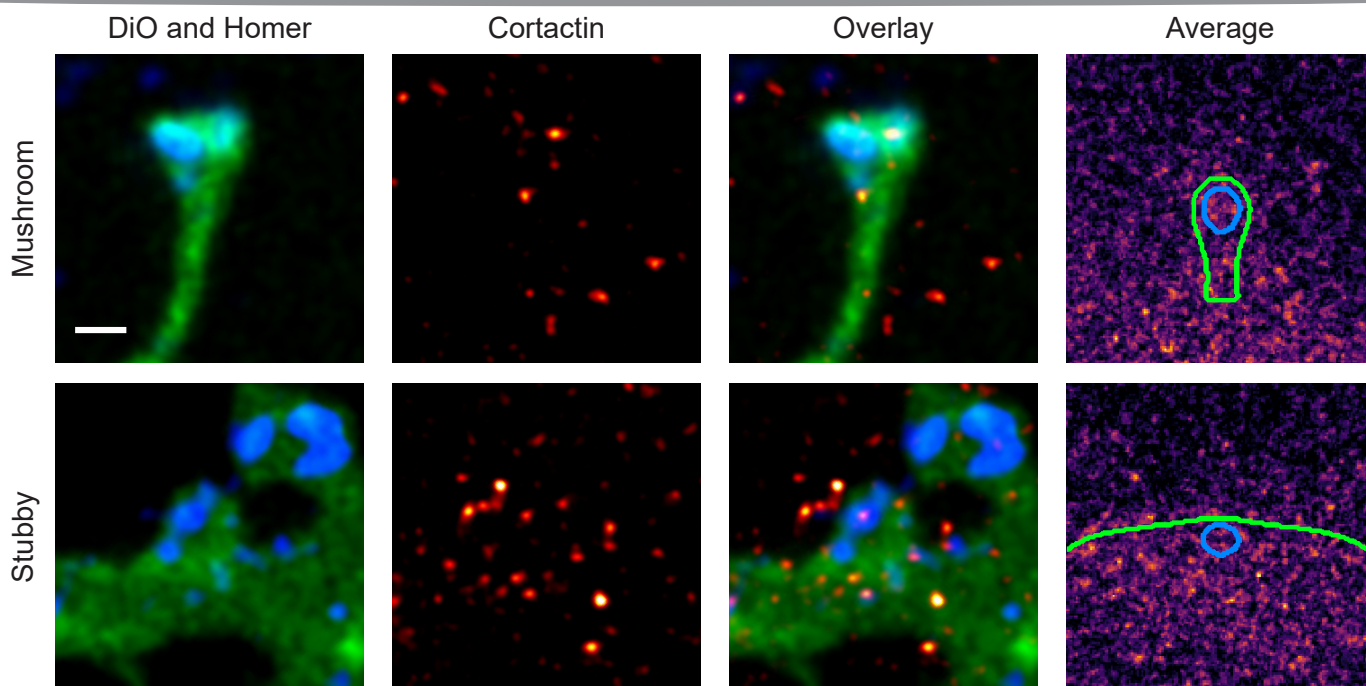
Rosendale et al., 2017, Cell. Rep.

Tao-Cheng et al., 2011, J. Neurosci.

Ungewickell and Branton, 1981, Nature

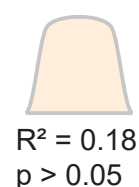
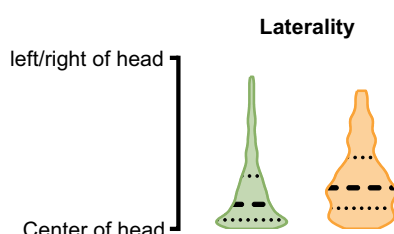
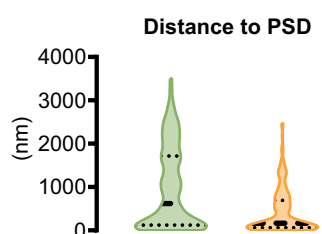
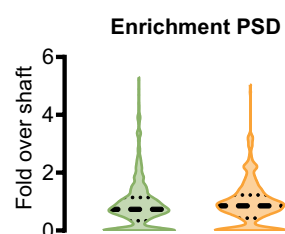
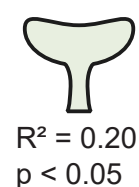
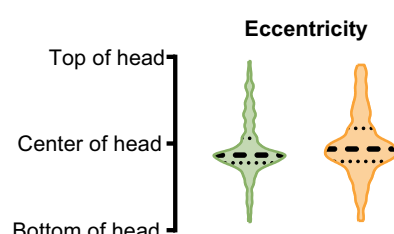
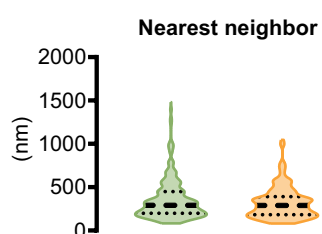
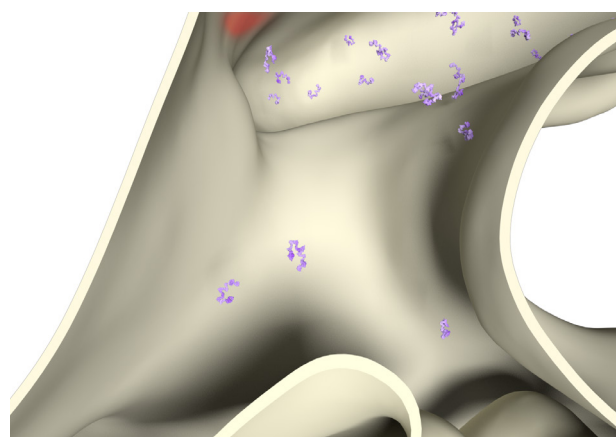
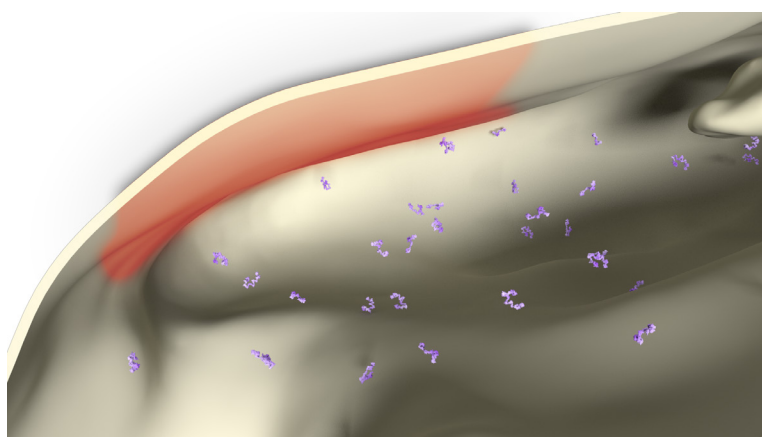
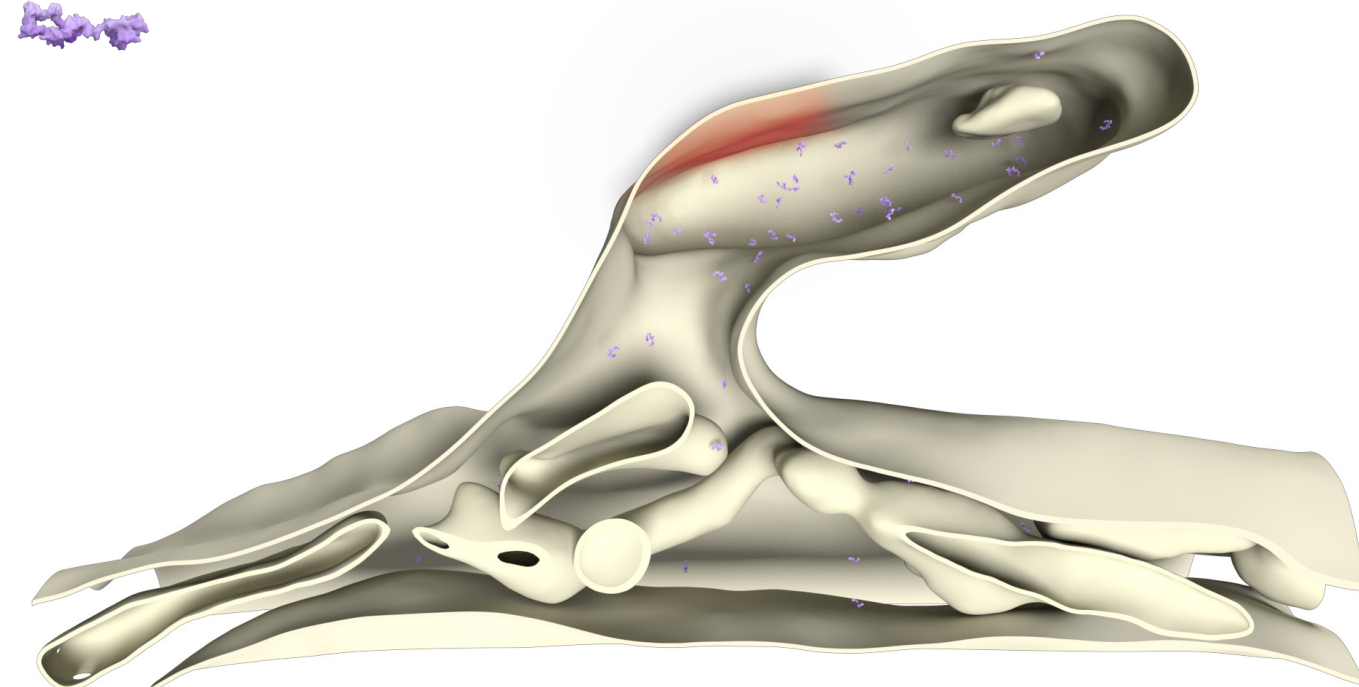
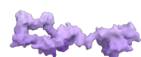
Yudowski et al., 2007, J. Neurosci.

Known Interactions: Actin, Shank proteins, PSD95

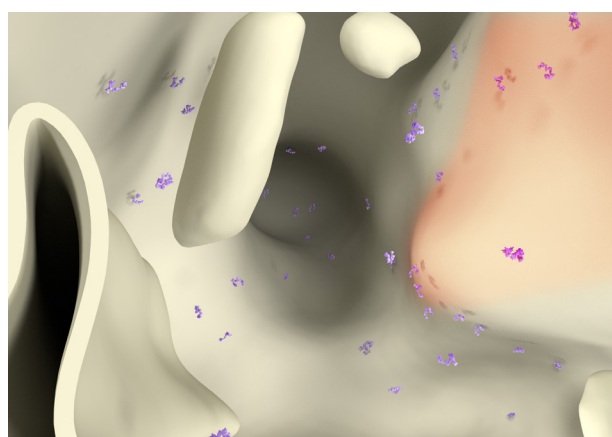
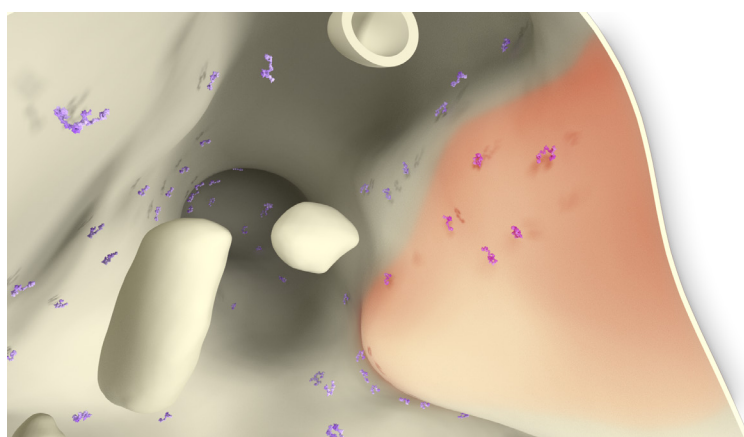
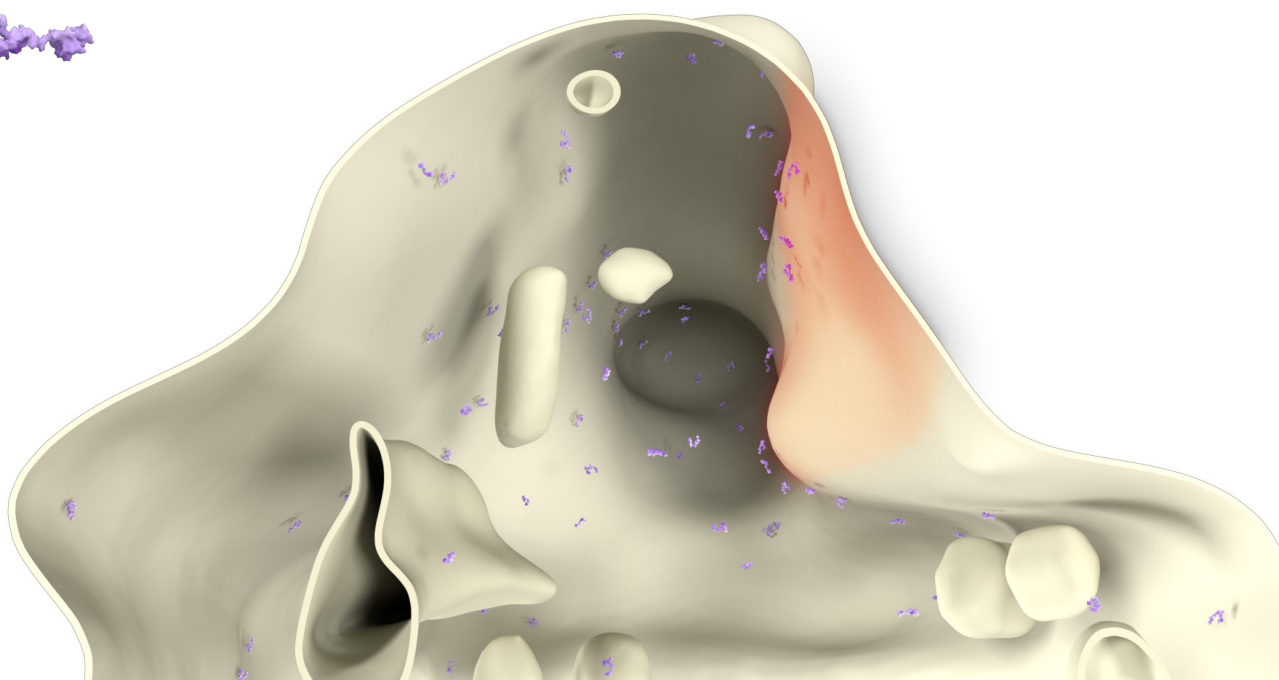
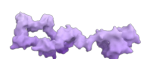


Whole cell copy number	1298507.4 ± 190151.8	
Spine copy number	121.2 ± 51.0	
Function	Cytoskeleton	
	Mushroom	Stubby
Spine copy number	101.6 ± 42.8	161.6 ± 68.0
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	1.3 ± 0.5	1.5 ± 0.6
PSD copy number	10 ± 4.2	13 ± 5.5
% in PSD	9.8 ± 4.1%	8.0 ± 3.4%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	101.6 ± 42.8	$0.0 \pm 0.0\%$	1.3 ± 0.5	10 ± 4.2
Stubby	161.6 ± 68.0	$0.0 \pm 0.0\%$	1.5 ± 0.6	13 ± 5.5



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	101.6 ± 42.8	$0.0 \pm 0.0\%$	1.3 ± 0.5	10 ± 4.2
Stubby	161.6 ± 68.0	$0.0 \pm 0.0\%$	1.5 ± 0.6	13 ± 5.5



References

Antibody: Synaptic Systems 313 111

PDB Identifier: 3ulr, 2d1x

Literature:

Catarino et al., 2013, J. Cell. Sci.

Du et al., 1998, Mol. Cell. Biol.

MacGillavry et al., 2016, Eur. J. Neurosci.

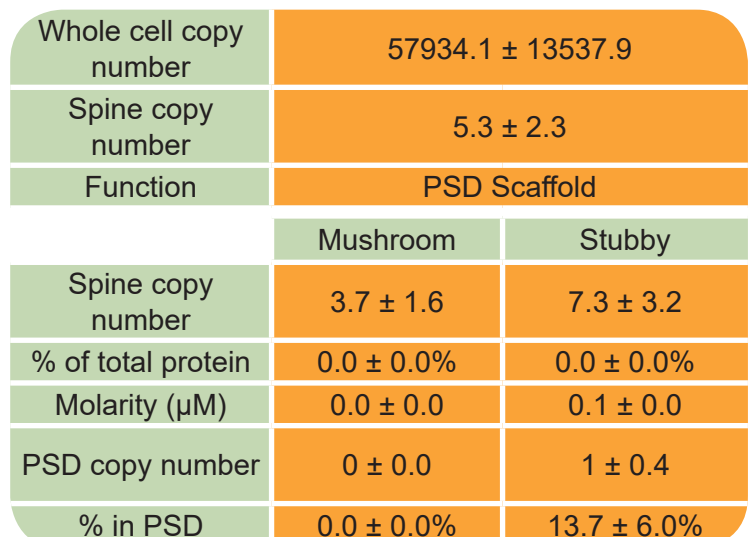
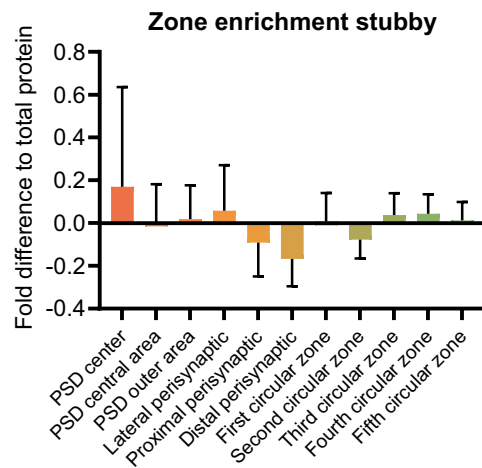
Naisbitt et al., 1999, Neuron

Ren et al., 2009, J. Biol. Chem.

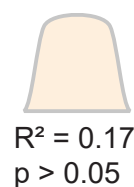
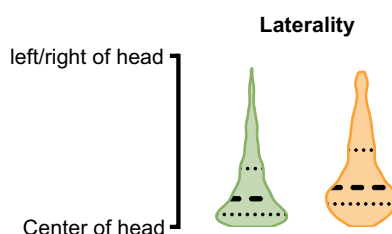
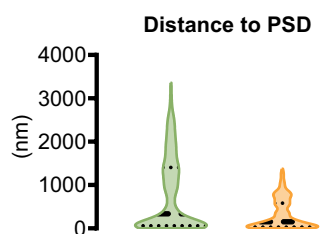
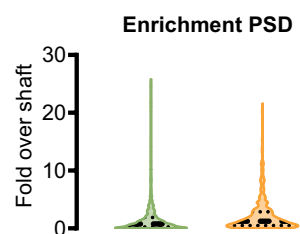
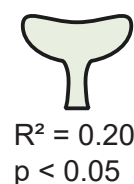
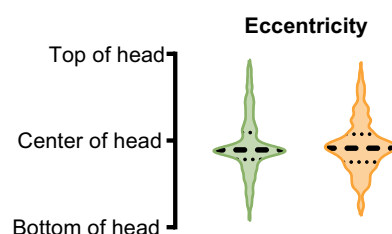
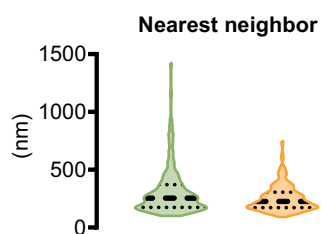
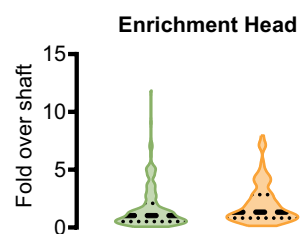
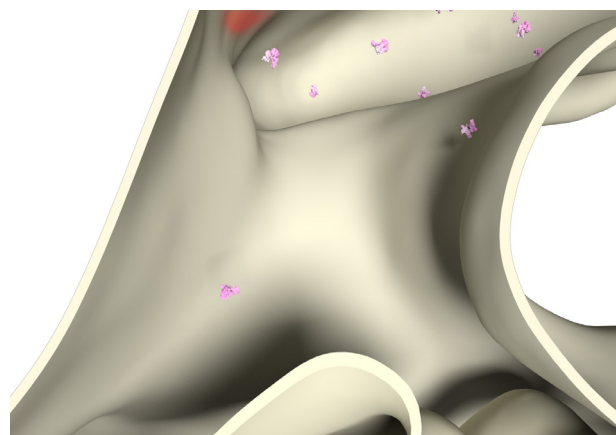
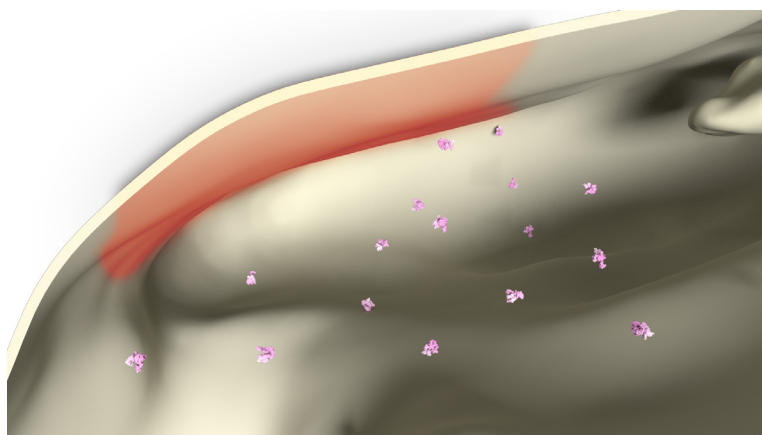
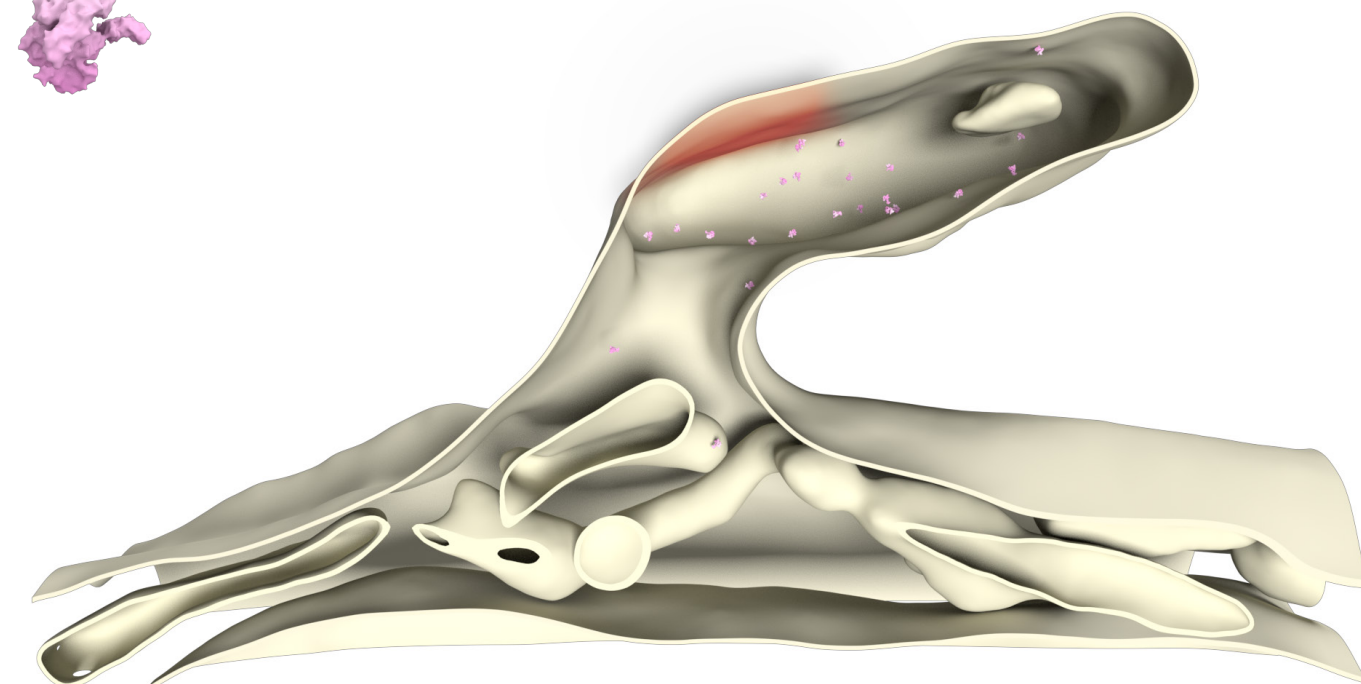
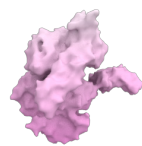
Rostaing et al., 2006, Eur. J. Neurosci.

Wu and Parsons, 1993, J. Cell. Biol.

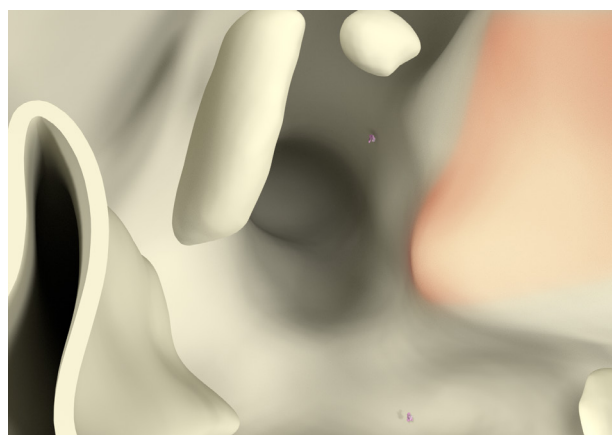
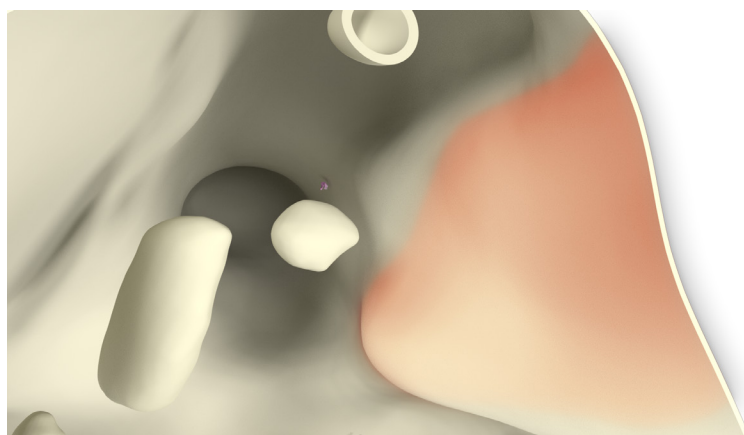
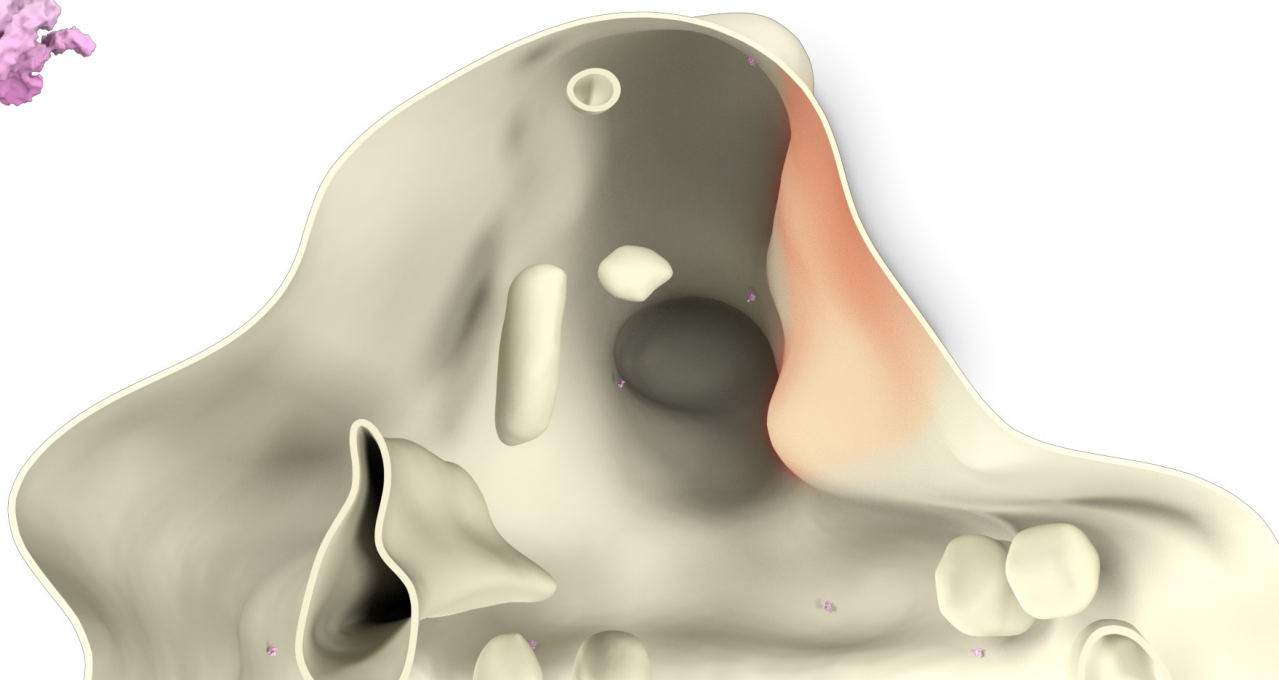
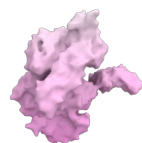
Known Interactions: PSD95, SAP97, Shank proteins



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	3.7 ± 1.6	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	7.3 ± 3.2	$0.0 \pm 0.0\%$	0.1 ± 0.0	1 ± 0.4



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	3.7 ± 1.6	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	7.3 ± 3.2	$0.0 \pm 0.0\%$	0.1 ± 0.0	1 ± 0.4



References

Antibody: Novus Biologicals NBP1-76911

PDB Identifier: 4r0y

Literature:

Boeckers et al., 1999a, J. Neurosci.

Kim et al., 1997, J. Cell. Biol.

MacGillavry et al., 2013, Neuron

Naisbitt et al., 1999, Neuron

Satoh et al., 1997, Genes Cells

Takeuchi et al., 1997, J. Biol. Chem.

Wu et al., 2000, EMBO J.

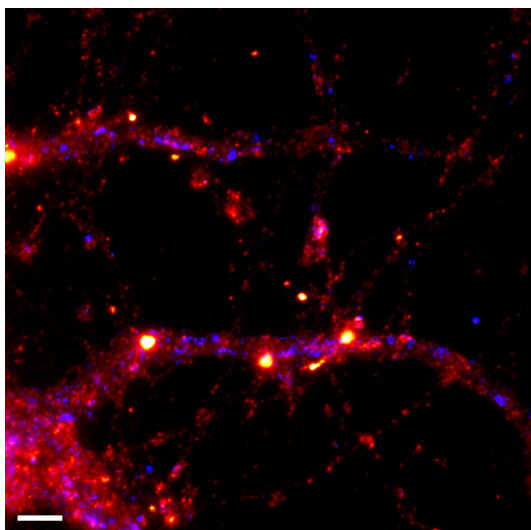
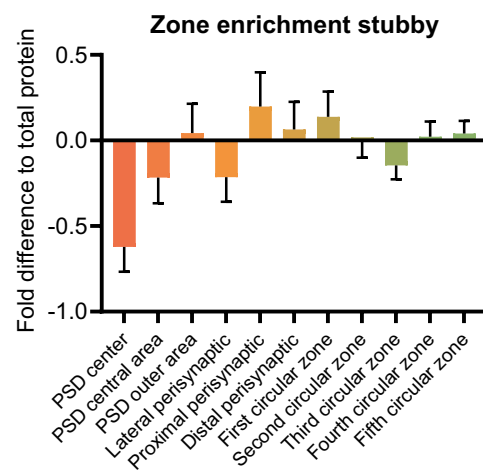
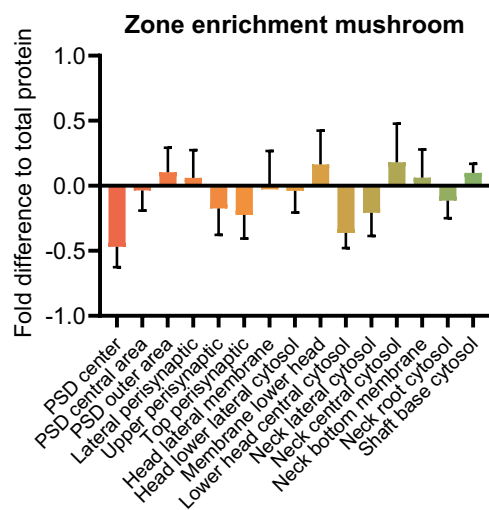
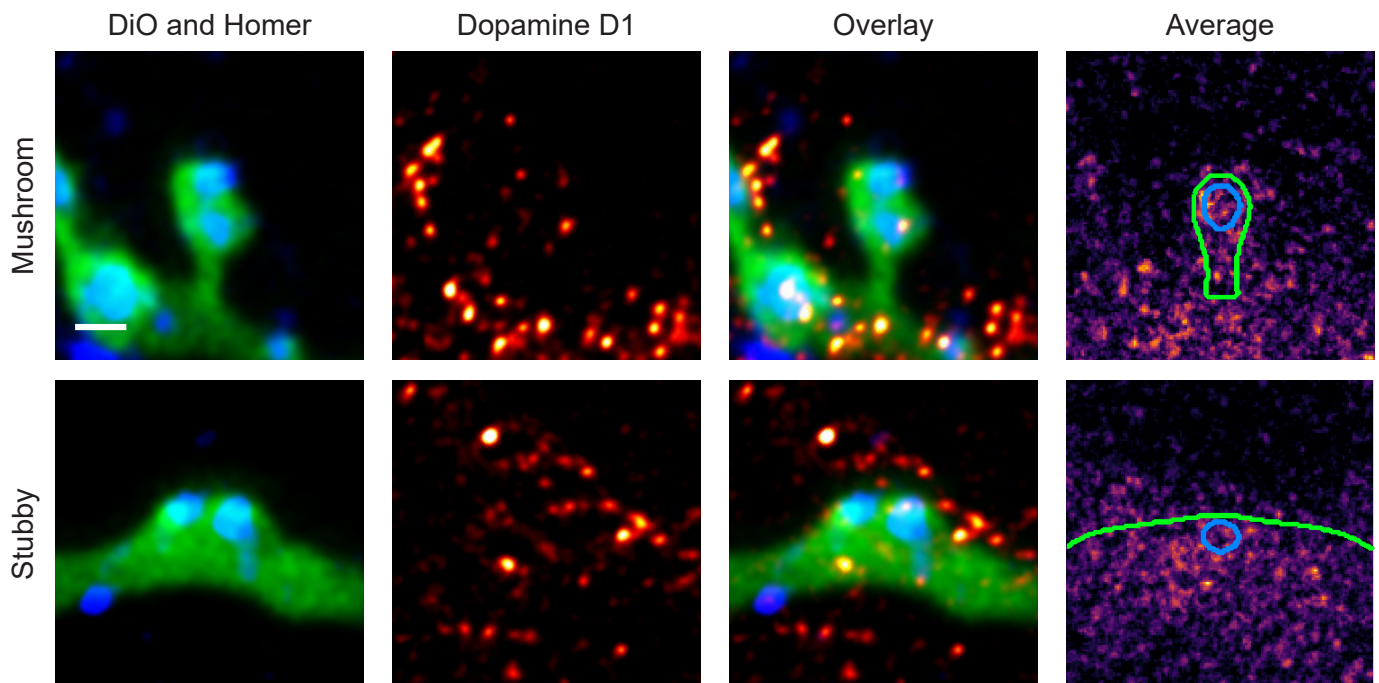
Yao, 1999, J. Biol. Chem.

Dopamine Receptor D1 (Gene: Drd1, Uniprot ID: P18901)

Known function: Activation of Adenylyl cyclase, Enhances NMDAR response

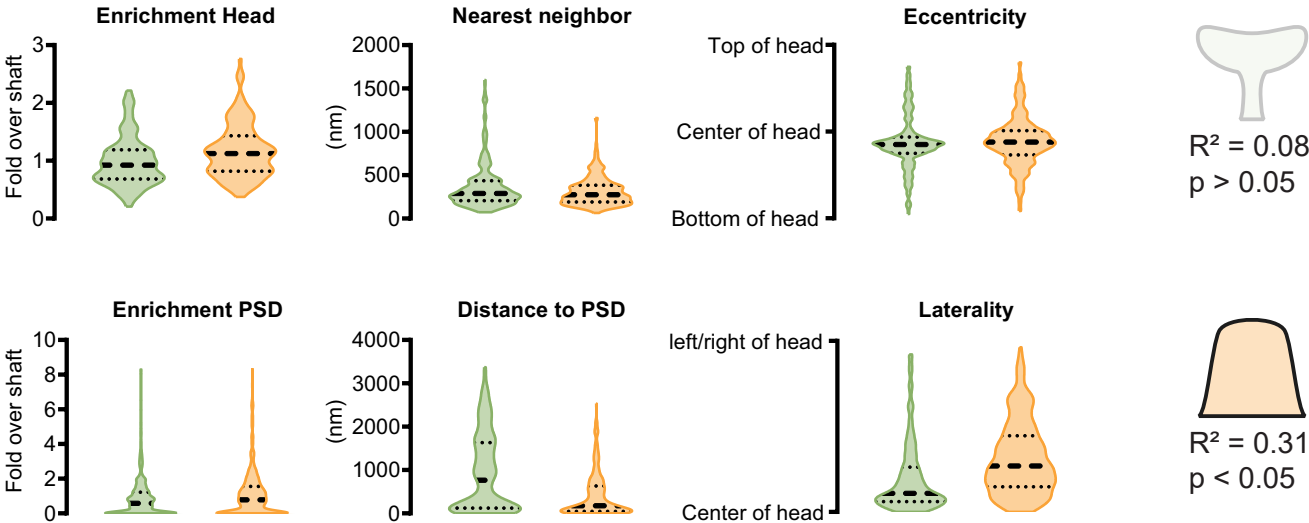
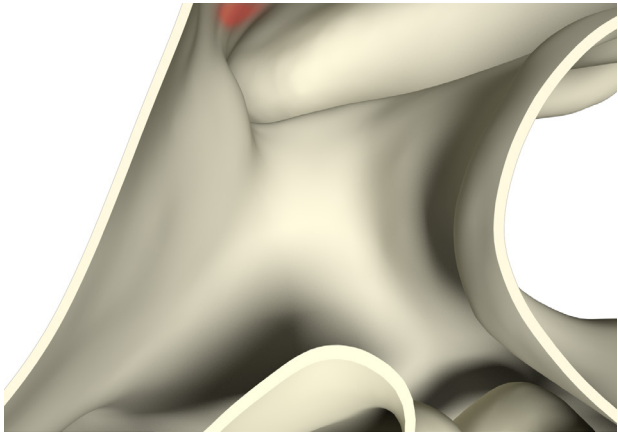
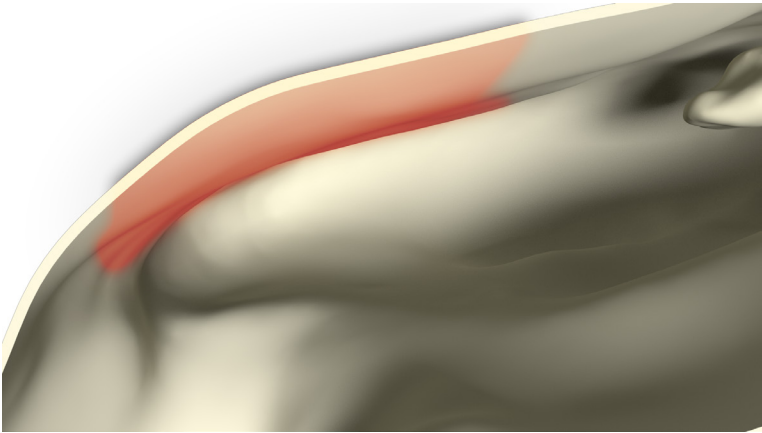
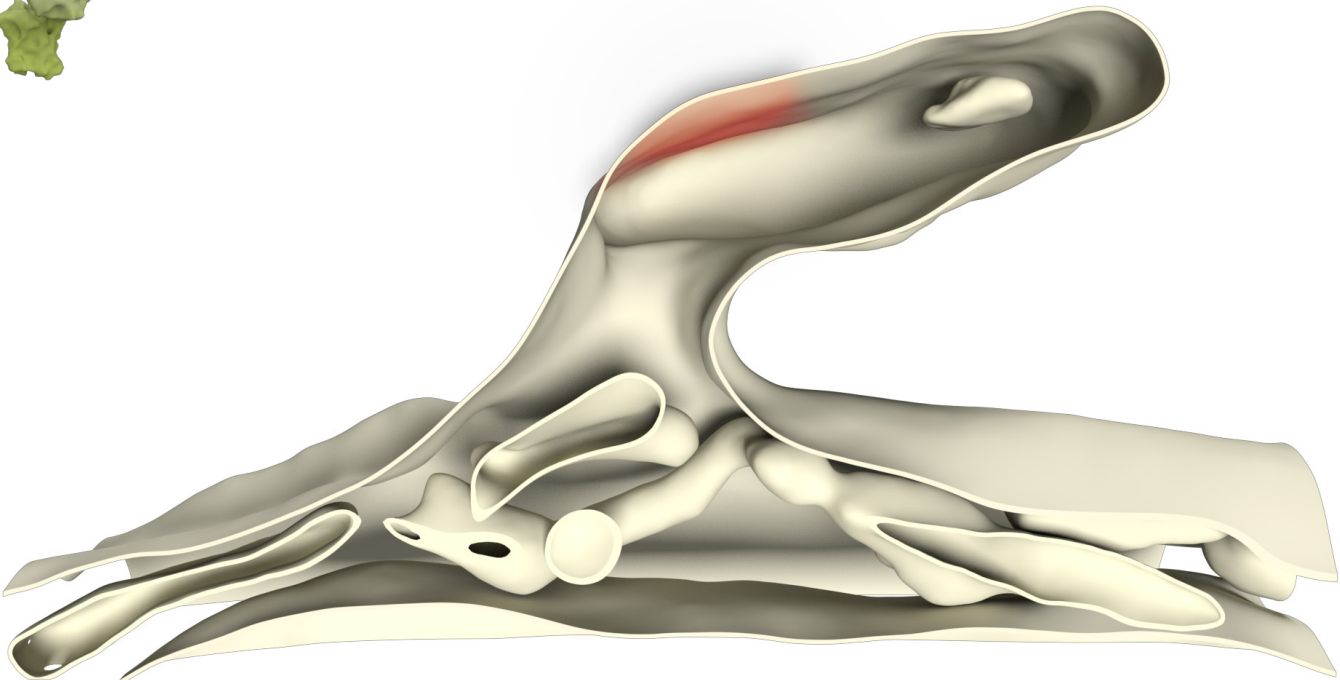
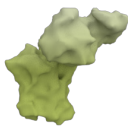
Known organization: Transmembrane protein, Present in clusters, Predominantly on shaft and perisynaptic regions

Known Interactions: Dopamine Receptor D2, NMDA Receptors

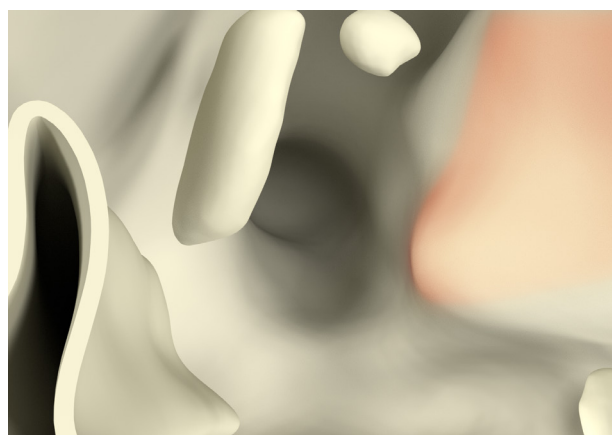
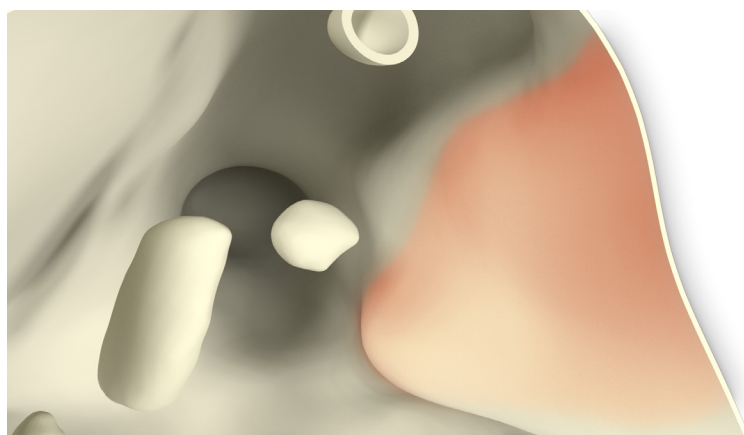
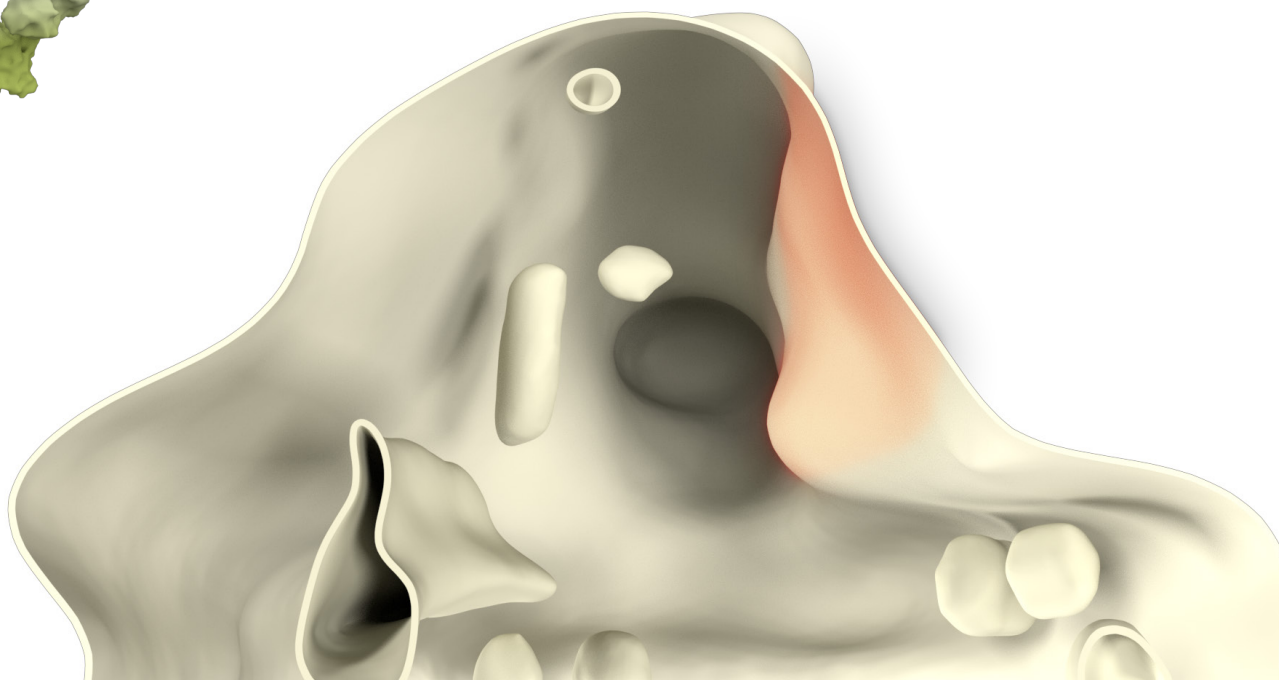
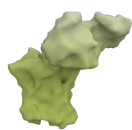


Whole cell copy number	1688583.2 ± 626867.3	
Spine copy number	not detected	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	not detected	not detected
% of total protein	not detected	not detected
Molarity (μM)	not detected	not detected
PSD copy number	not detected	not detected
% in PSD	not detected	not detected

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	not detected	not detected	not detected	not detected
Stubby	not detected	not detected	not detected	not detected



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	not detected	not detected	not detected	not detected
Stubby	not detected	not detected	not detected	not detected



References

Antibody: Abcam ab40653

PDB Identifier: 6cm4

Literature:

Agnati et al., 2016, Rev. Neurosci.

Beaulieu et al., 2015, Br. J. Pharmacol.

Ladepêche et al., 2013a, PLoS One

Ladepêche et al., 2013b, Proc. Natl. Acad. Sci. USA

Lee et al., 2002, Cell

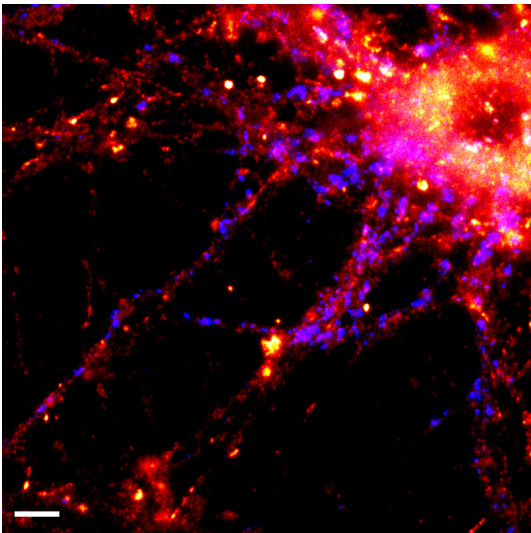
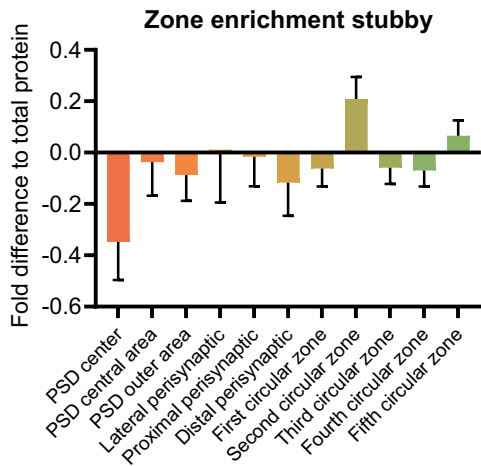
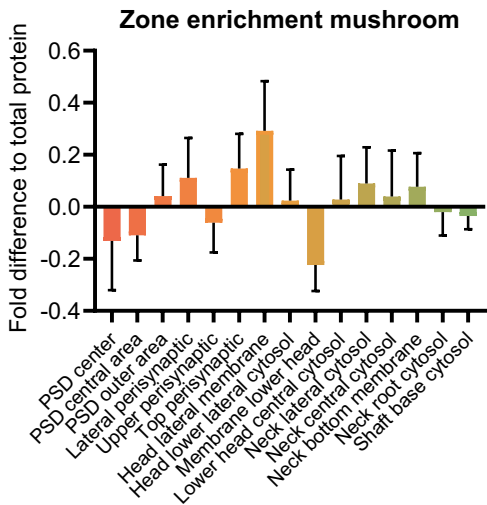
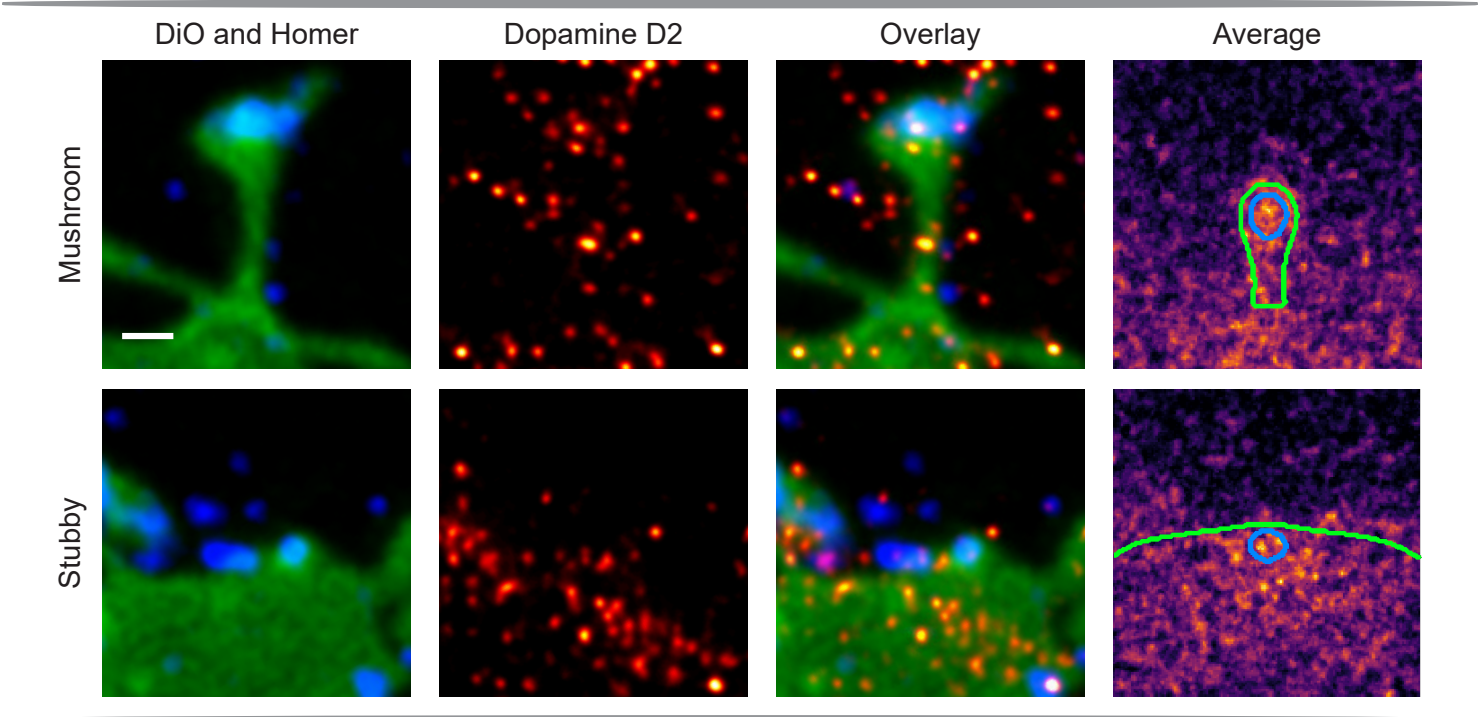
Pei, 2004, J. Neurosci.

Dopamine Receptor D2 (Gene: Drd2, Uniprot ID: P61169)

Known function: Inhibition of Adenylyl cyclase, Decreases NMDAR response and GluR1 insertion

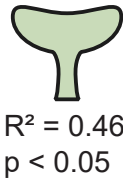
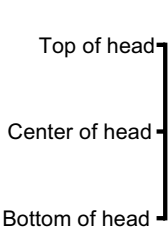
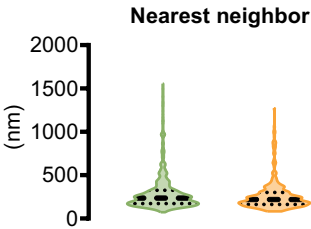
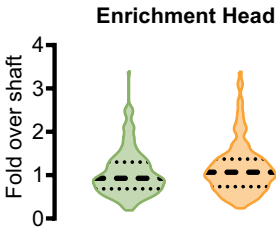
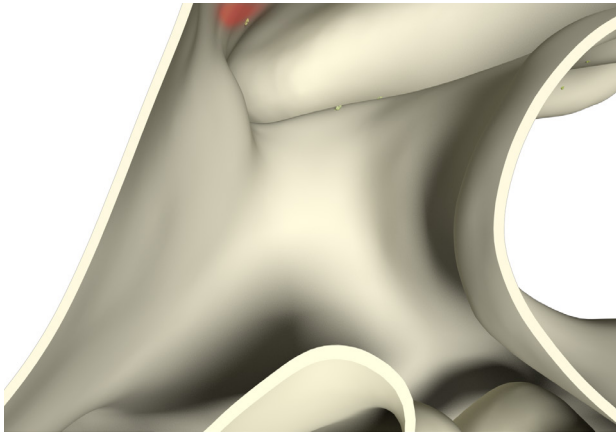
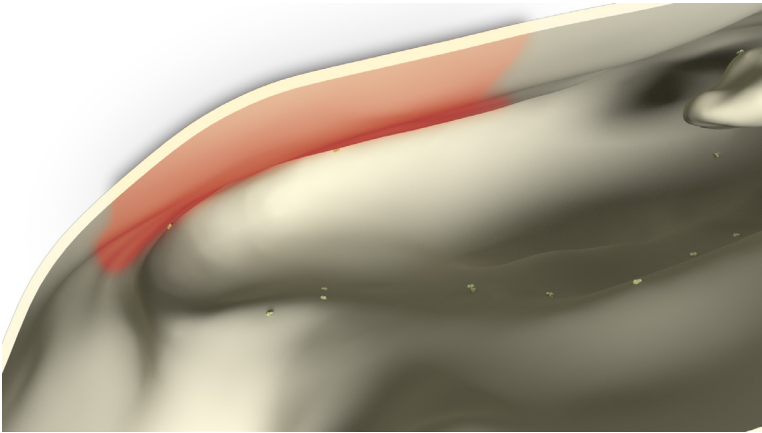
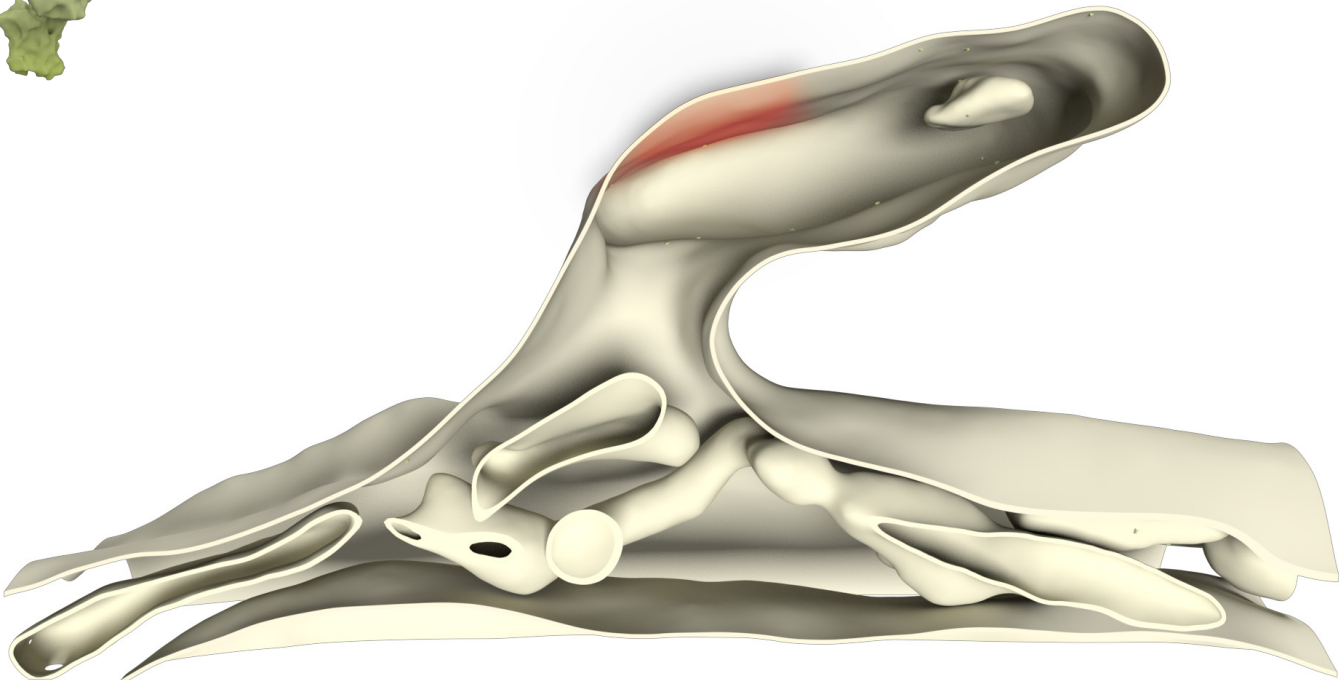
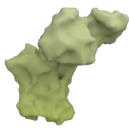
Known organization: Transmembrane protein, Close to or within PSD

Known Interactions: Other Dopamine receptor isoforms, NMDA receptors

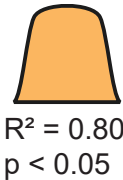
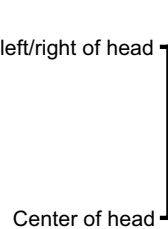
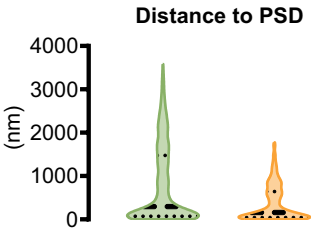
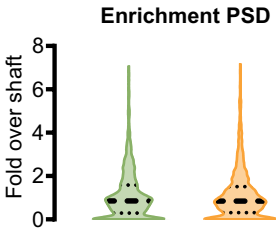


Whole cell copy number	618111.3 ± 168121.4	
Spine copy number	66.9 ± 24.1	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	65.8 ± 23.7	72.2 ± 26.0
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.8 ± 0.3	0.7 ± 0.2
PSD copy number	9 ± 3.2	6 ± 2.2
% in PSD	13.7 ± 4.9%	8.3 ± 3.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	65.8 ± 23.7	$0.0 \pm 0.0\%$	0.8 ± 0.3	9 ± 3.2
Stubby	72.2 ± 26.0	$0.0 \pm 0.0\%$	0.7 ± 0.2	6 ± 2.2

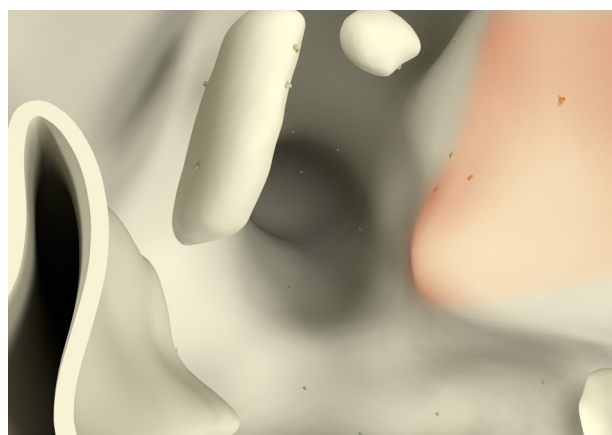
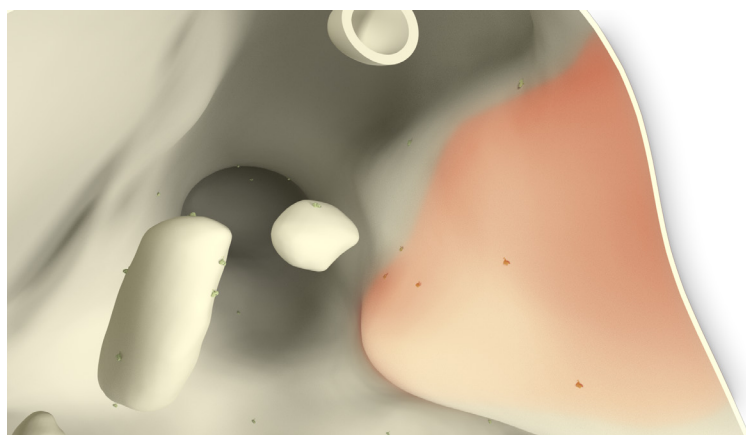
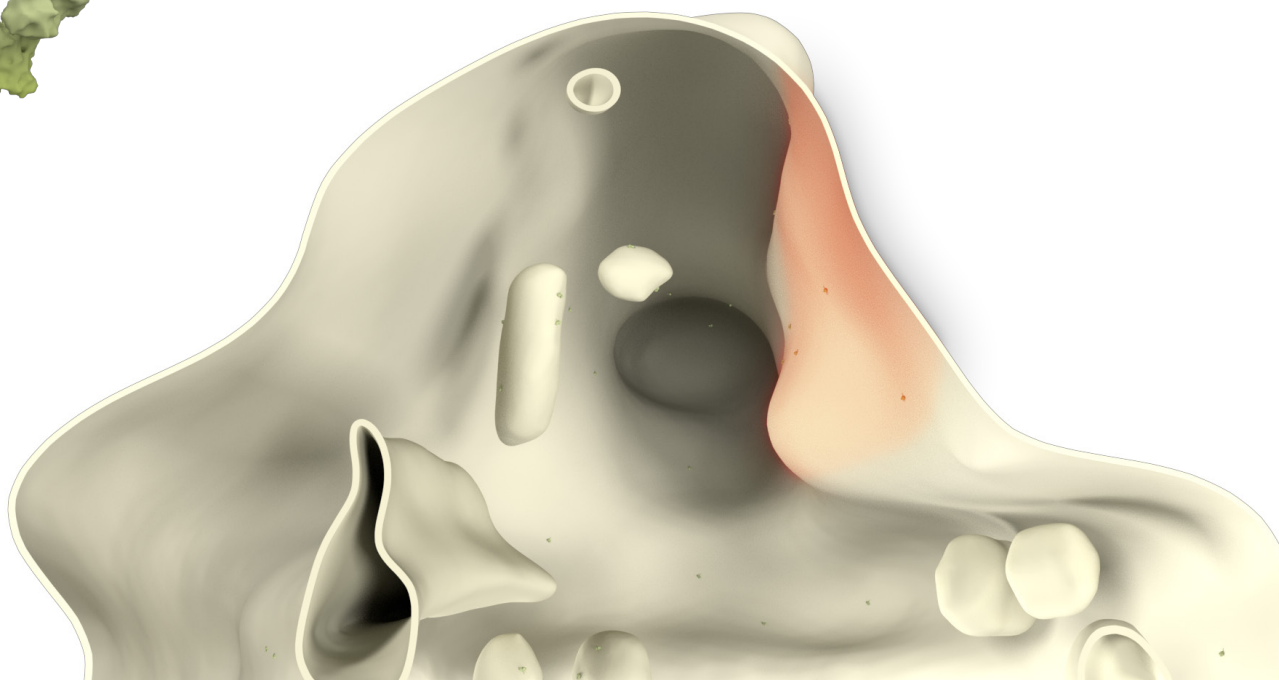
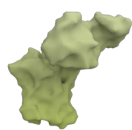


$R^2 = 0.46$
 $p < 0.05$



$R^2 = 0.80$
 $p < 0.05$

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	65.8 ± 23.7	$0.0 \pm 0.0\%$	0.8 ± 0.3	9 ± 3.2
Stubby	72.2 ± 26.0	$0.0 \pm 0.0\%$	0.7 ± 0.2	6 ± 2.2



References

Antibody: Merck Millipore AB5084P

PDB Identifier: 6cm4

Literature:

Agnati et al., 2016, Rev. Neurosci.

Beaulieu et al., 2015, Br. J. Pharmacol.

Ladepeche et al., 2013a, PLoS One

Ladepeche et al., 2013b, Proc. Natl. Acad. Sci. USA

Liu et al., 2006, Neuron

Pei, 2004, J. Neurosci.

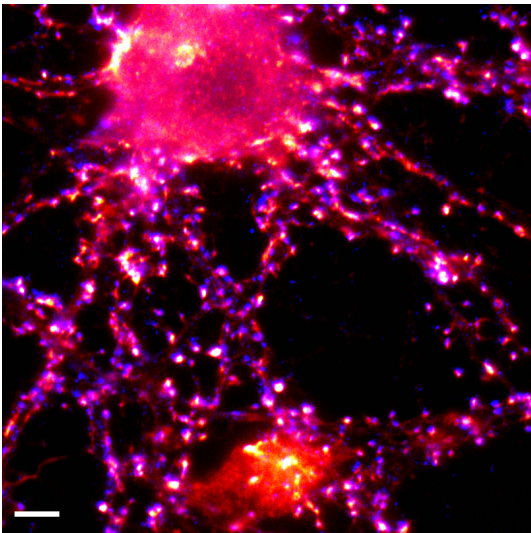
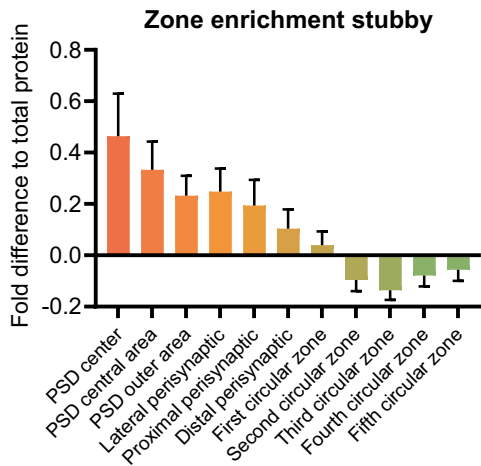
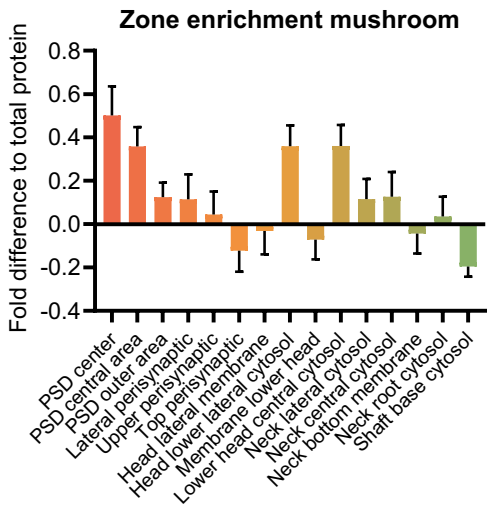
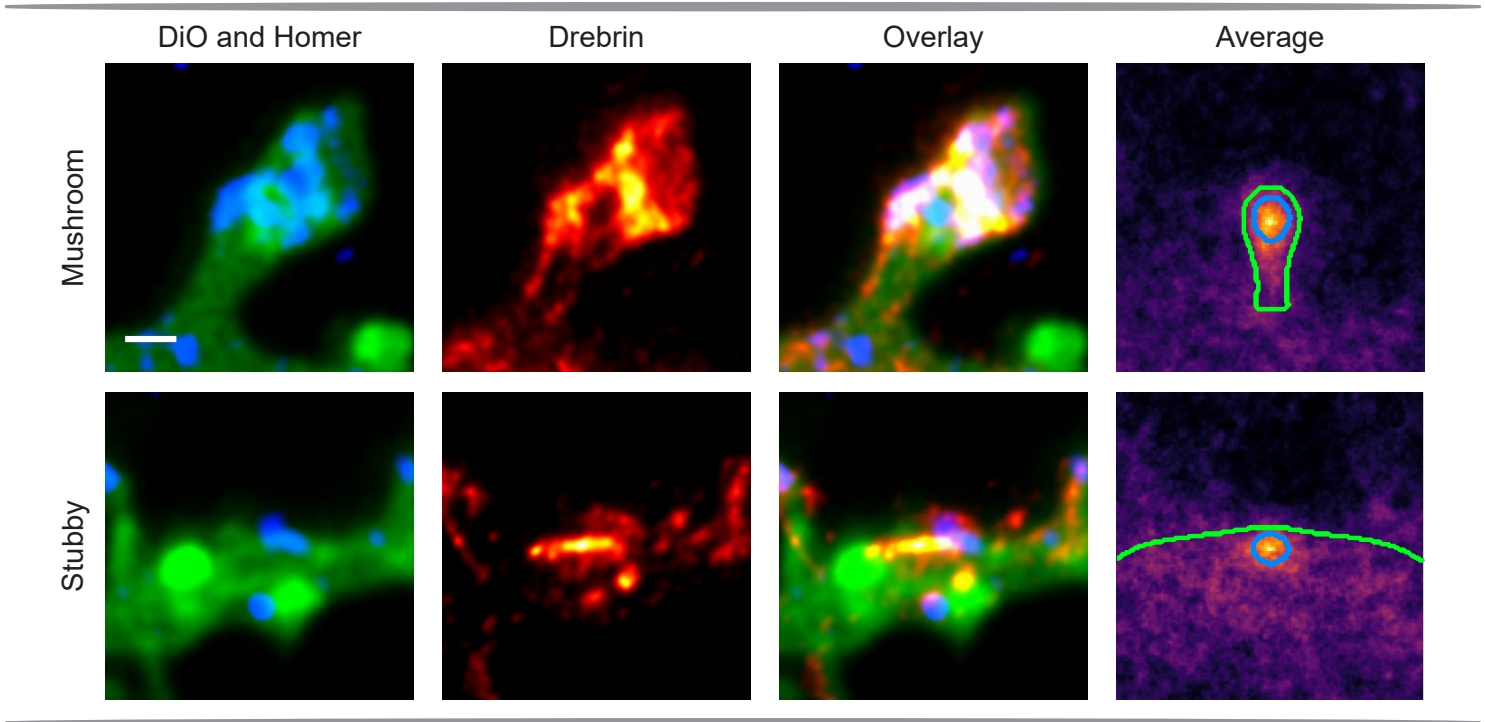
Sun et al., 2005, J. Neurosci.

Drebrin (Gene: Dbn1, Uniprot ID: Q07266)

Known function: Stabilizes Actin, Regulates microtubule entry into spines

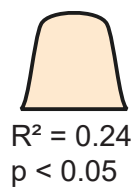
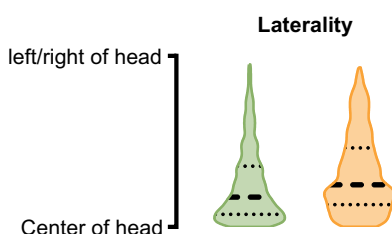
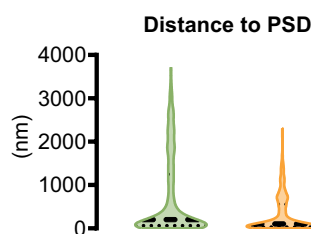
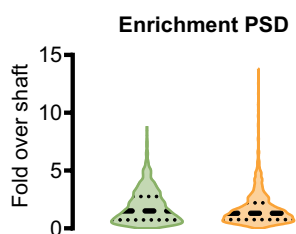
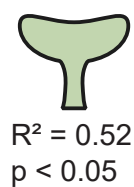
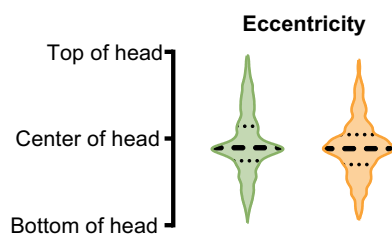
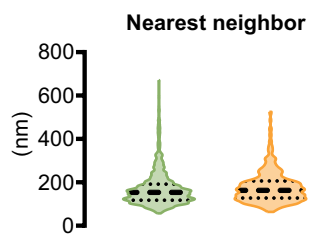
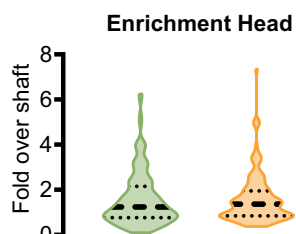
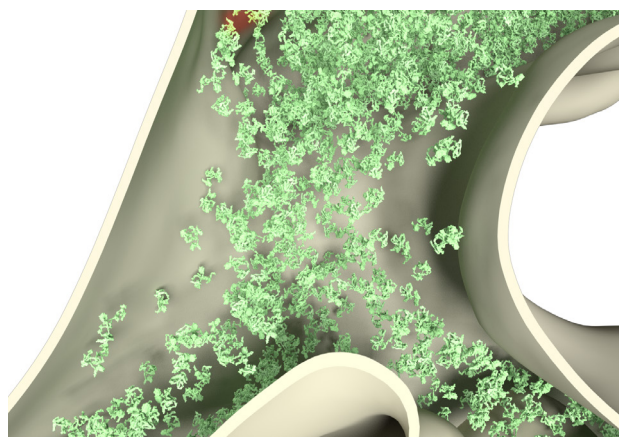
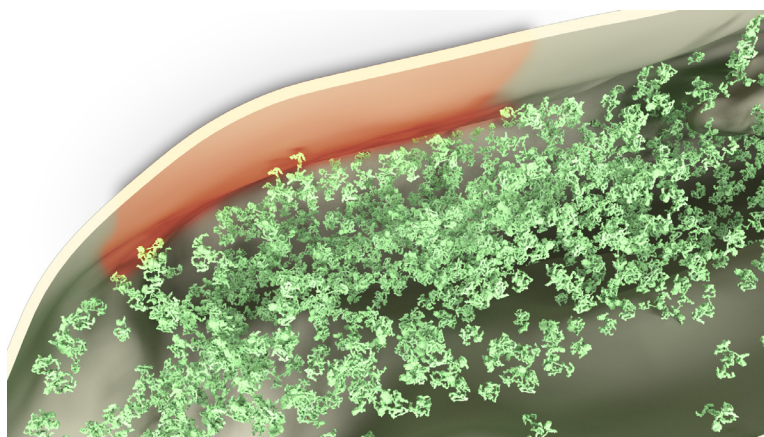
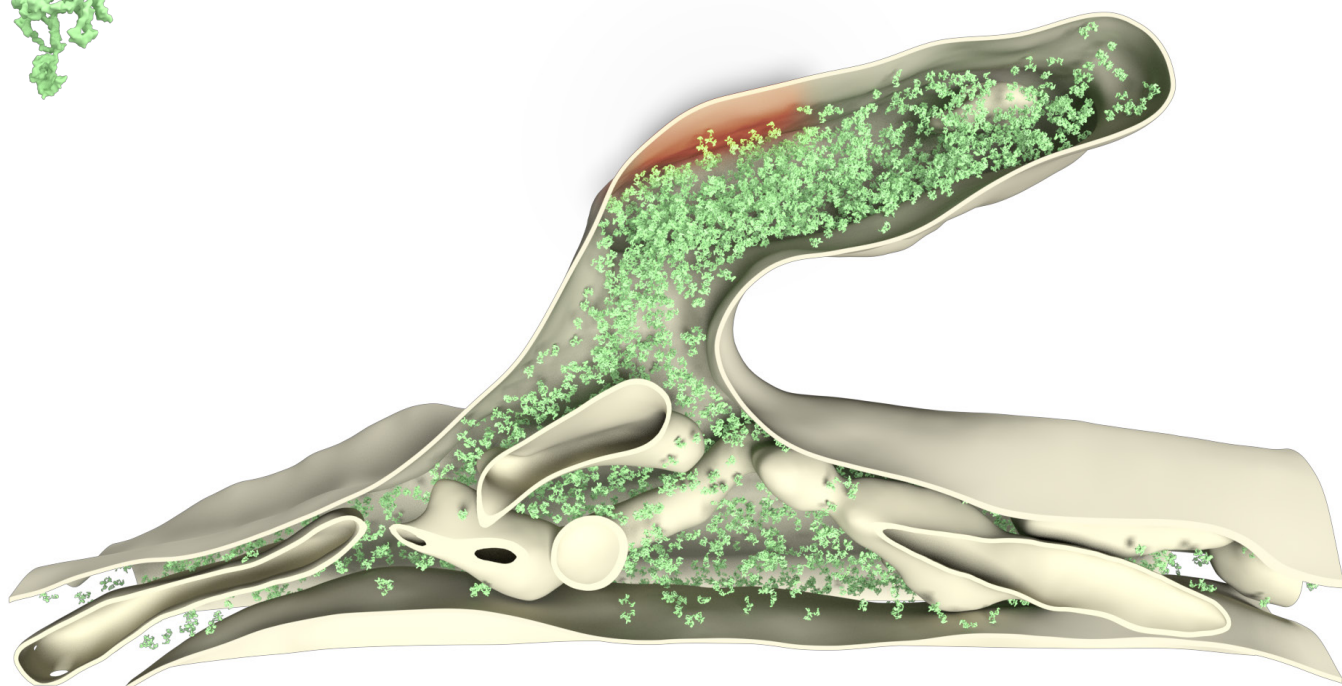
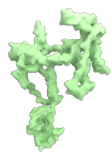
Known organization: Cytosolic

Known Interactions: Actin

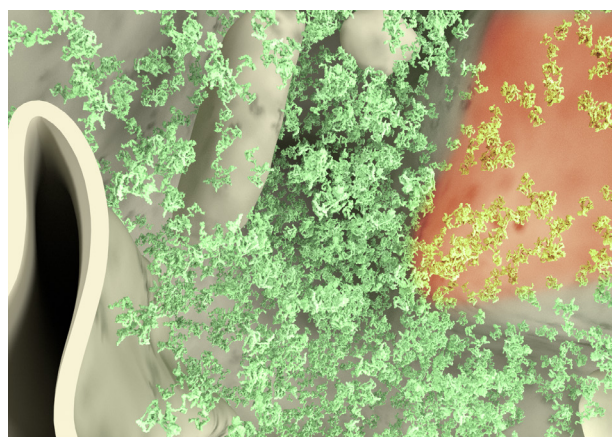
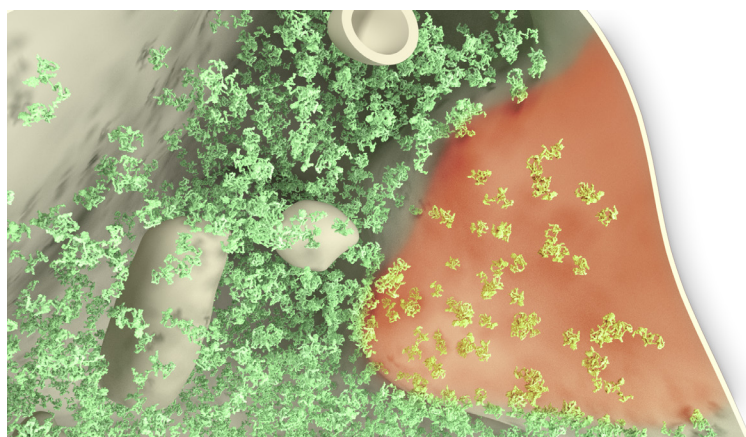
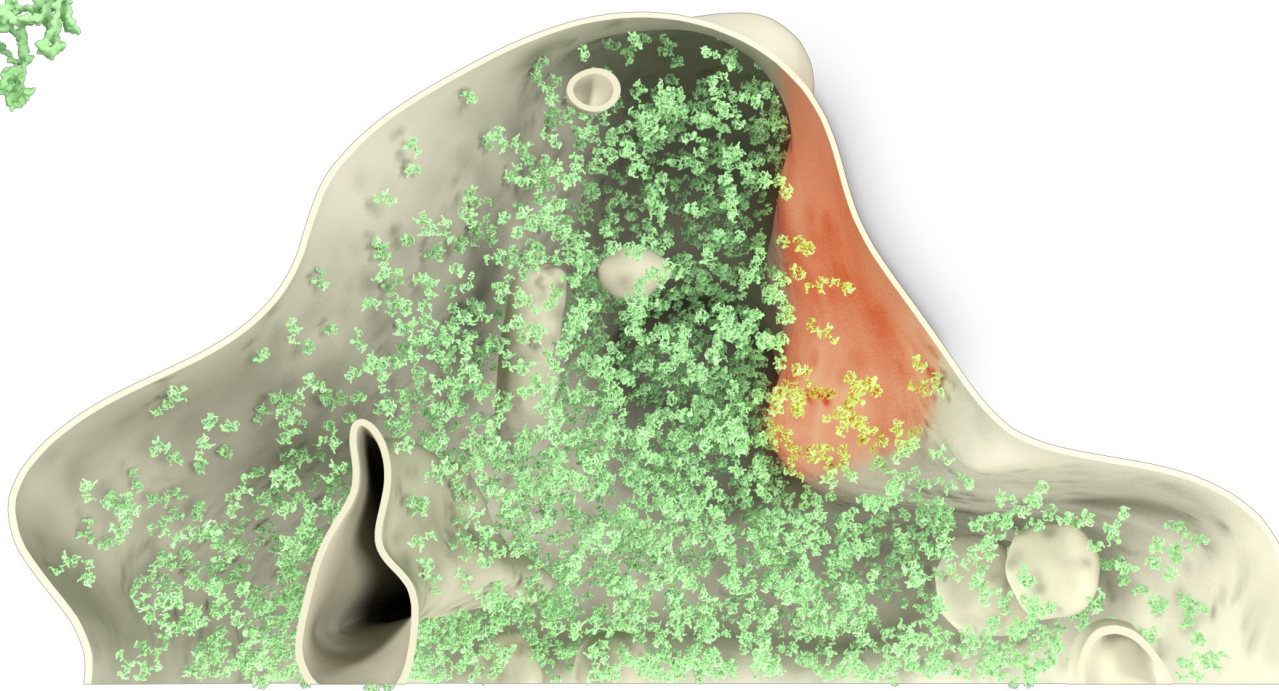


Whole cell copy number	6331446.3 ± 88419.8	
Spine copy number	5598.9 ± 624.1	
Function	Cytoskeleton	
	Mushroom	Stubby
Spine copy number	5459.6 ± 608.5	6210.3 ± 692.2
% of total protein	2.1 ± 0.2%	2.0 ± 0.2%
Molarity (μM)	69.3 ± 7.7	58.7 ± 6.5
PSD copy number	2072 ± 230.9	2513 ± 280.1
% in PSD	38.0 ± 4.2%	40.5 ± 4.5%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	5459.6 ± 608.5	$2.1 \pm 0.2\%$	69.3 ± 7.7	2072 ± 230.9
Stubby	6210.3 ± 692.2	$2.0 \pm 0.2\%$	58.7 ± 6.5	2513 ± 280.1



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	5459.6 ± 608.5	$2.1 \pm 0.2\%$	69.3 ± 7.7	2072 ± 230.9
Stubby	6210.3 ± 692.2	$2.0 \pm 0.2\%$	58.7 ± 6.5	2513 ± 280.1



References

Antibody: Novus Biologicals NB100-1951

PDB Identifier: 5y1z

Literature:

Hayashi et al., 1996, J. Neurosci.

Ishikawa et al., 1994, J. Biol. Chem.

Merriam et al., 2013, J. Neurosci.

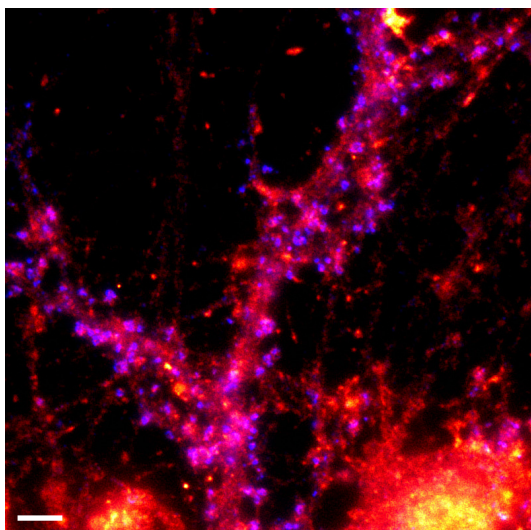
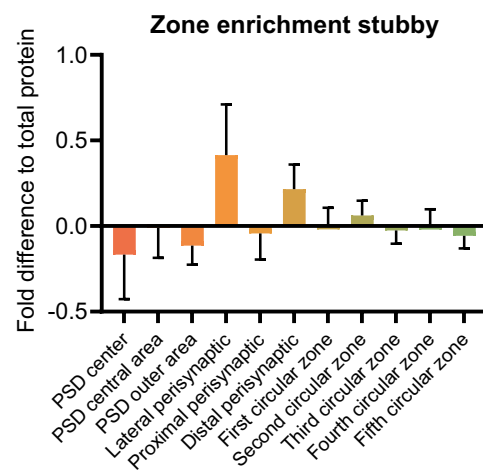
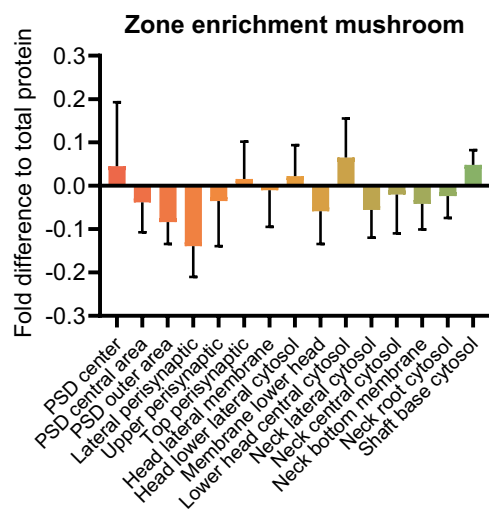
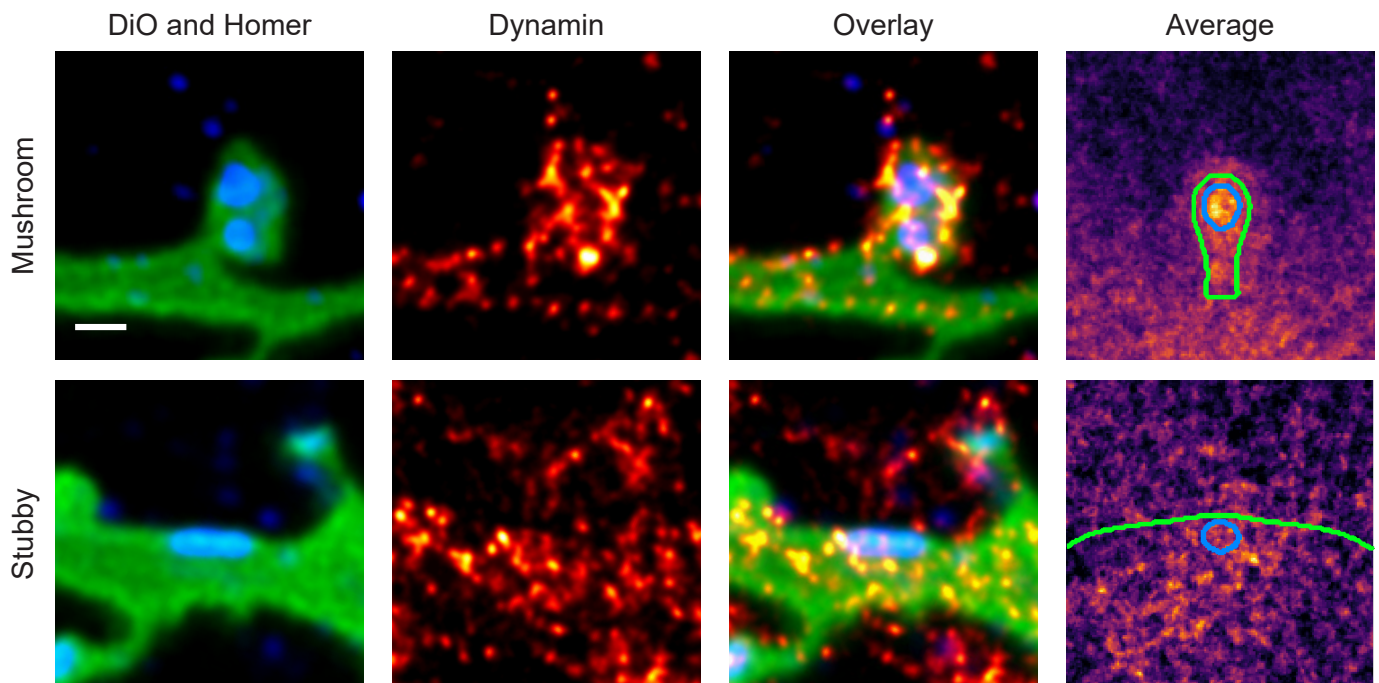
Mikati et al., 2013, J. Biol. Chem.

Dynamin1-3 (Genes: Dnm1, Dnm2, Dnm3, Uniprot IDs: P21575, P39052, Q08877)

Known function: Membrane fission in endocytosis, AMPAR and NMDAR endocytosis

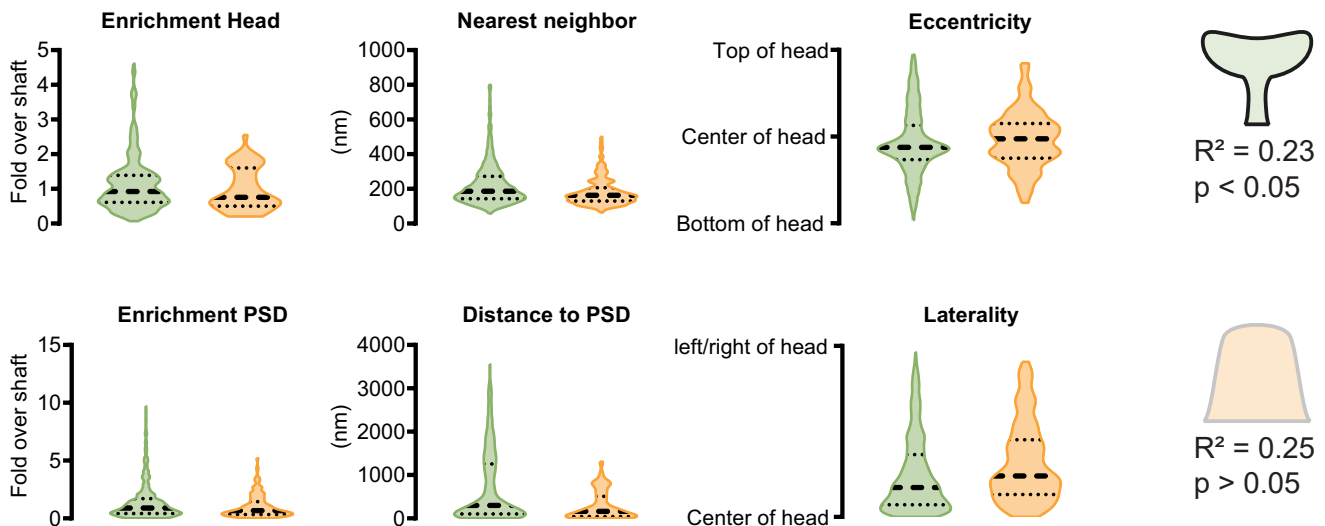
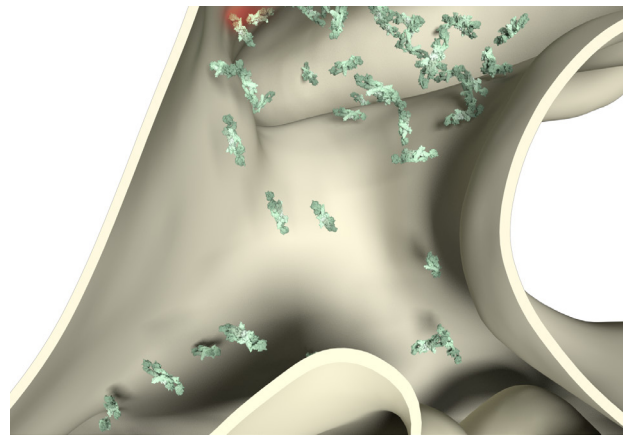
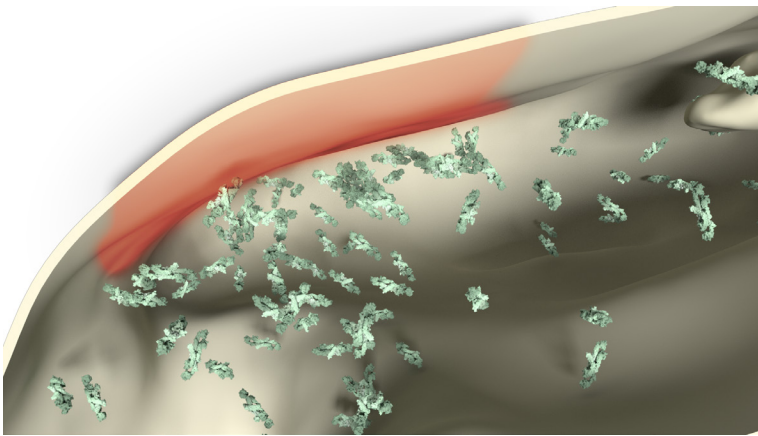
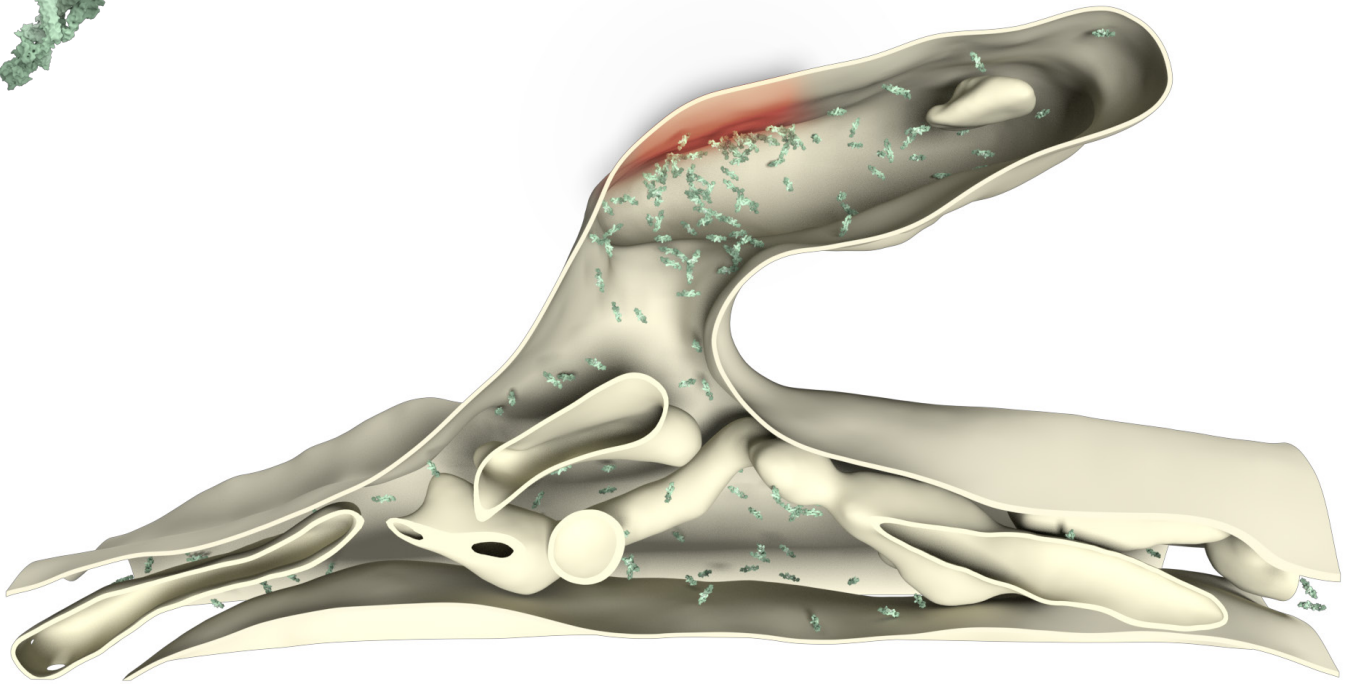
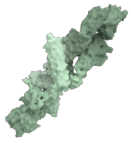
Known organization: Cytosolic, Forms dimers and helices

Known Interactions: Homer and Shank proteins, mGluR5

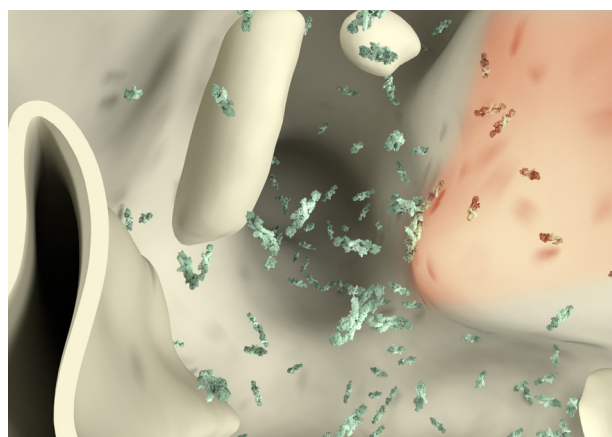
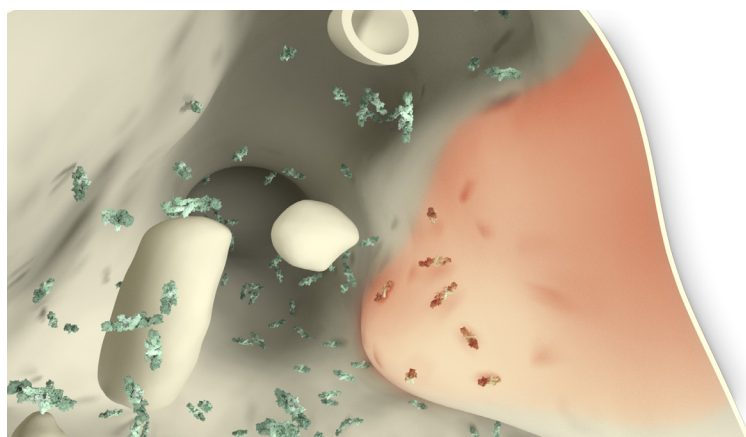
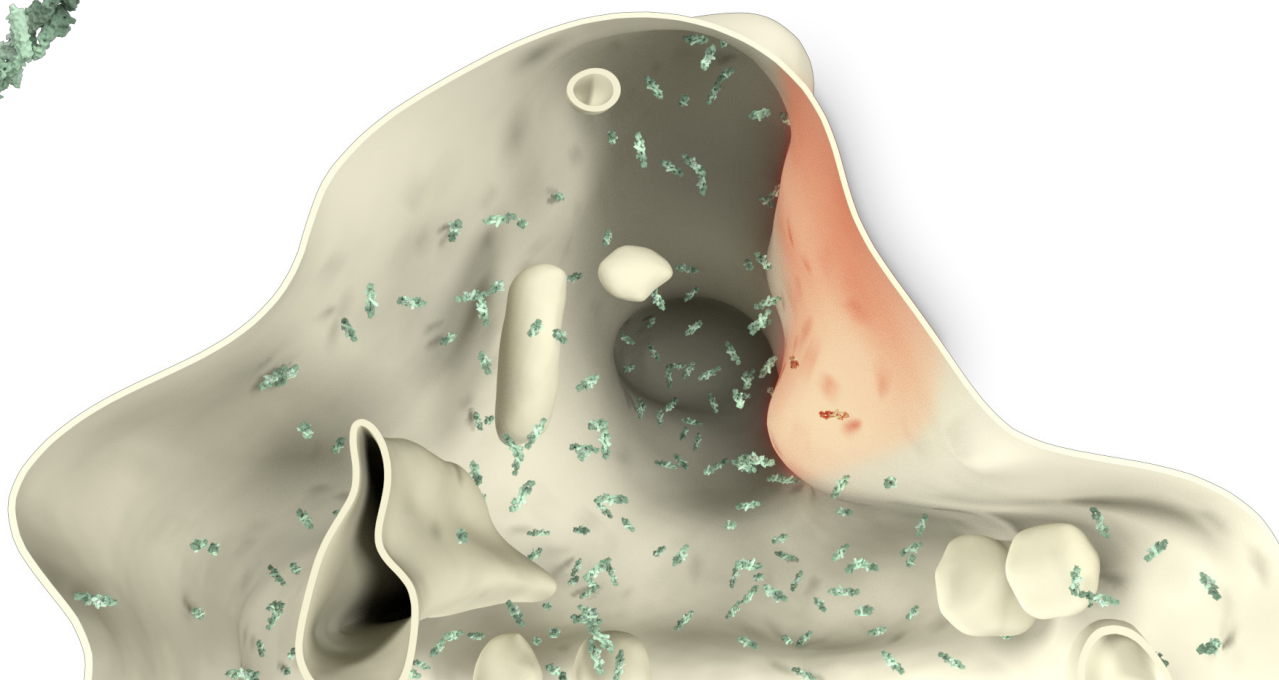
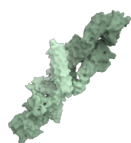


Whole cell copy number	6435888.0 ± 251140.2	
Spine copy number	1495.6 ± 299.5	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	1355.2 ± 271.3	1525.6 ± 305.5
% of total protein	0.6 ± 0.1%	0.6 ± 0.1%
Molarity (μM)	17.2 ± 3.4	14.4 ± 2.9
PSD copy number	394 ± 78.9	121 ± 24.2
% in PSD	29.1 ± 5.8%	7.9 ± 1.6%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1355.2 ± 271.3	$0.6 \pm 0.1\%$	17.2 ± 3.4	394 ± 78.9
Stubby	1525.6 ± 305.5	$0.6 \pm 0.1\%$	14.4 ± 2.9	121 ± 24.2



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1355.2 ± 271.3	$0.6 \pm 0.1\%$	17.2 ± 3.4	394 ± 78.9
Stubby	1525.6 ± 305.5	$0.6 \pm 0.1\%$	14.4 ± 2.9	121 ± 24.2



References

Antibody: BD Biosciences 610245

PDB Identifier: 5a3f

Literature:

Carroll et al., 1999, Proc. Natl. Acad. Sci. U S A

Damke et al., 1994, J. Cell. Biol.

Faelber et al., 2011, Nature

Gray et al., 2003, Curr. Biol.

Lu et al., 2007, Neuron

Pérez-Otaño et al., 2006, Nat. Neurosci.

Raimondi et al., 2011, Neuron

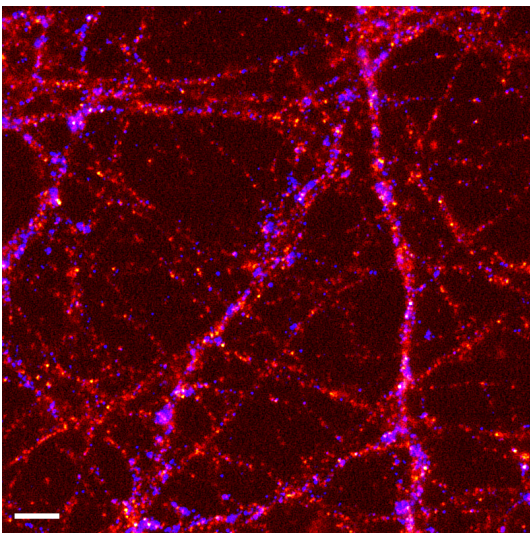
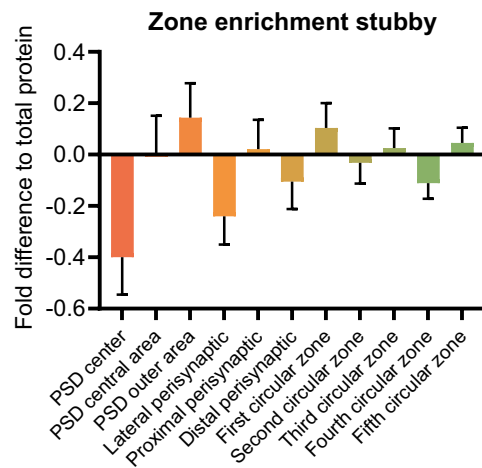
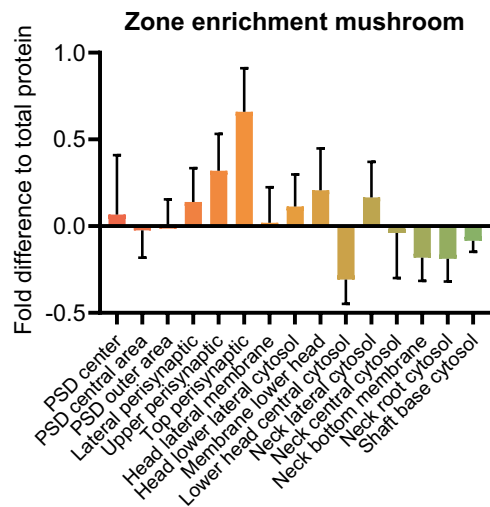
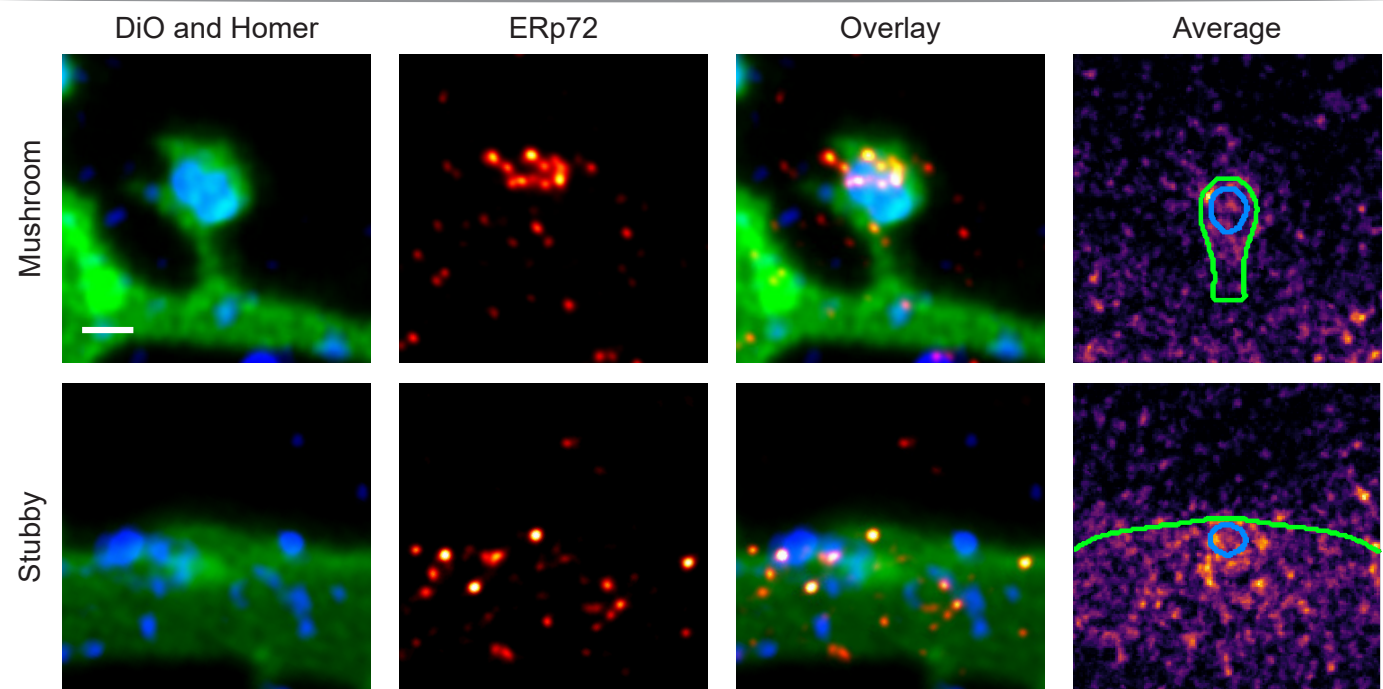
Takei et al., 1996, J. Cell. Biol.

ERp72 (ERp70, CaBP2, Gene: Pdia4, Uniprot ID: P38659)

Known function: ER-resident chaperone, Isomerizes disulfide bonds

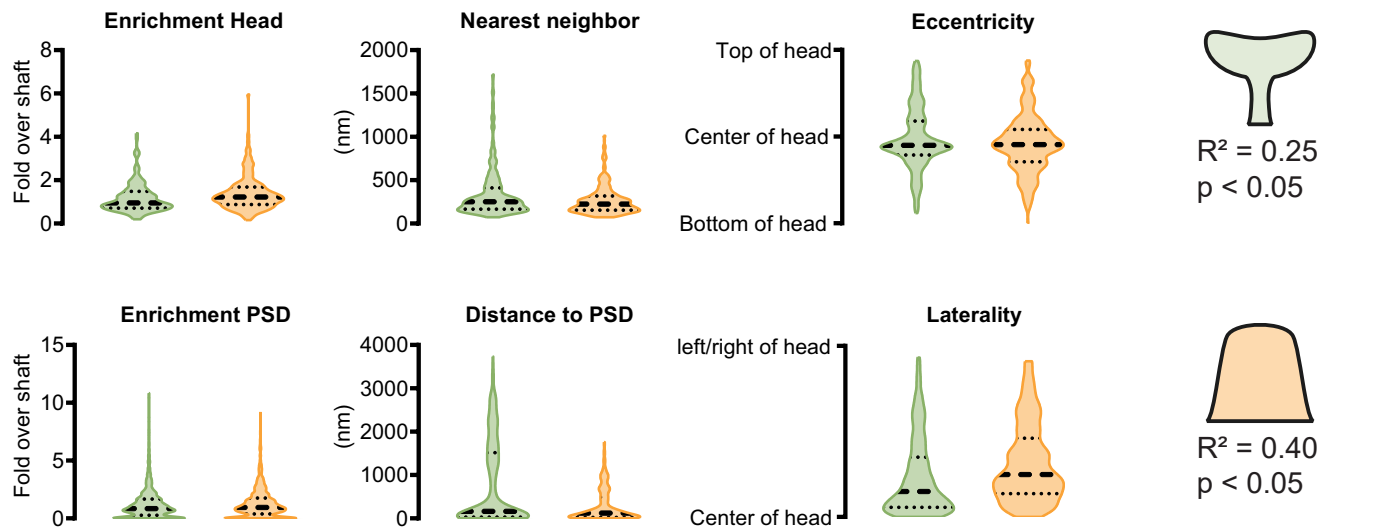
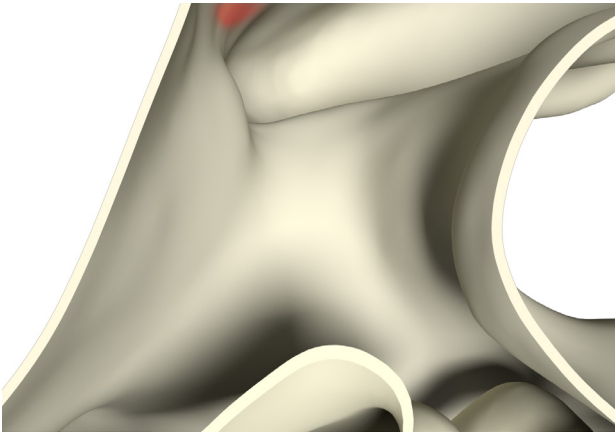
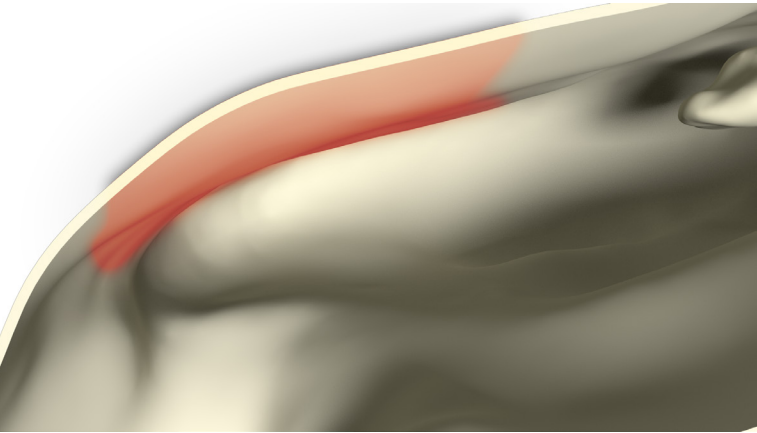
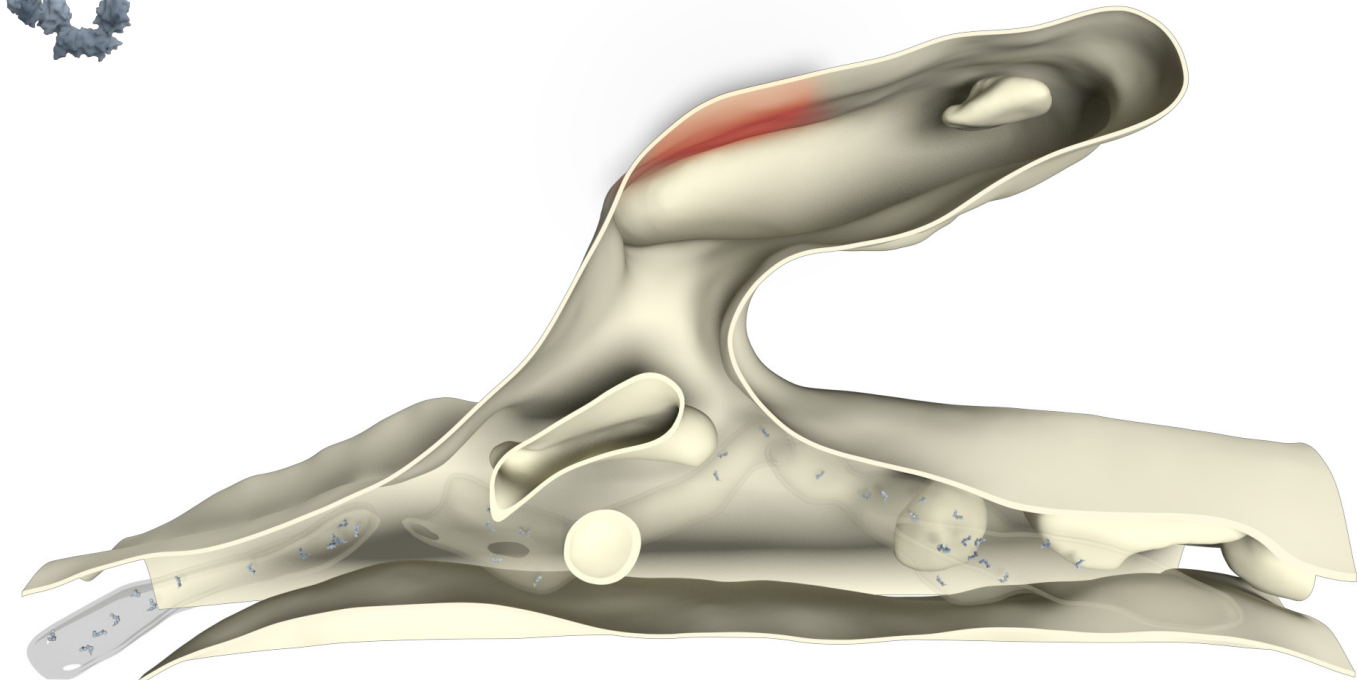
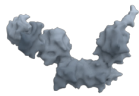
Known organization: ER lumen

Known Interactions: None

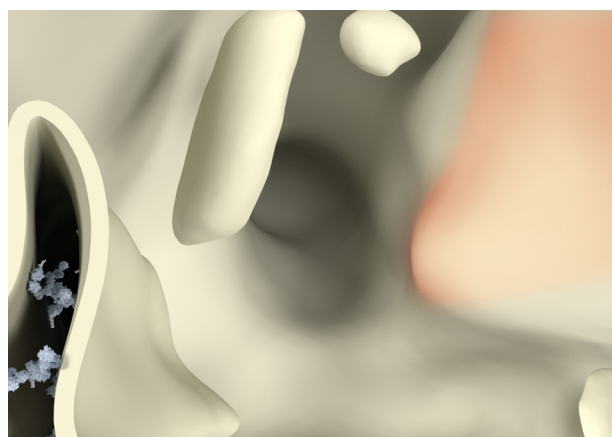
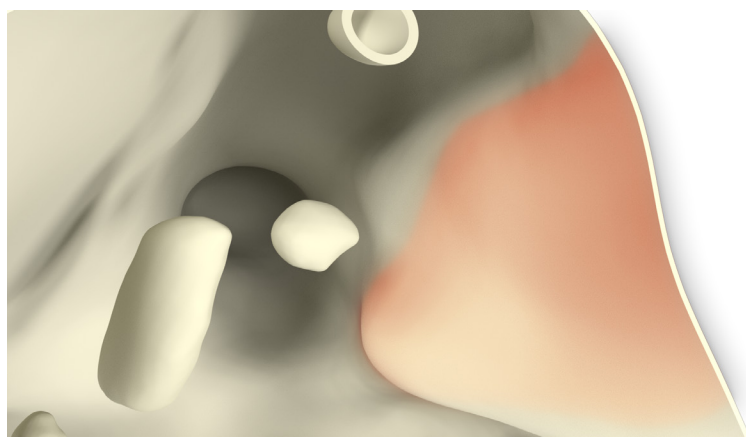
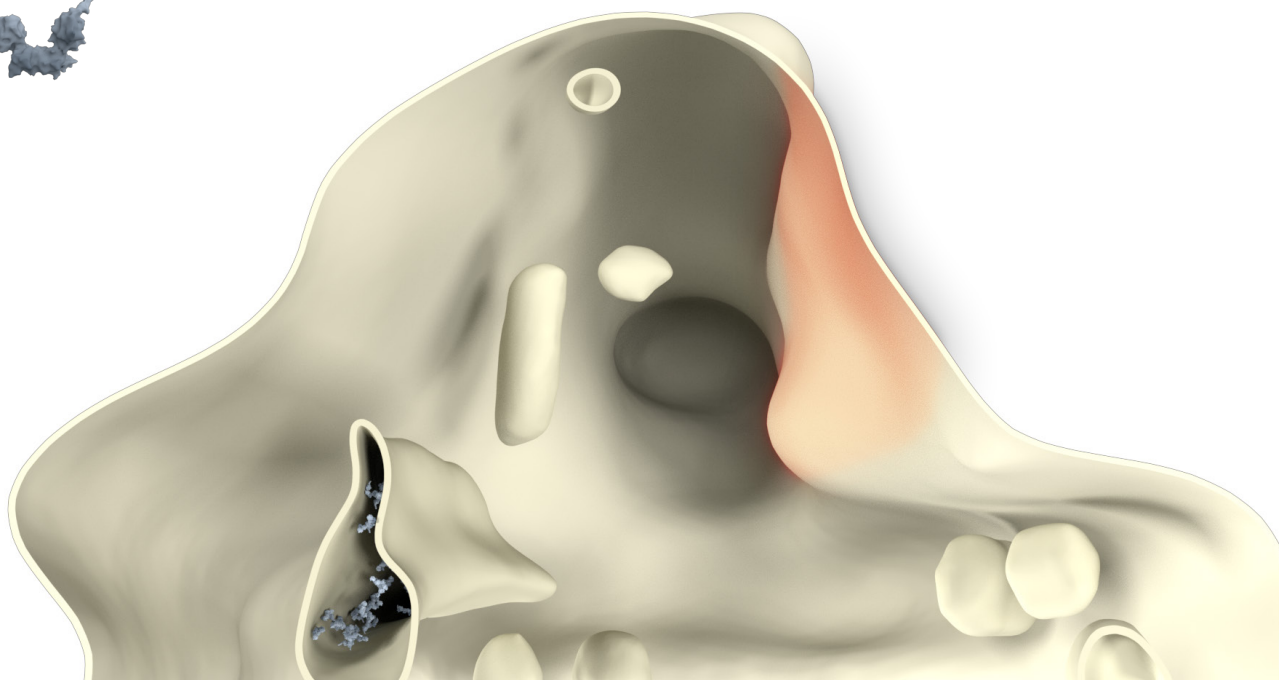
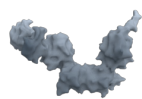


Whole cell copy number	1159270.0 ± 165411.4	
Spine copy number	97.3 ± 26.5	
Function	Organelle	
	Mushroom	Stubby
Spine copy number	73.7 ± 20.1	119.6 ± 32.6
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.9 ± 0.3	1.1 ± 0.3
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	73.7 ± 20.1	$0.0 \pm 0.0\%$	0.9 ± 0.3	0 ± 0.0
Stubby	119.6 ± 32.6	$0.0 \pm 0.0\%$	1.1 ± 0.3	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	73.7 ± 20.1	$0.0 \pm 0.0\%$	0.9 ± 0.3	0 ± 0.0
Stubby	119.6 ± 32.6	$0.0 \pm 0.0\%$	1.1 ± 0.3	0 ± 0.0



References

Antibody: Cell Signaling 5033

PDB Identifier: 2dj1, 3ec3

Literature:

Lièvremonet et al., 1997, J. Biol. Chem.

Mazzarella et al., 1990, J. Biol. Chem.

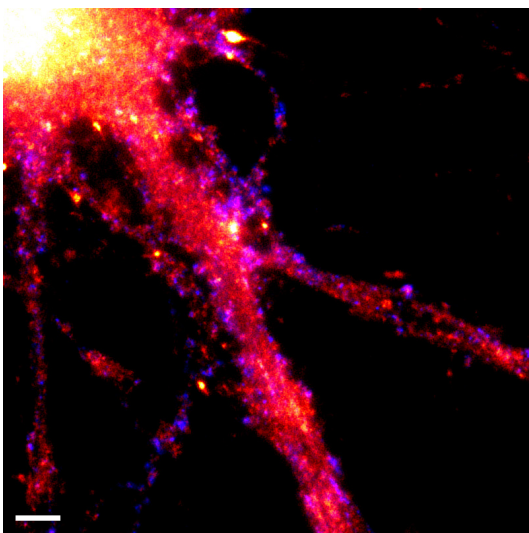
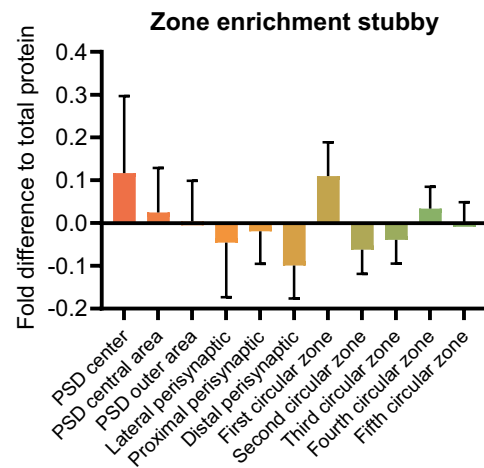
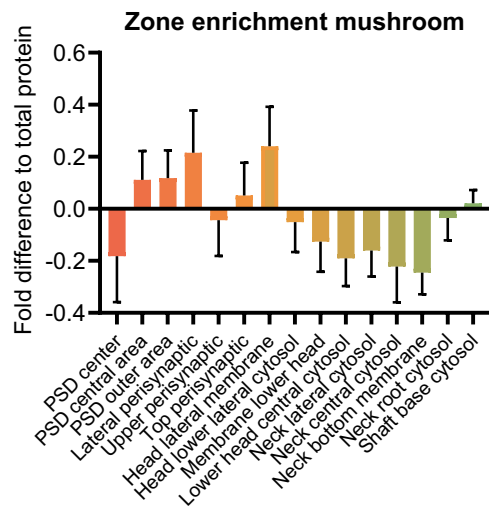
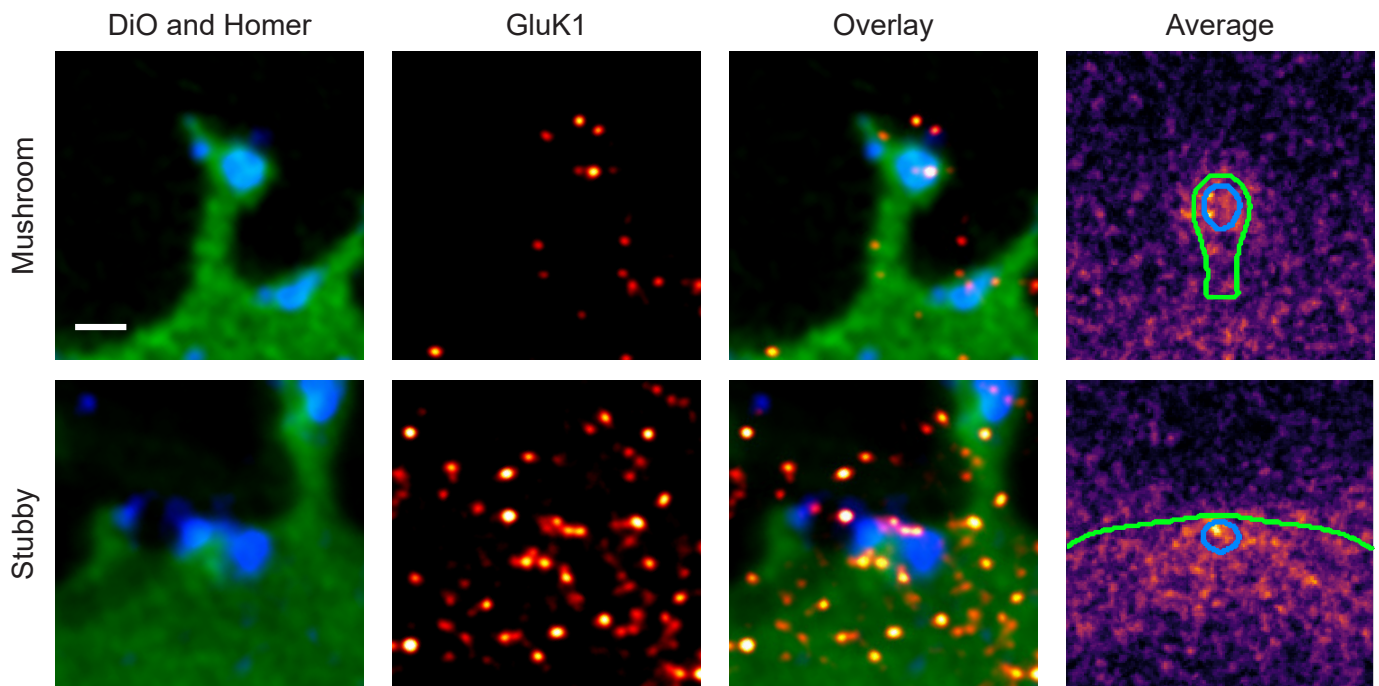
Rupp et al., 1994, J. Biol. Chem.

GluK1 (GluR5, Grik1, Gene: Grik1, Uniprot ID: P22756)

Known function: Involved in excitatory transmission, Limited role in plasticity

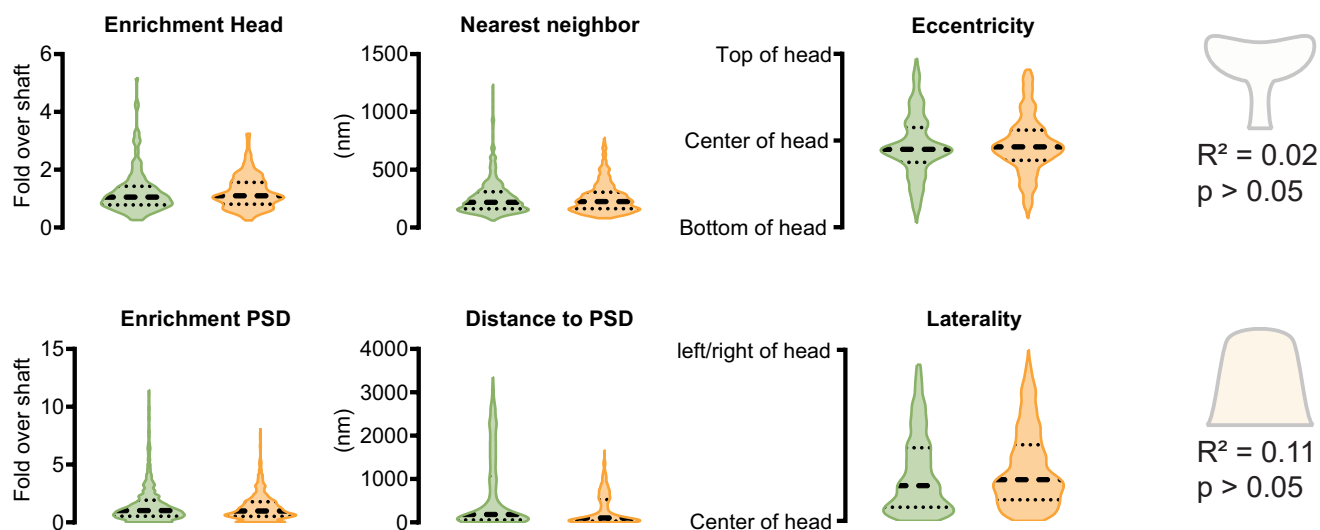
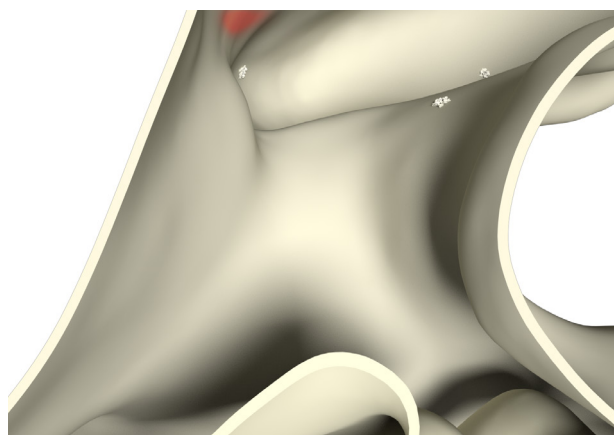
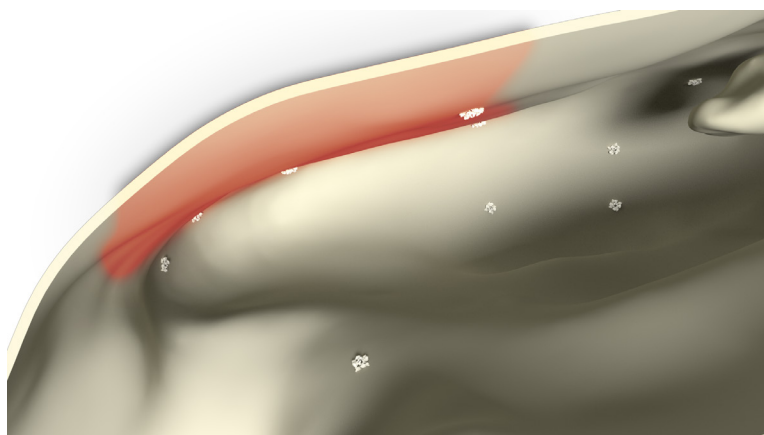
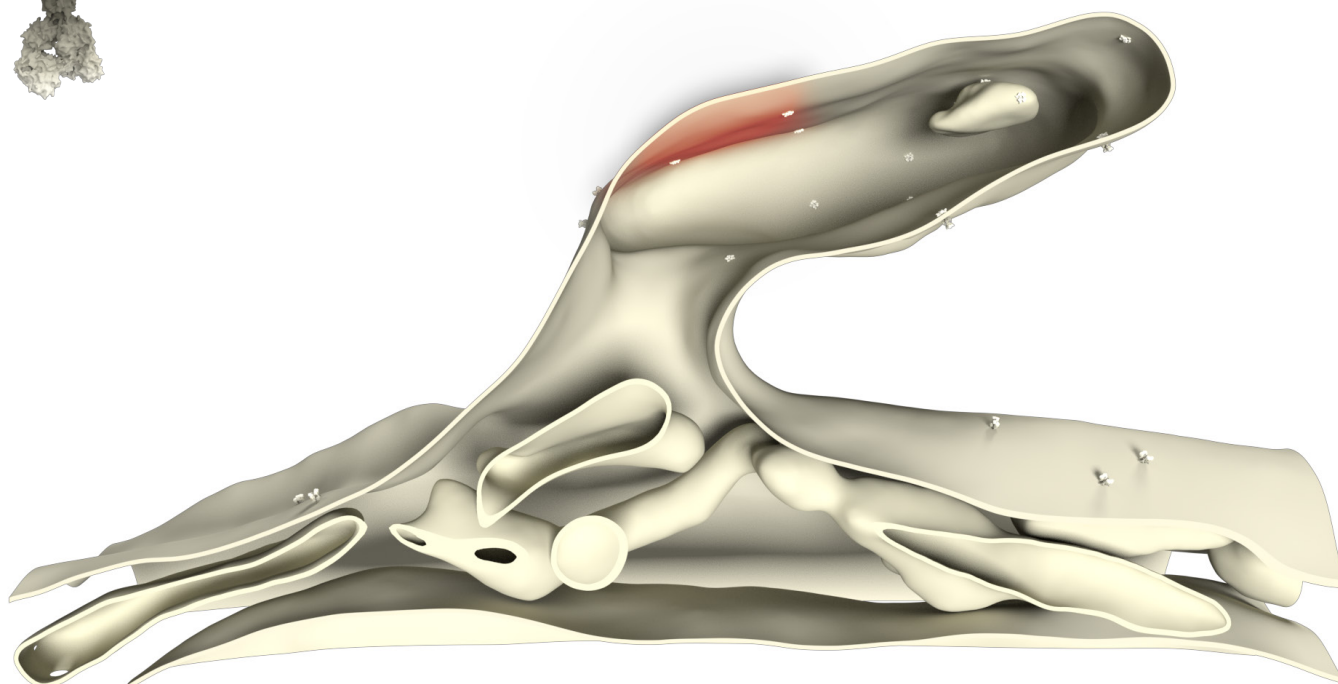
Known organization: Transmembrane protein

Known Interactions: PSD95

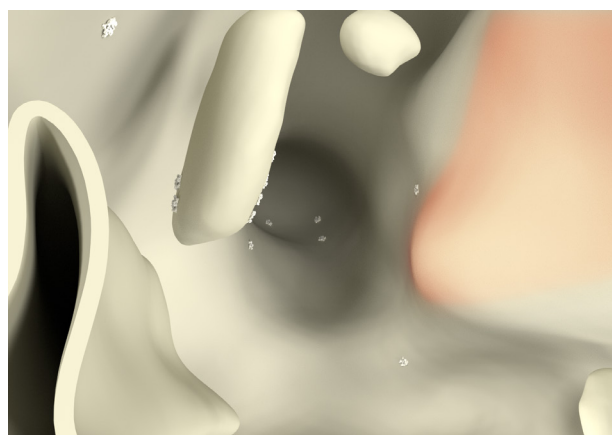
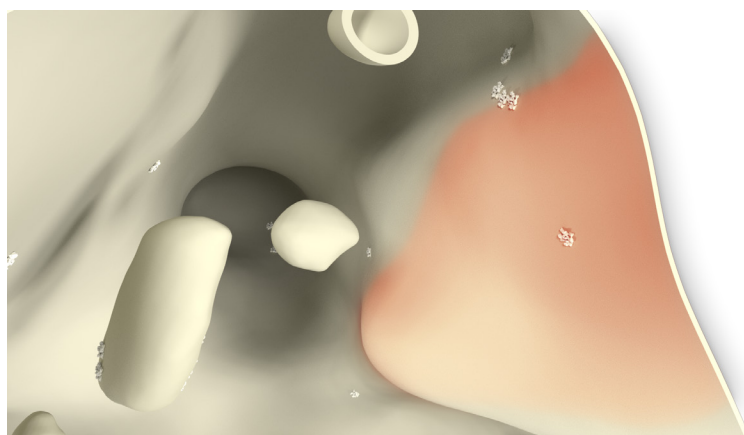
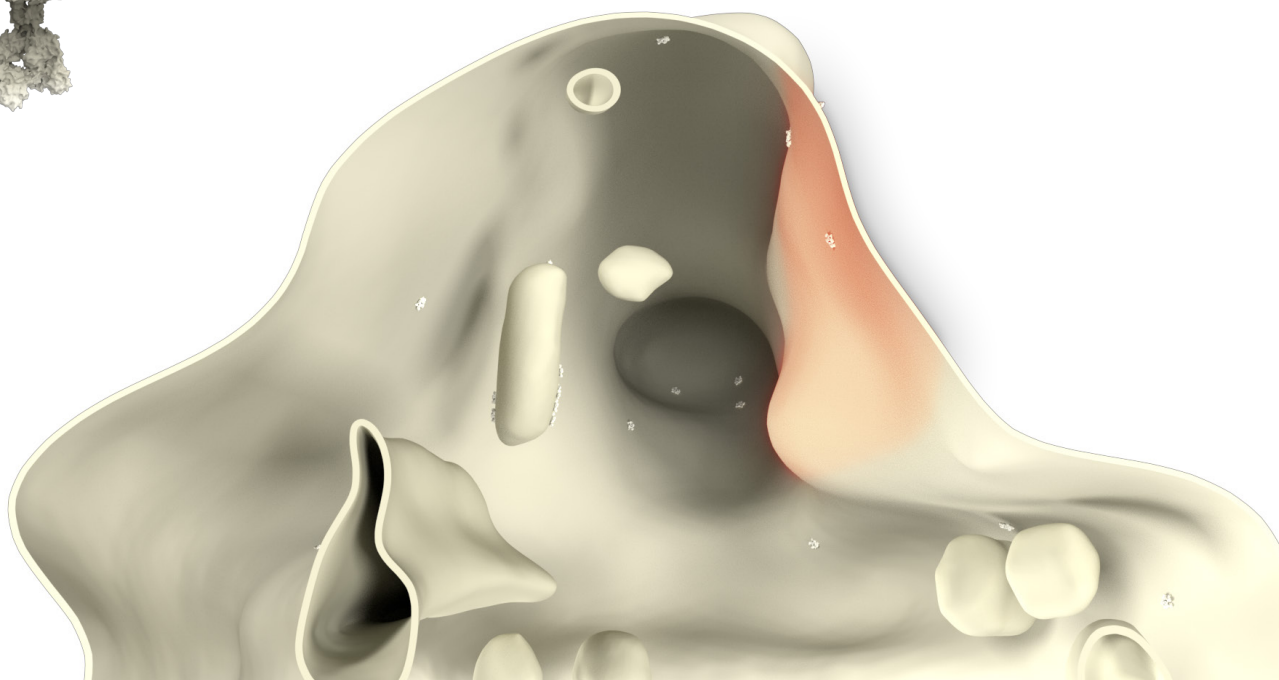


Whole cell copy number	981570.0 ± 267396.4	
Spine copy number	165.8 ± 55.7	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	158.9 ± 53.4	179.8 ± 60.4
% of total protein	0.1 ± 0.0%	0.1 ± 0.0%
Molarity (μM)	2.0 ± 0.7	1.7 ± 0.6
PSD copy number	26 ± 8.7	27 ± 9.1
% in PSD	16.4 ± 5.5%	15.0 ± 5.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	158.9 ± 53.4	$0.1 \pm 0.0\%$	2.0 ± 0.7	26 ± 8.7
Stubby	179.8 ± 60.4	$0.1 \pm 0.0\%$	1.7 ± 0.6	27 ± 9.1



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	158.9 ± 53.4	$0.1 \pm 0.0\%$	2.0 ± 0.7	26 ± 8.7
Stubby	179.8 ± 60.4	$0.1 \pm 0.0\%$	1.7 ± 0.6	27 ± 9.1



References

Antibody: Alomone Labs AGC-008

PDB Identifier: 5kuv

Literature:

Contractor et al., 2011, Trends Neurosci.

Hirbec et al., 2003, Neuron

Schmitz et al., 2001, Science

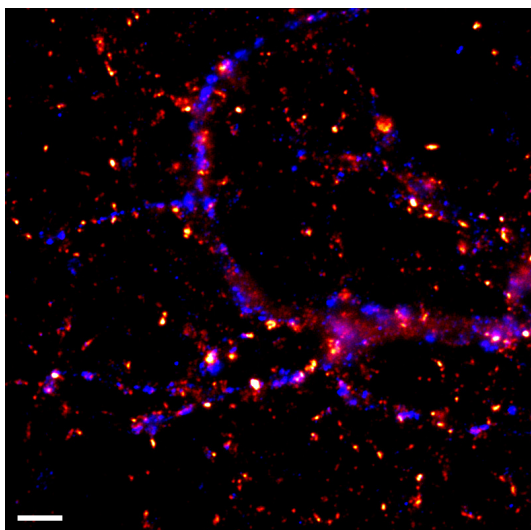
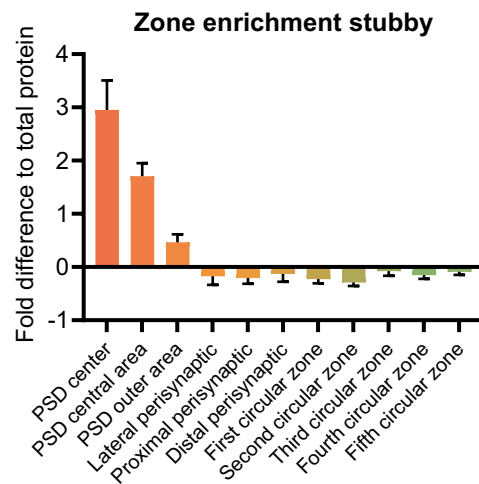
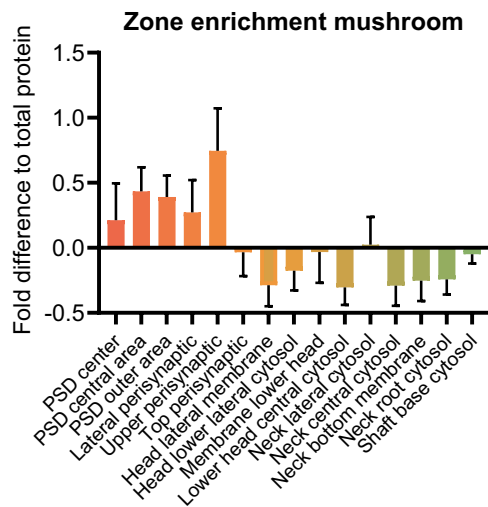
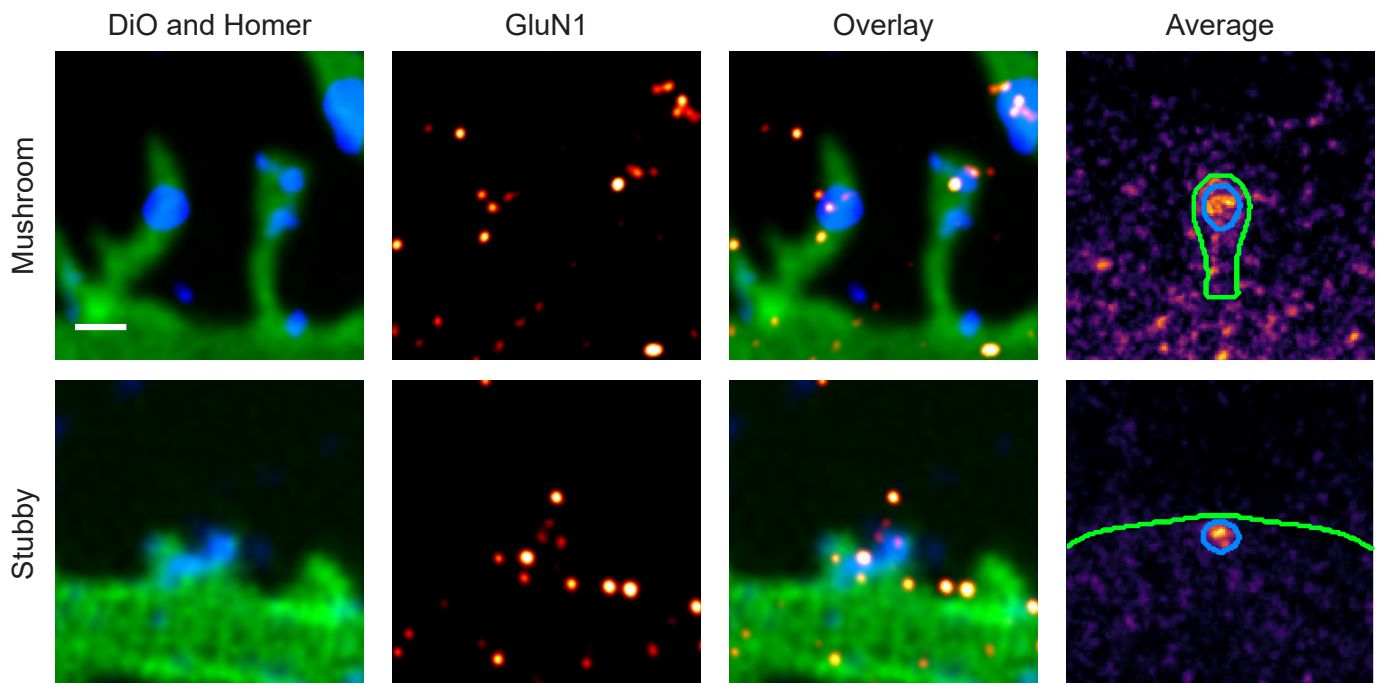
Song and Huganir, 2002, Trends Neurosci

GluN1 (NMDAR1, NR1, Gene: Grin1, Uniprot ID: P35439)

Known function: Critical for synaptic plasticity and learning

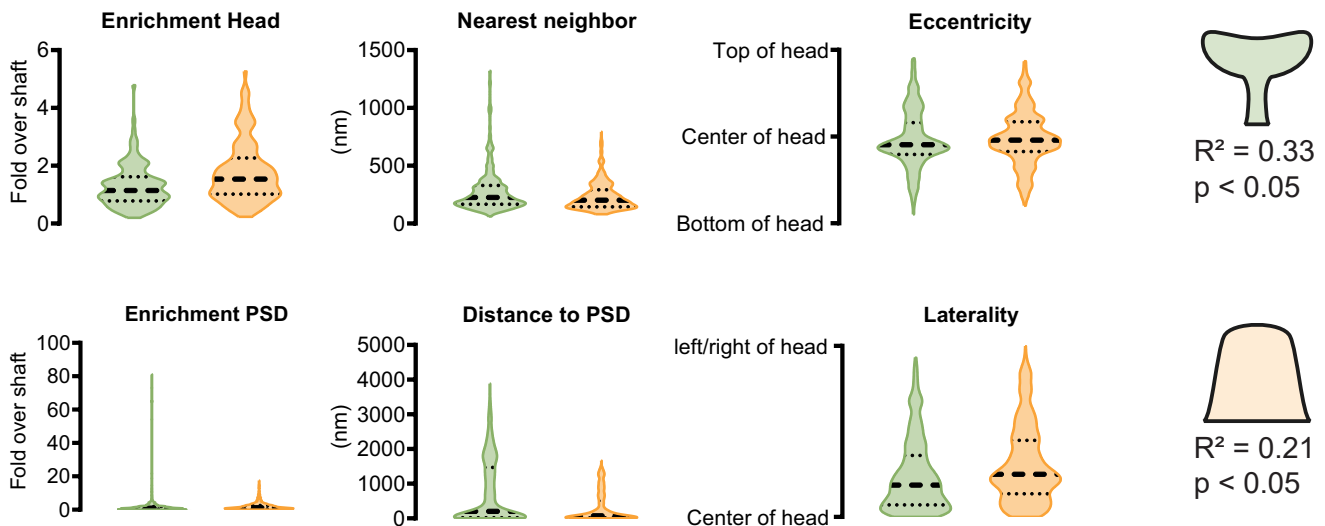
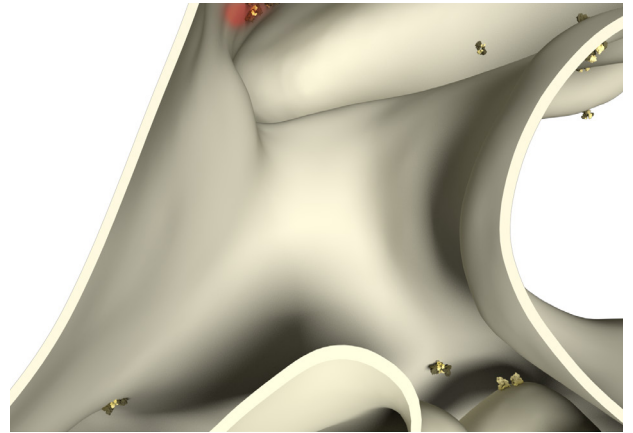
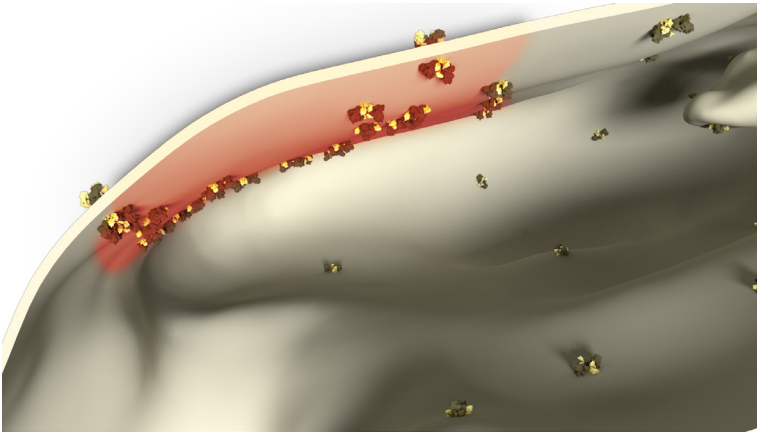
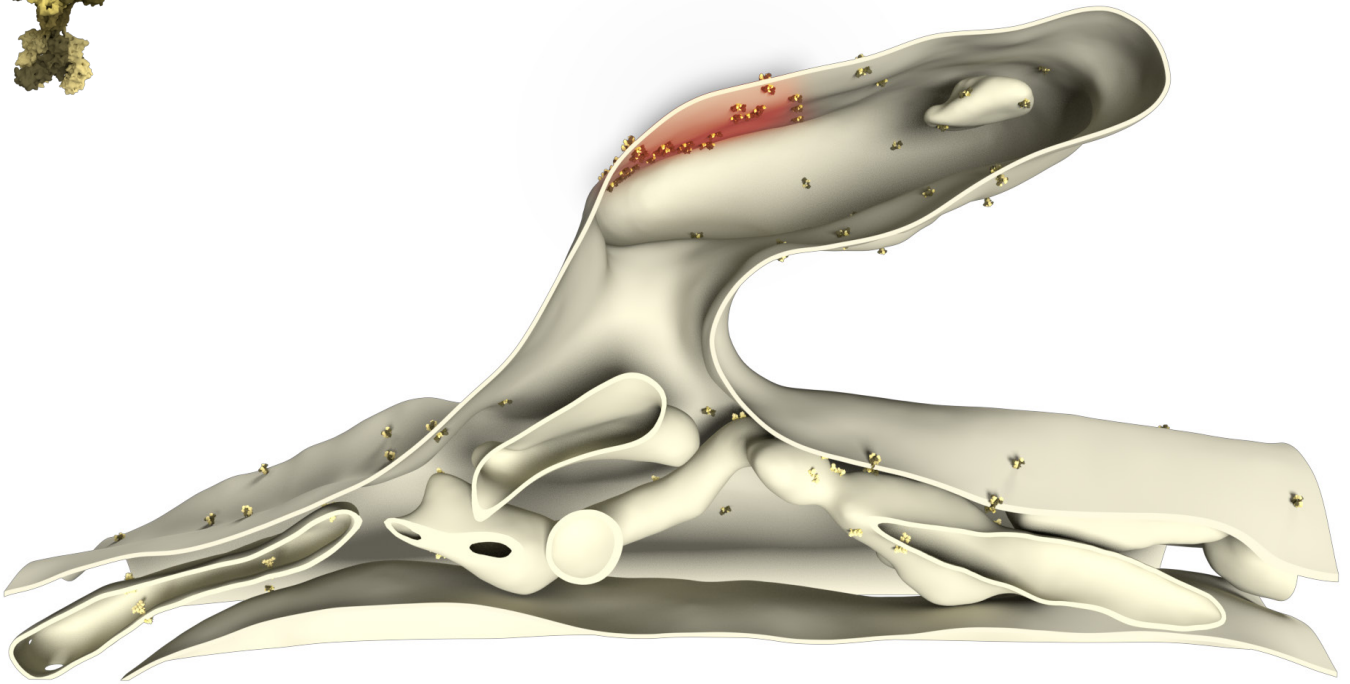
Known organization: Transmembrane protein, Highly concentrated in PSD, Part of supercomplexes with PSD95 and other proteins, Often close to dopamine receptors

Known Interactions: mGluR5, Dopamine receptor D1

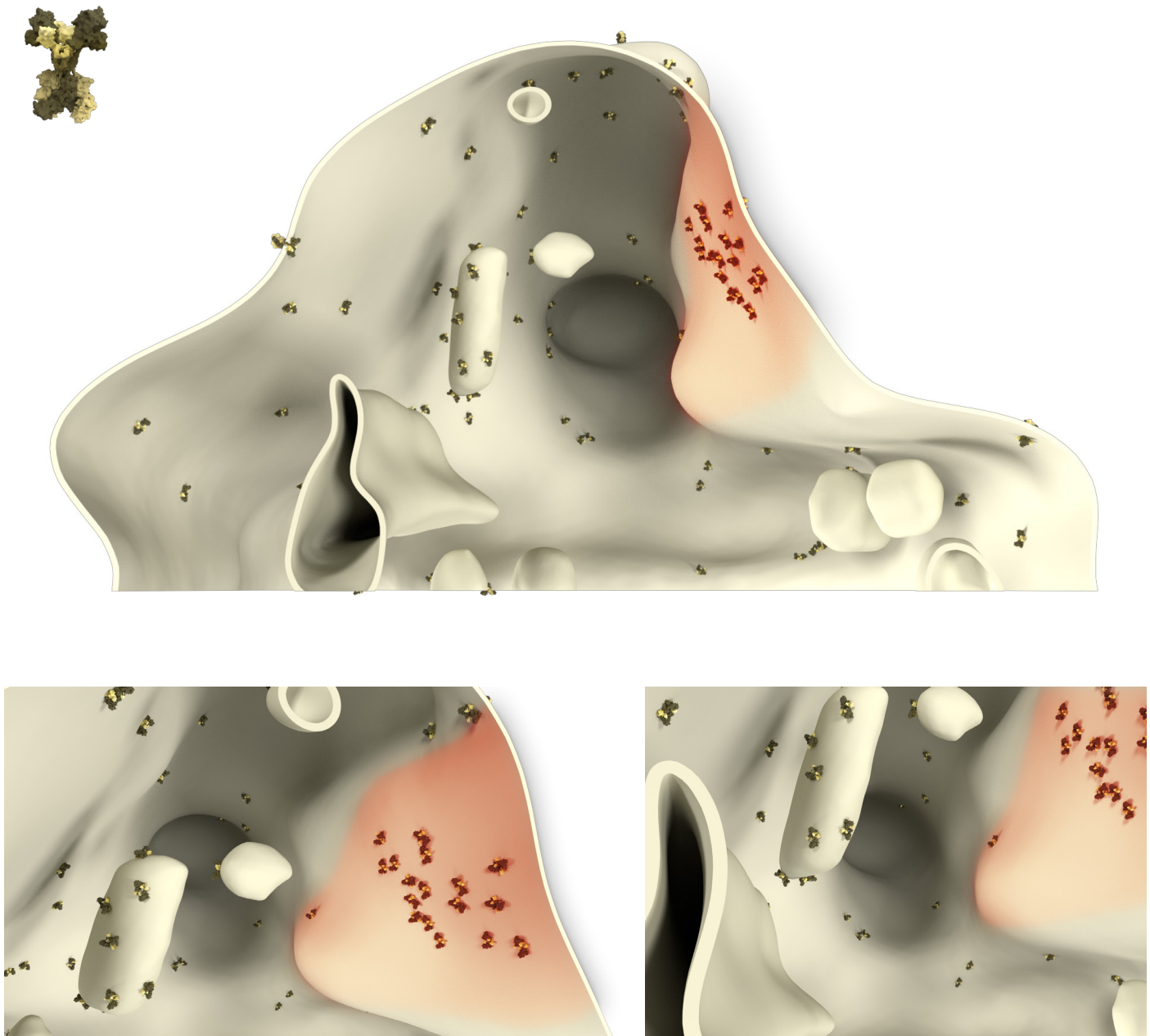


Whole cell copy number	602749.5 ± 80650.8 (extrapolated)	
Spine copy number	247.5 ± 24.9	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	214.8 ± 21.6	282.6 ± 28.4
% of total protein	0.1 ± 0.0%	0.1 ± 0.0%
Molarity (μM)	2.7 ± 0.3	2.7 ± 0.3
PSD copy number	55 ± 5.5	139 ± 14.0
% in PSD	25.6 ± 2.6%	49.2 ± 5.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	214.8 ± 21.6	$0.1 \pm 0.0\%$	2.7 ± 0.3	55 ± 5.5
Stubby	282.6 ± 28.4	$0.1 \pm 0.0\%$	2.7 ± 0.3	139 ± 14.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	214.8 ± 21.6	$0.1 \pm 0.0\%$	2.7 ± 0.3	55 ± 5.5
Stubby	282.6 ± 28.4	$0.1 \pm 0.0\%$	2.7 ± 0.3	139 ± 14.0



References

Antibody: Synaptic Systems 114 011

PDB Identifier: 4pe5

Literature:

Perroy et al., 2008, J. Biol. Chem.

Pei, 2004, J. Neurosci.

Lee et al., 2002, Cell

MacGillavry et al., 2013, Neuron

Dani et al., 2010, Neuron

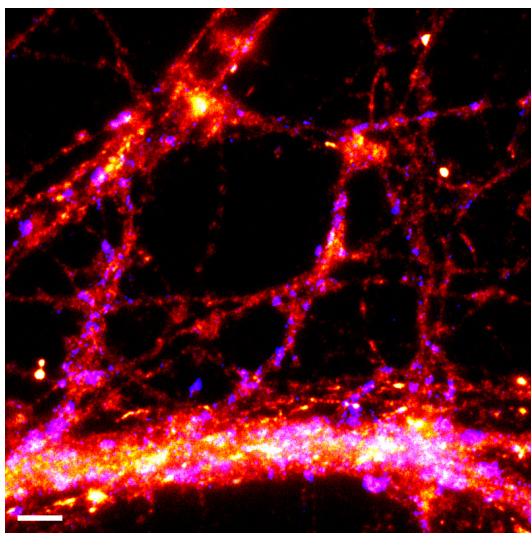
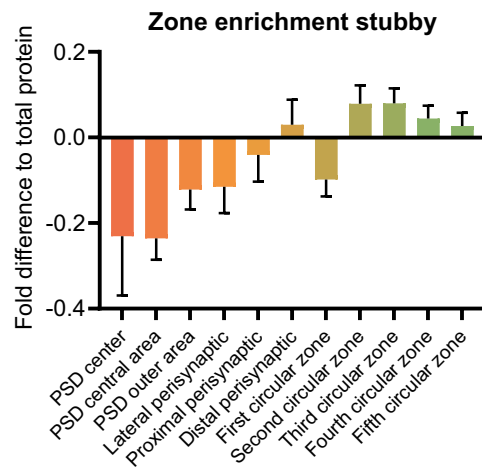
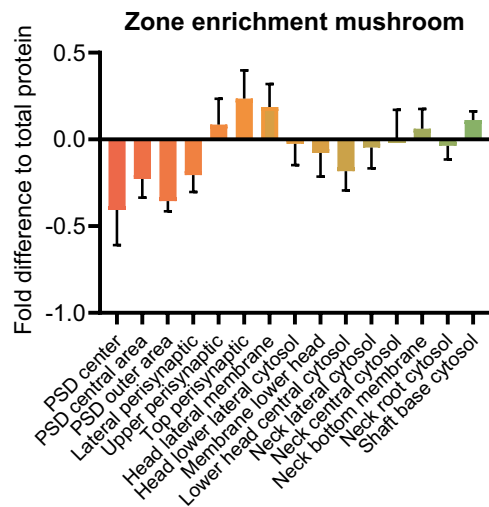
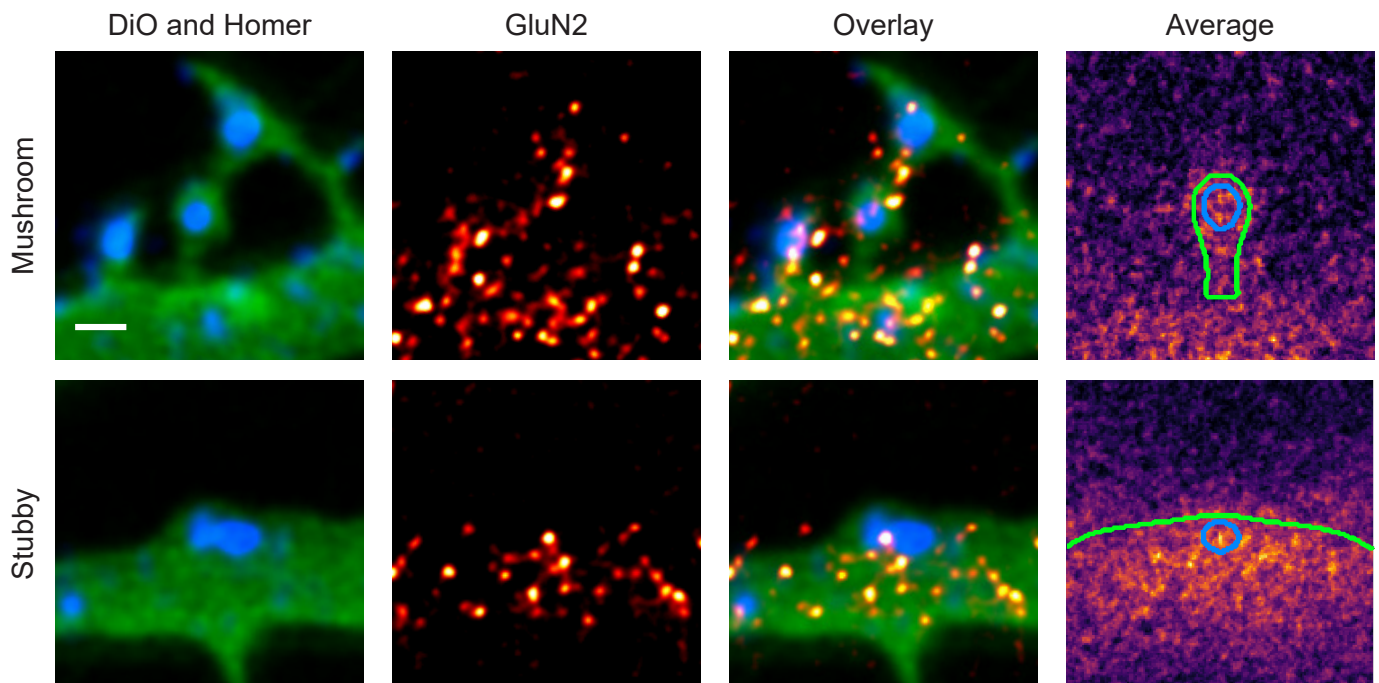
Frank et al., 2016, Nat. Commun.

GluN2A (NMDAR2A, NR2A, Gene: Grin2a, Uniprot ID: Q00959)

Known function: Critical for synaptic plasticity and learning, Postnatal dominant isoform.

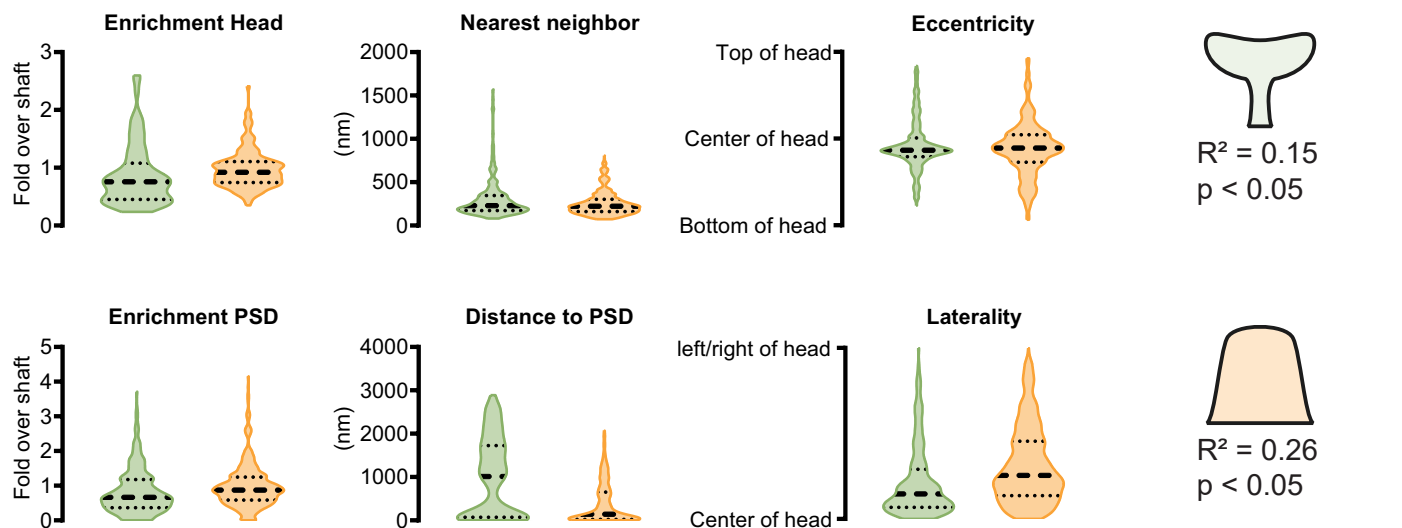
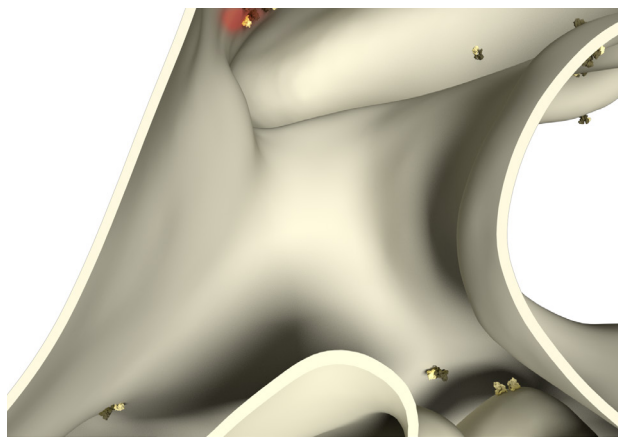
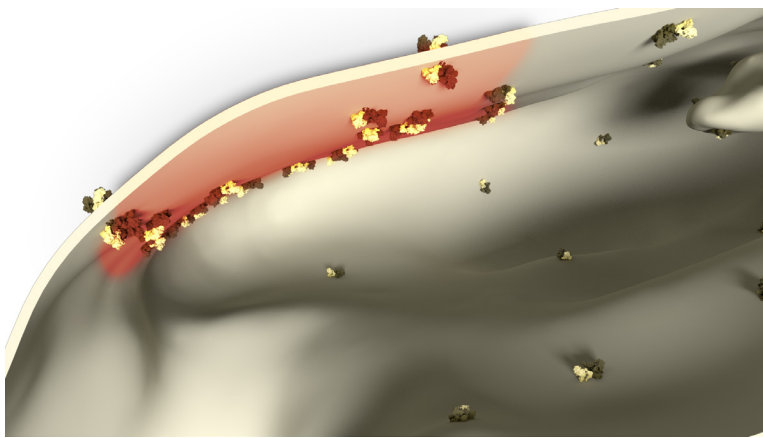
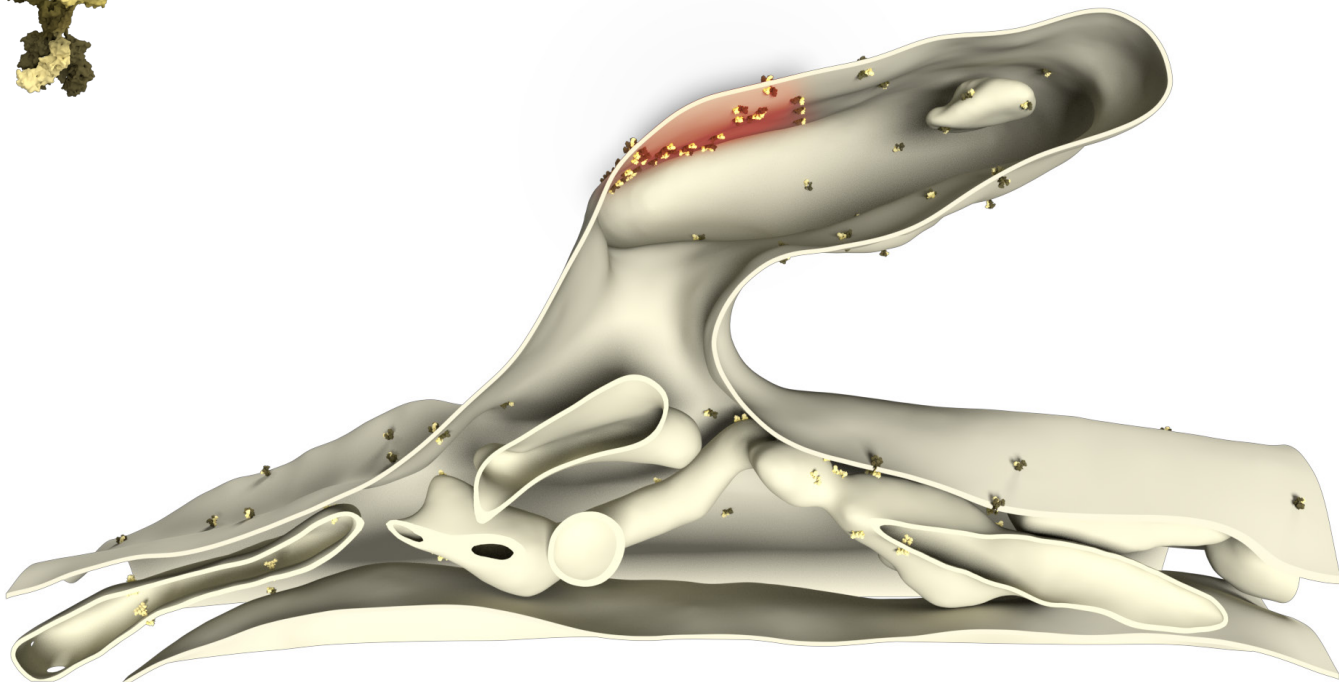
Known organization: Transmembrane protein, Highly concentrated in PSD, Part of supercomplexes with PSD95 and other proteins, Often close to Dopamine receptors

Known Interactions: PSD93, PSD95, Dopamine Receptor D1, Calmodulin, CaMKII

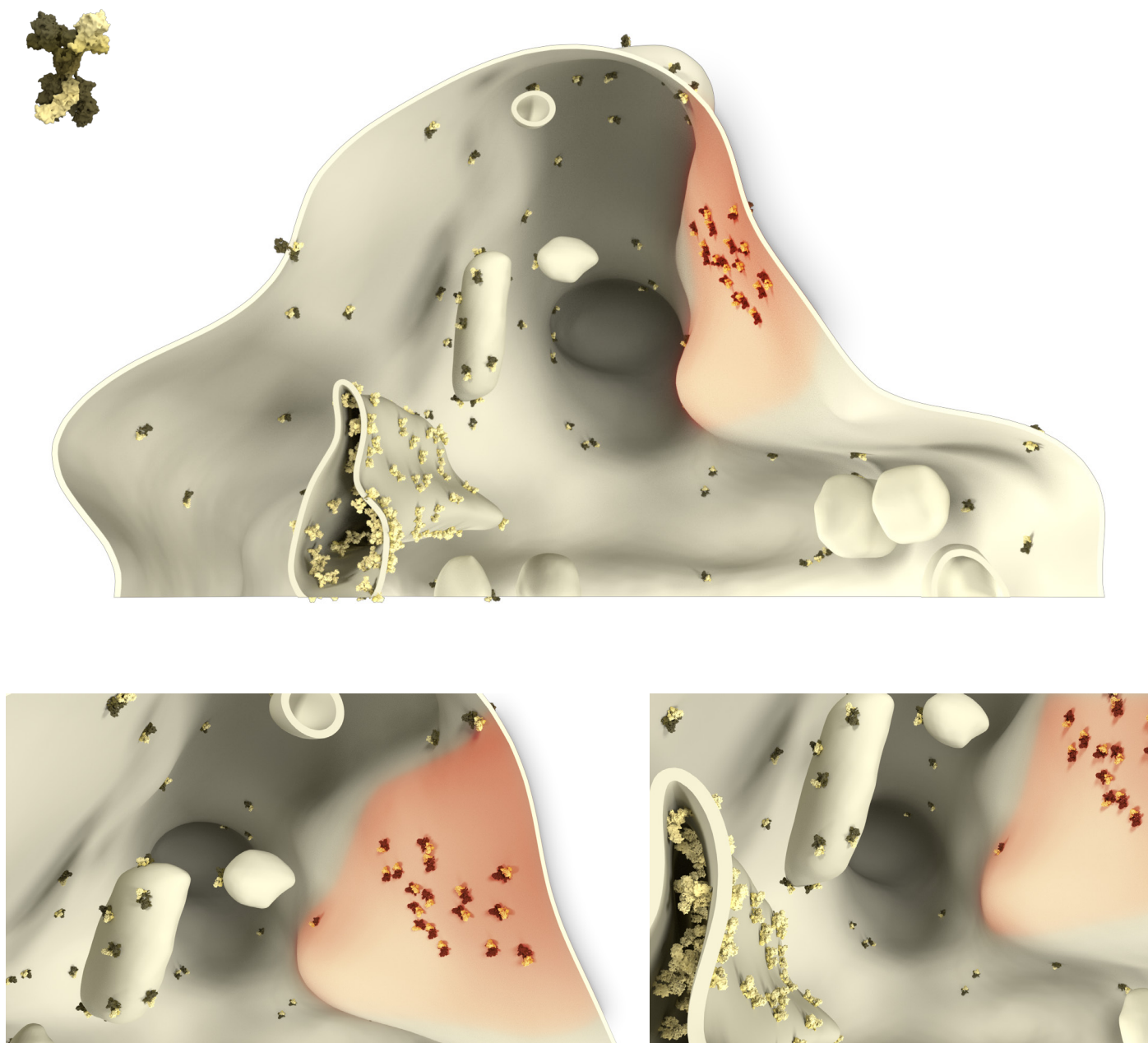


Whole cell copy number	20863.6 ± 358.3	
Spine copy number	2.2 ± 0.7	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	1.7 ± 0.6	2.9 ± 0.9
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.0 ± 0.0	0.0 ± 0.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1.7 ± 0.6	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	2.9 ± 0.9	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1.7 ± 0.6	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	2.9 ± 0.9	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



References

Antibody: NeuroMab 75-288

PDB Identifier: 5uow

Literature:

Al-Hallaq et al., 2007, J. Neurosci.

Bard et al., 2010, Proc. Natl. Acad. Sci. U S A

Ehlers et al., 1996, Cell

Elias and Nicoll, 2007, Trends Cell. Biol.

Frank et al., 2016, Nat. Commun.

Krapivinsky et al., 2003, Neuron

Lee et al., 2002, Cell

MacGillavry et al., 2013, Neuron

Pei, 2004, J. Neurosci.

Racca et al., 2000, J. Neurosci.

Sans et al., 2000, J. Neurosci.

Sheng et al., 1994, Nature

Shinohara et al., 2008, Proc. Natl. Acad. Sci. U S A

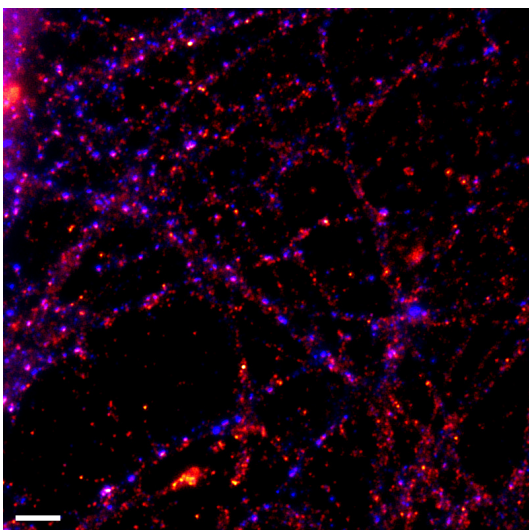
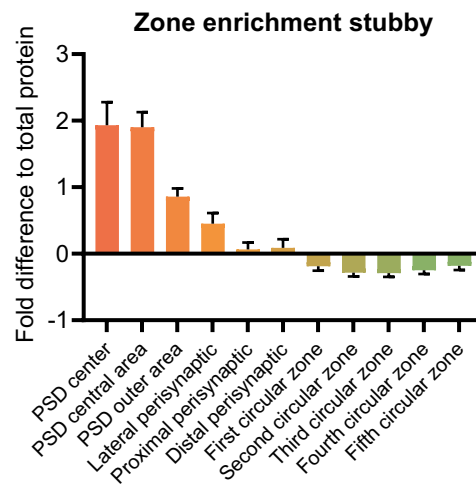
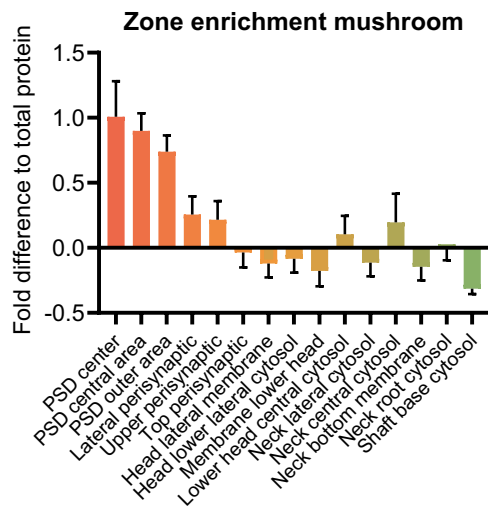
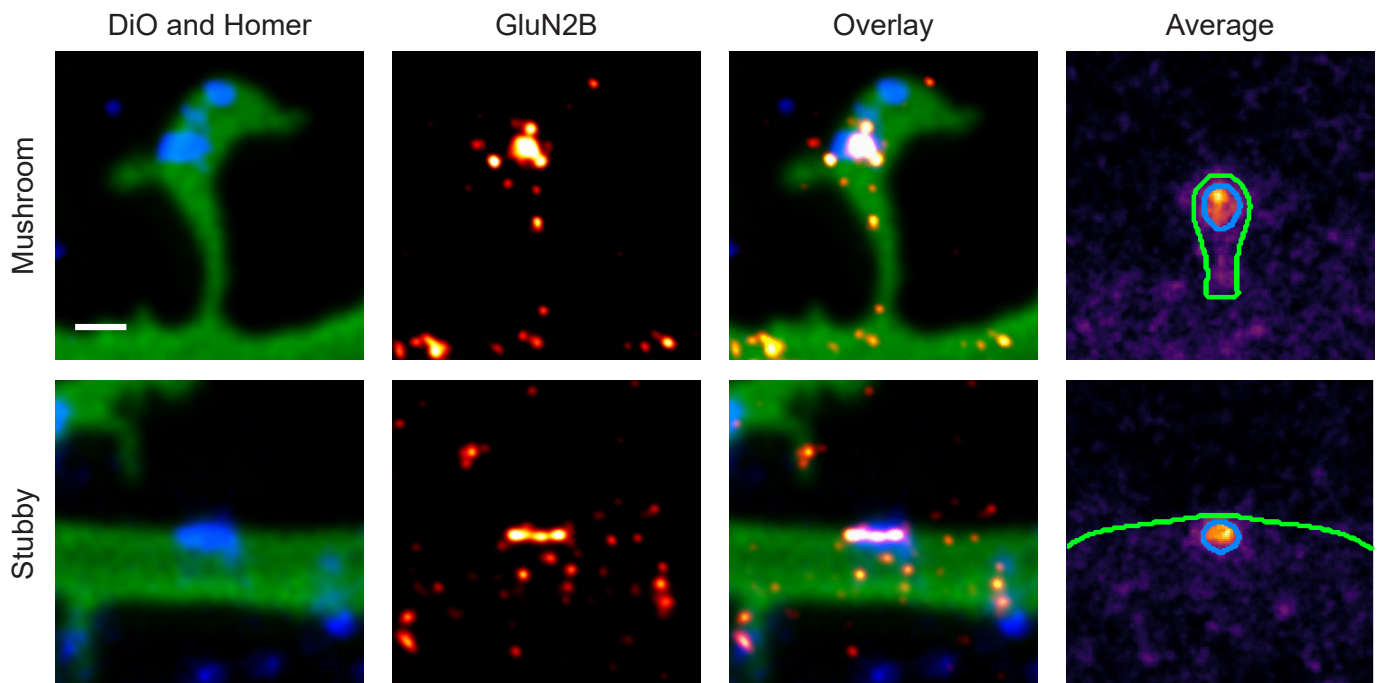
Wyszynski et al., 1997, Nature

GluN2B (NR2B, NMDAR2B, Gene: Grin2b, Uniprot ID: Q00960)

Known function: Critical for synaptic plasticity and learning, Prenatal dominant isoform

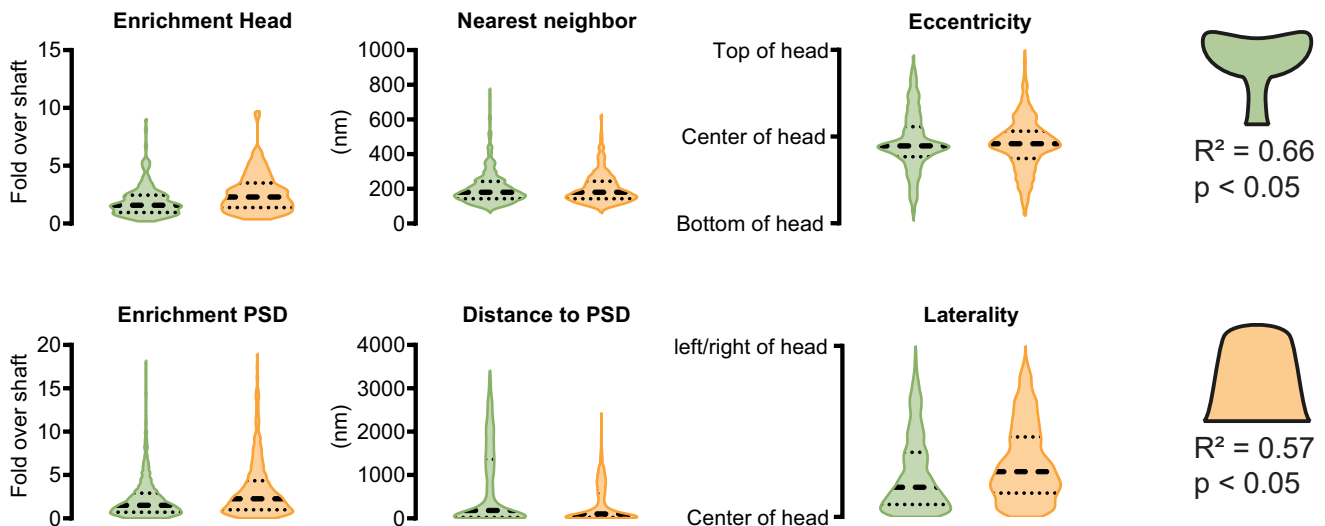
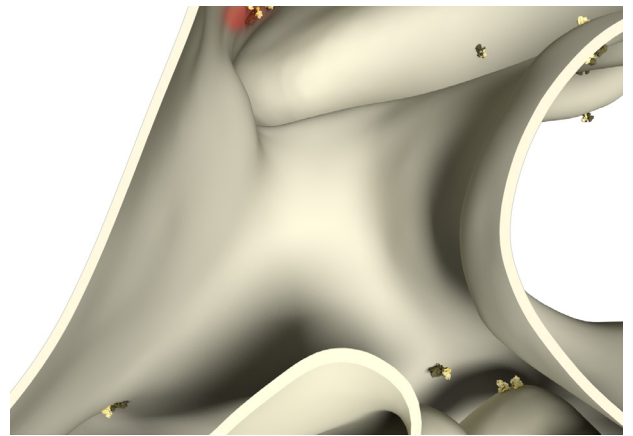
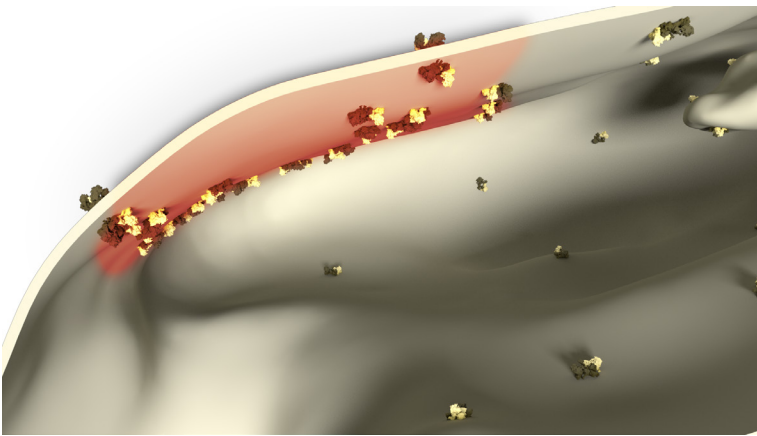
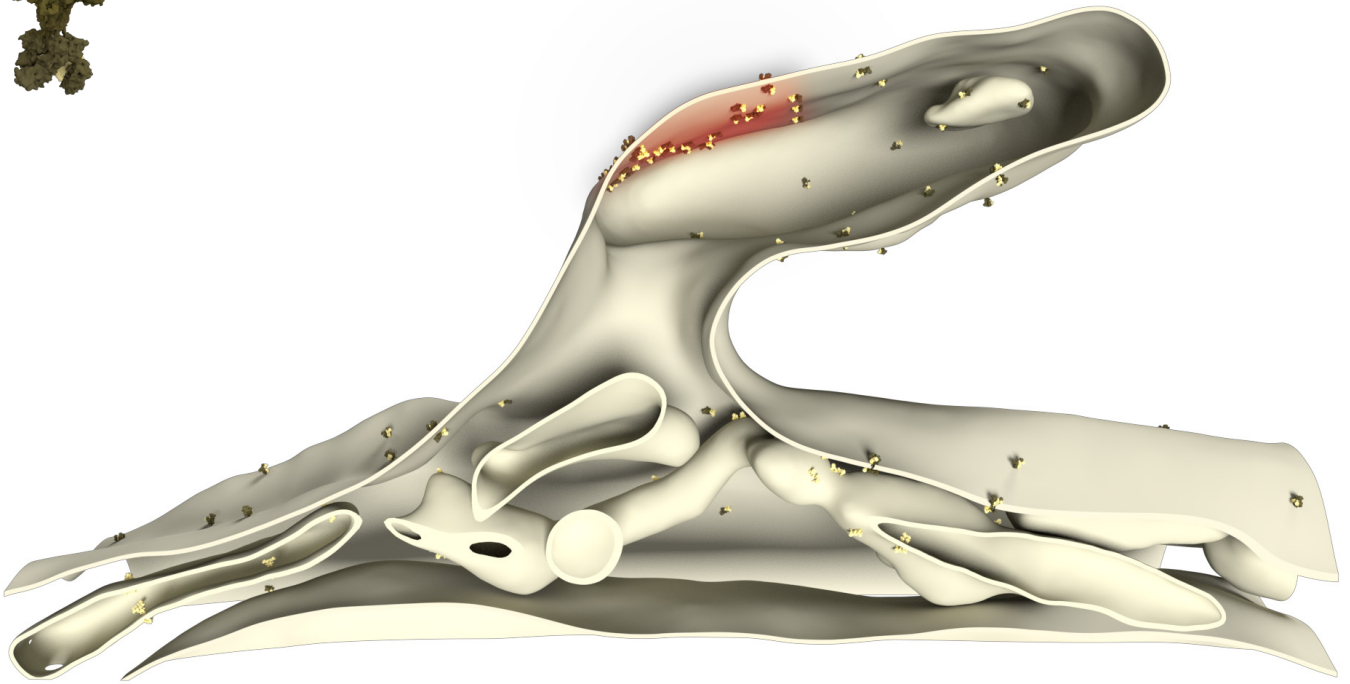
Known organization: Transmembrane protein, Highly concentrated in PSD, Part of supercomplexes with PSD95 and other proteins, Often colocalized with Dopamine receptors

Known Interactions: PSD93, PSD95, mGluR5, Dopamine Receptor D2, CaM, CaMKII

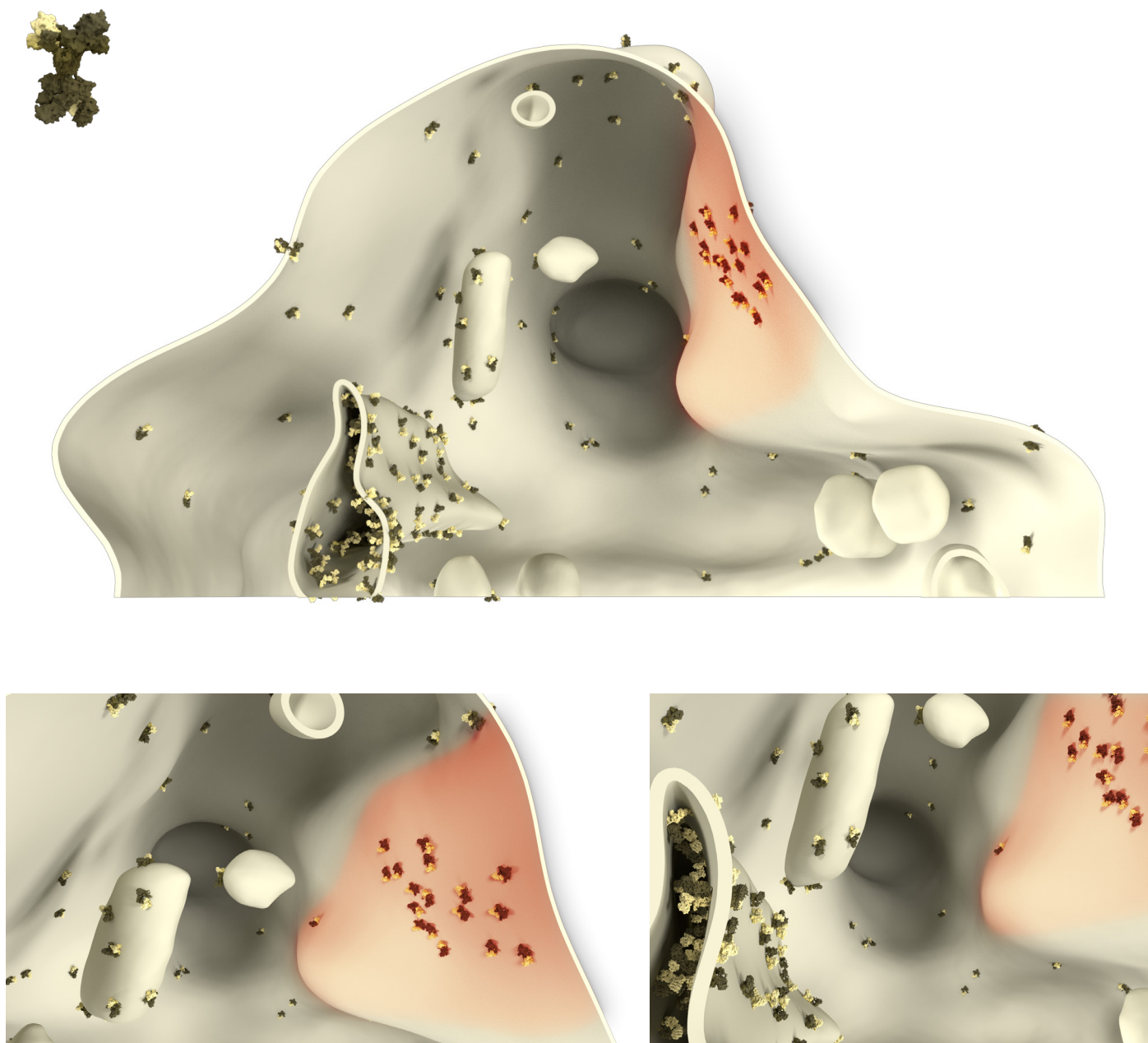


Whole cell copy number	757451.7 ± 105875.3 (extrapolated)	
Spine copy number	355.2 ± 40.7	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	319.9 ± 36.7	433.7 ± 49.7
% of total protein	0.3 ± 0.0%	0.3 ± 0.0%
Molarity (μM)	4.1 ± 0.5	4.1 ± 0.5
PSD copy number	152 ± 17.4	253 ± 29.0
% in PSD	47.5 ± 5.4%	58.3 ± 6.7%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	319.9 ± 36.7	$0.3 \pm 0.0\%$	4.1 ± 0.5	152 ± 17.4
Stubby	433.7 ± 49.7	$0.3 \pm 0.0\%$	4.1 ± 0.5	253 ± 29.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	319.9 ± 36.7	$0.3 \pm 0.0\%$	4.1 ± 0.5	152 ± 17.4
Stubby	433.7 ± 49.7	$0.3 \pm 0.0\%$	4.1 ± 0.5	253 ± 29.0



References

Antibody: Neuromab 75-101

PDB Identifier: 6cna

Literature:

Al-Hallaq et al., 2007, J. Neurosci.

Bard et al., 2010, Proc. Natl. Acad. Sci. U S A

Ehlers et al., 1996, Cell

Elias and Nicoll, 2007, Trends Cell. Biol.

Krapivinsky et al., 2003, Neuron

Racca et al., 2000, J. Neurosci.

Sans et al., 2000, J. Neurosci.

Sheng et al., 1994, Nature

Shinohara et al., 2008, Proc. Natl. Acad. Sci. U S A

Wyszynski et al., 1997, Nature

Halt et al., 2012, EMBO J.

Liu et al., 2006, Neuron

Zhang and Diamond, 2009, J. Neurosci.

Zhou et al., 2007, J. Neurosci.

MacGillavry et al., 2013, Neuron

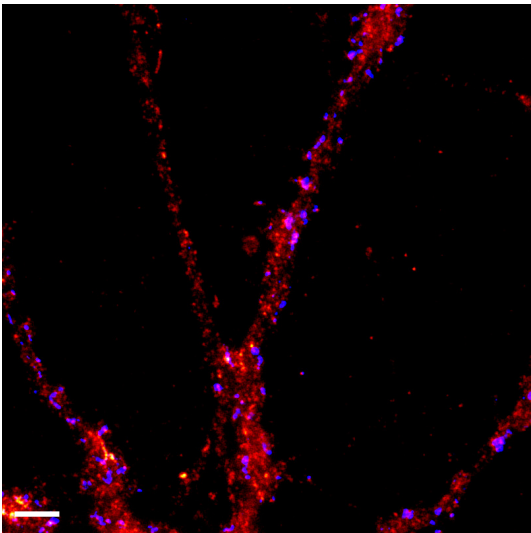
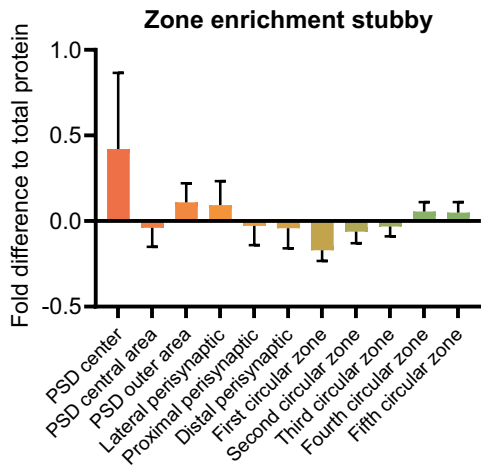
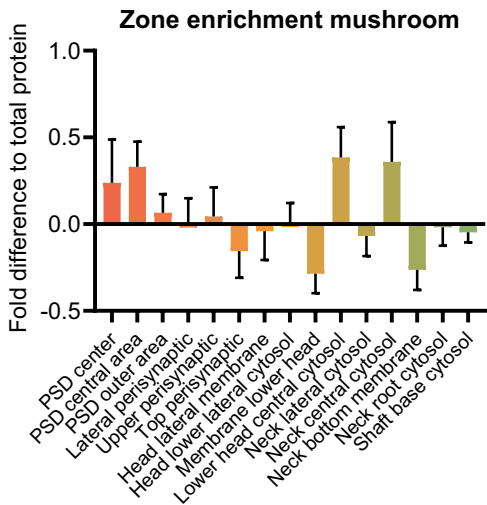
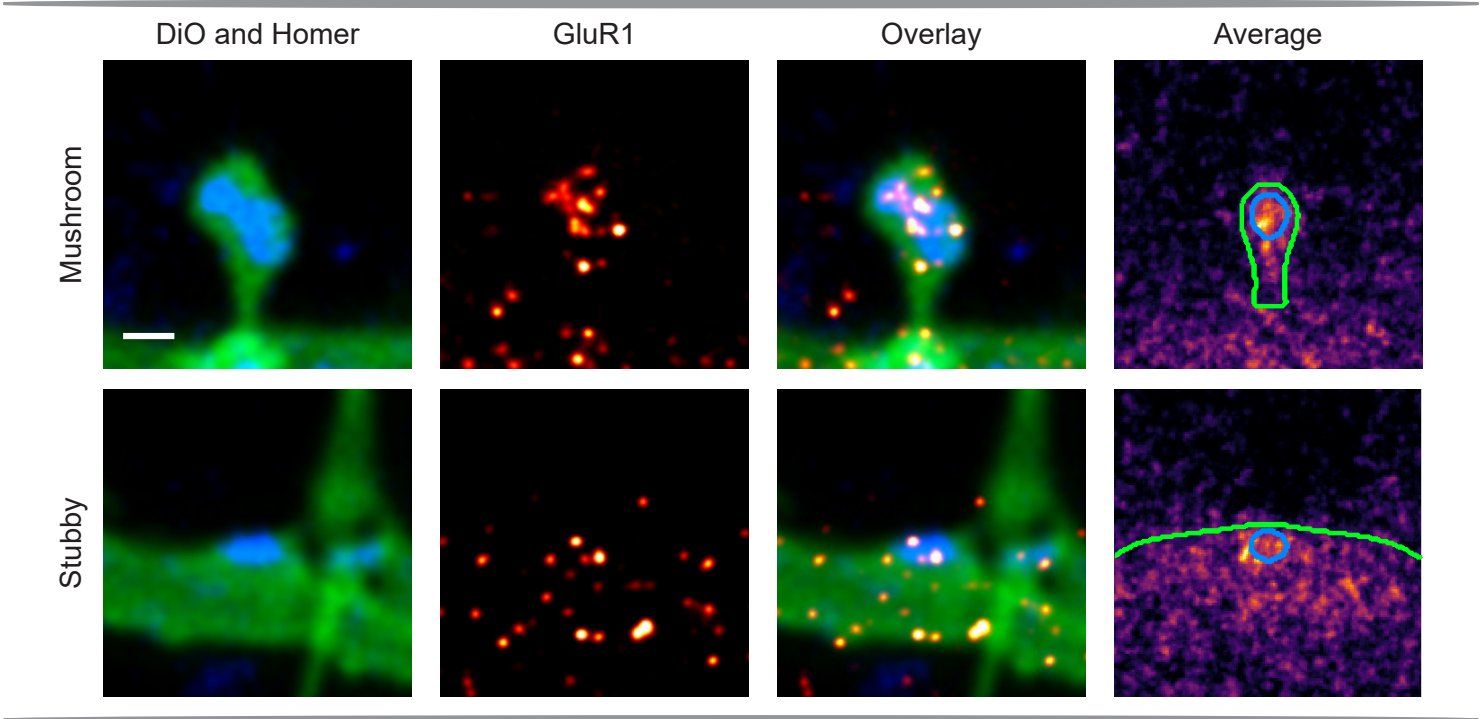
Dani et al., 2010, Neuron

GluR1 (GluA1, Gene: Gria1, Uniprot ID: P19490)

Known function: Part of primary glutamate receptor, Important for plasticity, Rapidly delivered to synapse upon activation, Stable localization at synapse

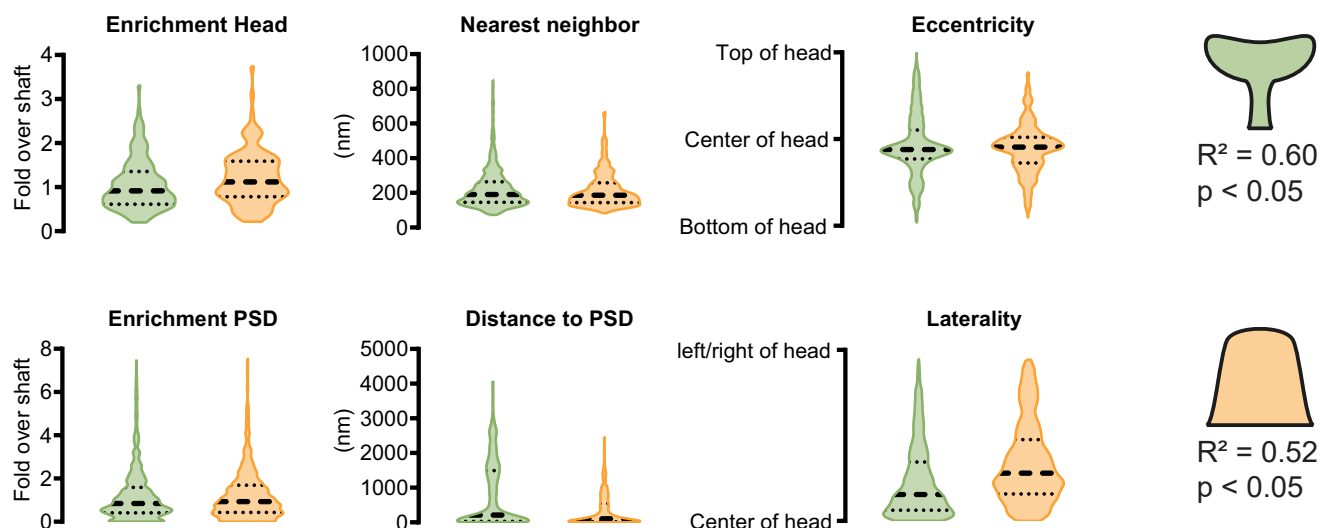
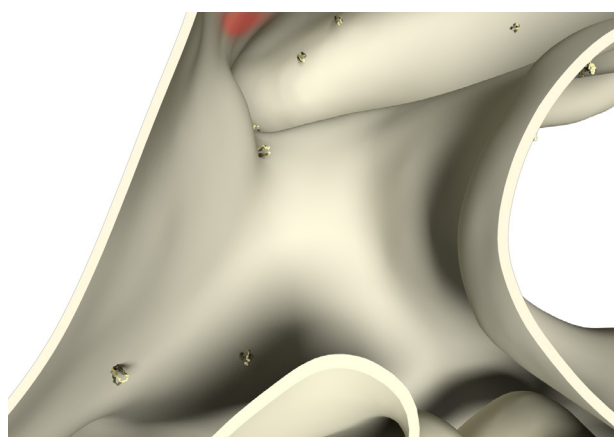
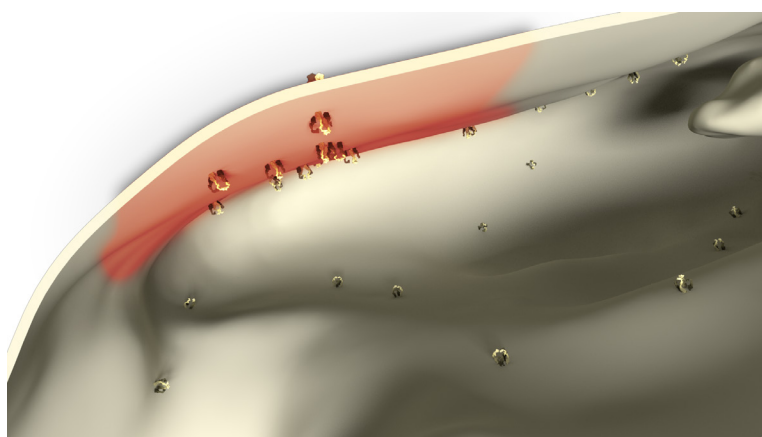
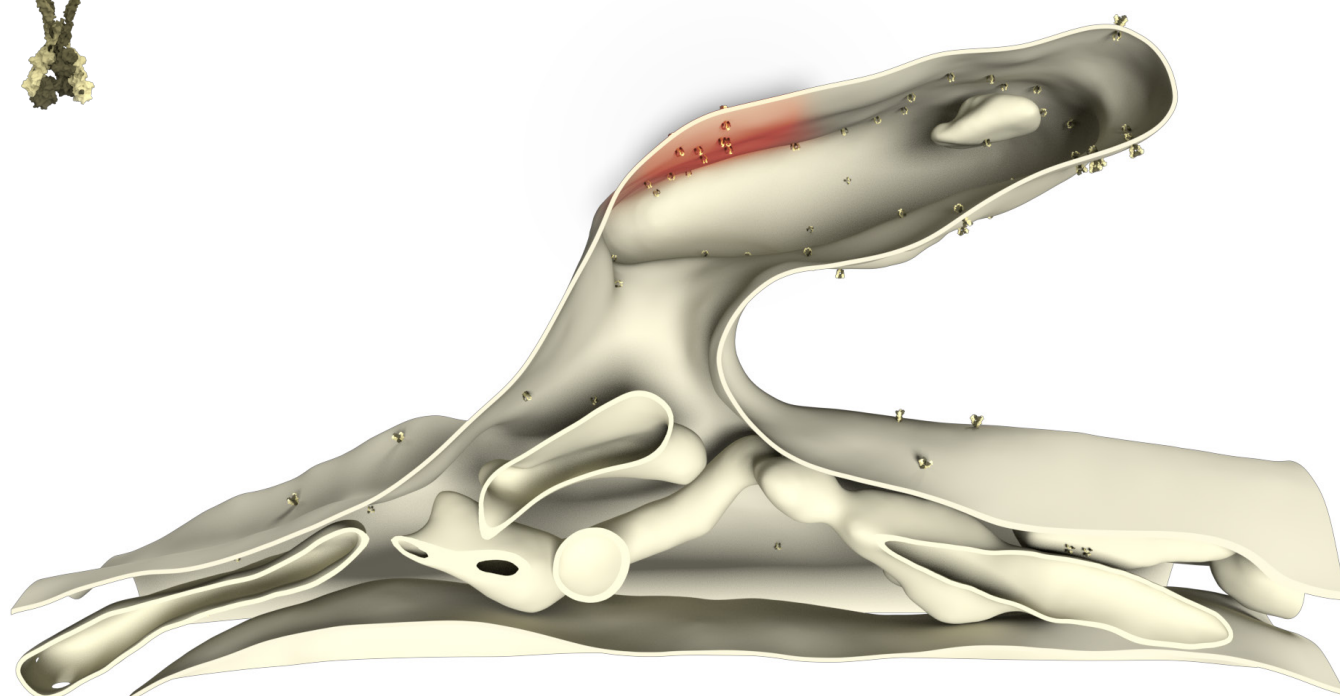
Known organization: Transmembrane proteine, Heterotetramers, Forms 80 nm clusters,

Known Interactions: None

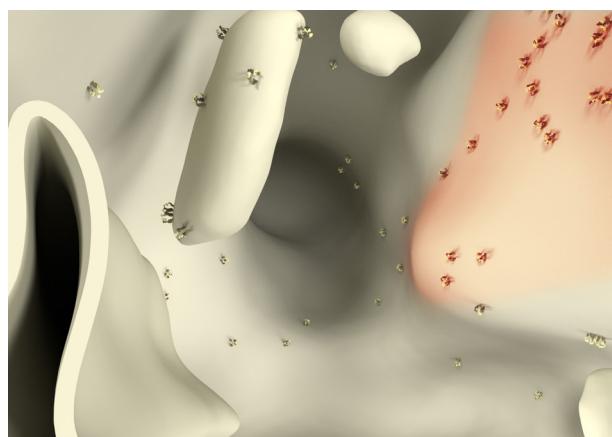
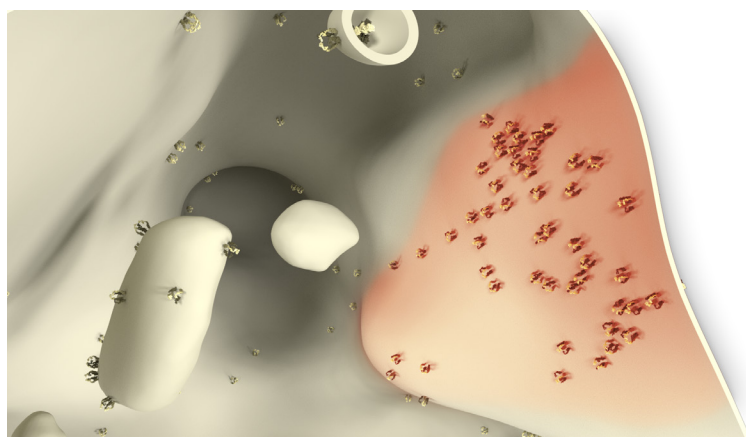
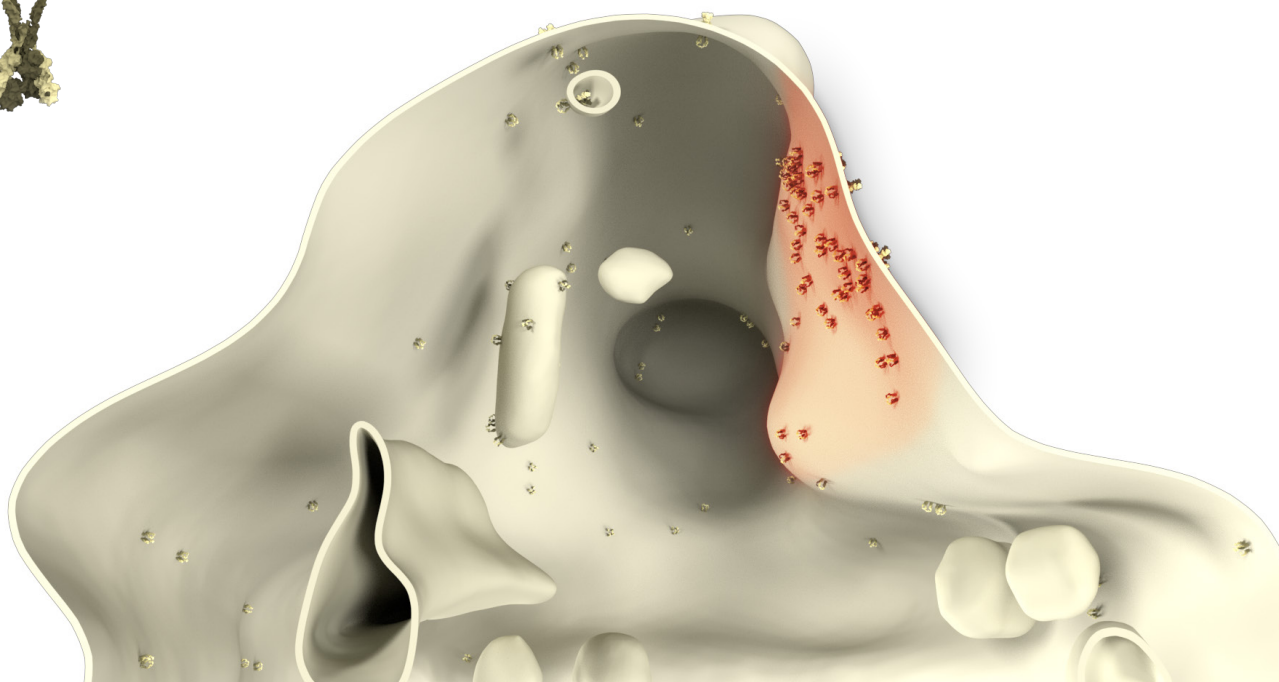


Whole cell copy number	976411.9 ± 196915.5 (extrapolated)	
Spine copy number	279.5 ± 41.8	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	236.4 ± 35.4	326.9 ± 48.9
% of total protein	0.1 ± 0.0%	0.1 ± 0.0%
Molarity (µM)	3.0 ± 0.4	3.1 ± 0.5
PSD copy number	62 ± 9.3	47 ± 7.0
% in PSD	26.2 ± 3.9%	14.4 ± 2.2%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	236.4 ± 35.4	$0.1 \pm 0.0\%$	3.0 ± 0.4	62 ± 9.3
Stubby	326.9 ± 48.9	$0.1 \pm 0.0\%$	3.1 ± 0.5	47 ± 7.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	236.4 ± 35.4	$0.1 \pm 0.0\%$	3.0 ± 0.4	62 ± 9.3
Stubby	326.9 ± 48.9	$0.1 \pm 0.0\%$	3.1 ± 0.5	47 ± 7.0



References

Antibody: Synaptic Systems 182 003

PDB Identifier: modified GluR2

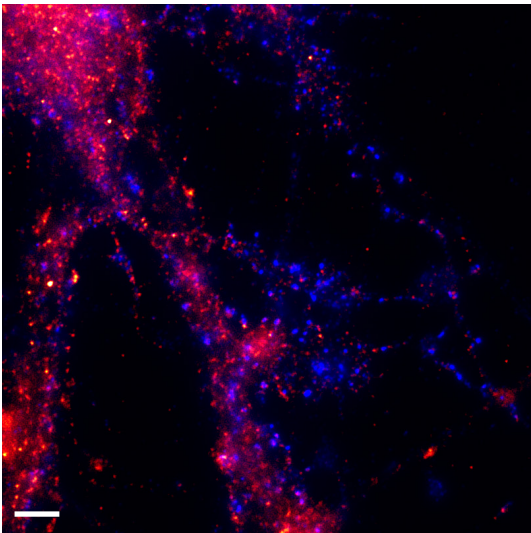
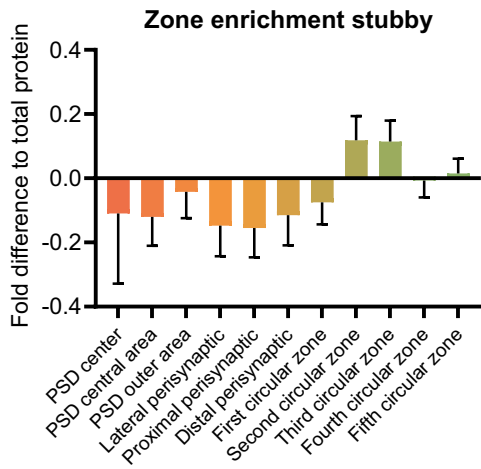
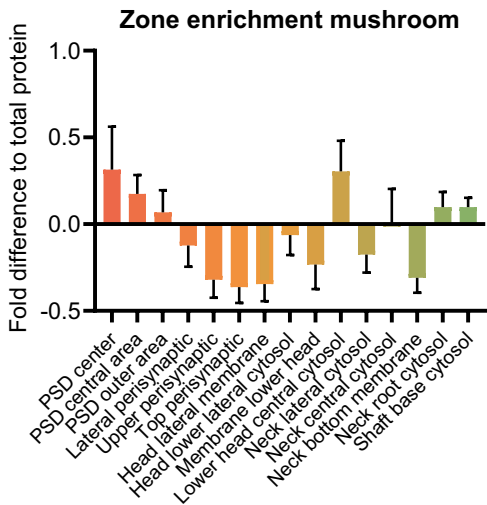
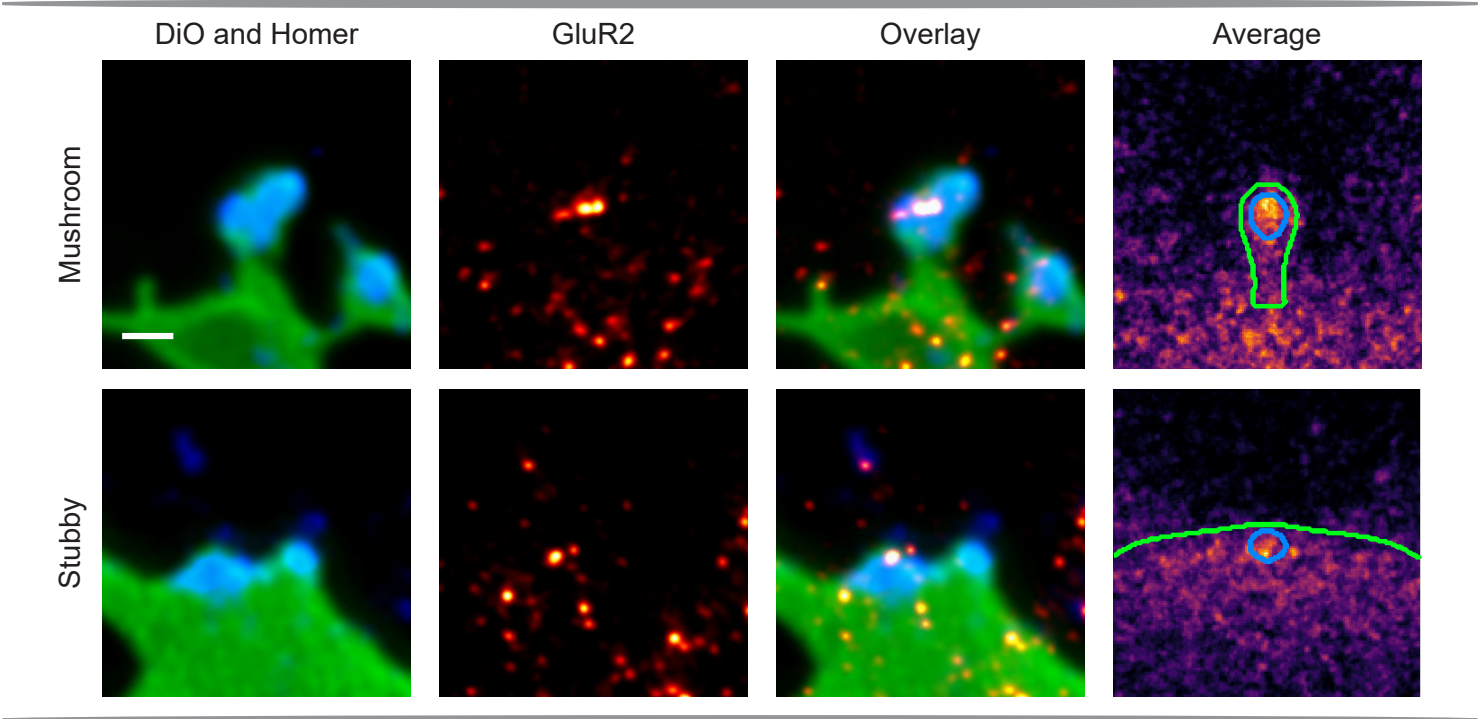
Literature:

Nair et al., 2013, J. Neurosci.

MacGillavry et al., 2013, Neuron

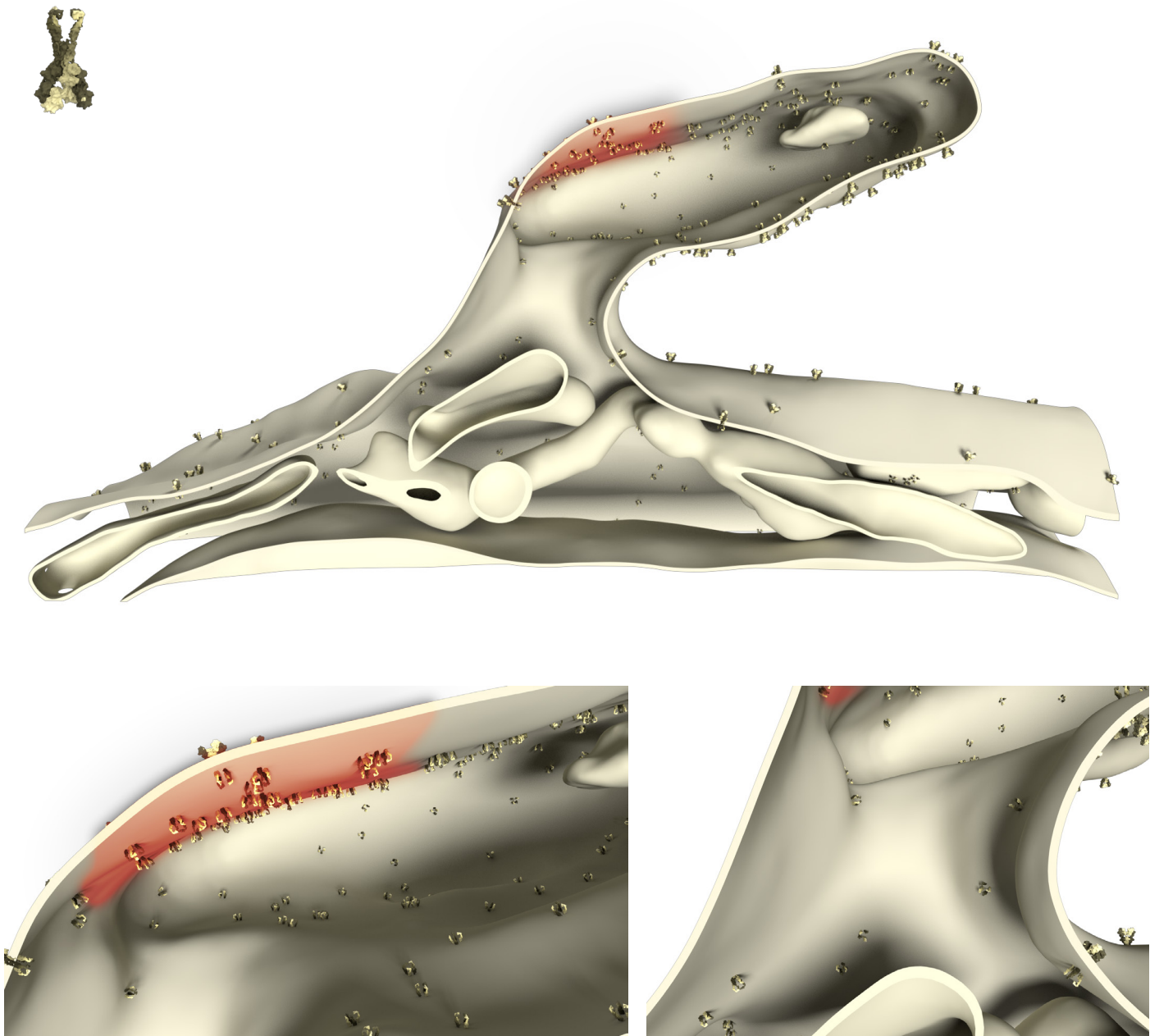
GluR2 (GluA2, Gene: Gria2, Uniprot ID: P19491)

Known function: Part of primary glutamate receptor, Important for plasticity
Known organization: Transmembrane protein, Heterotetramers, Forms 80 nm clusters
Known Interactions: GRIP, NSF, alpha-SNAP, beta-SNAP, Syntaxin13

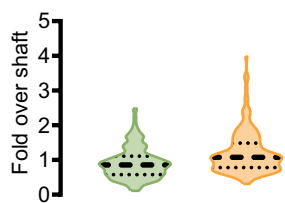


Whole cell copy number	4227066.8 ± 612238.7 (extrapolated)	
Spine copy number	1082.8 ± 98.5	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	872.0 ± 79.3	1411.0 ± 128.3
% of total protein	0.4 ± 0.0%	0.6 ± 0.1%
Molarity (μM)	11.1 ± 1.0	13.3 ± 1.2
PSD copy number	204 ± 18.6	230 ± 20.9
% in PSD	23.4 ± 2.1%	16.3 ± 1.5%

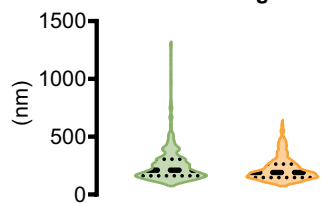
	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	872.0 ± 79.3	$0.4 \pm 0.0\%$	11.1 ± 1.0	204 ± 18.6
Stubby	1411.0 ± 128.3	$0.6 \pm 0.1\%$	13.3 ± 1.2	230 ± 20.9



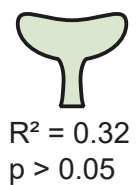
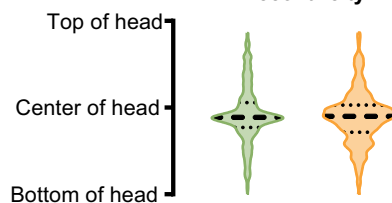
Enrichment Head



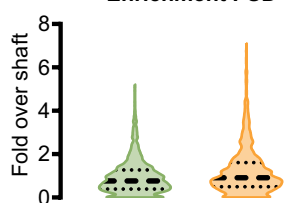
Nearest neighbor



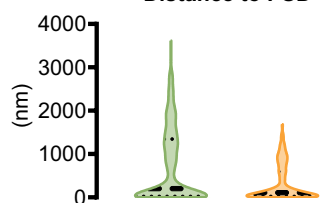
Eccentricity



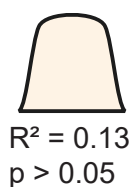
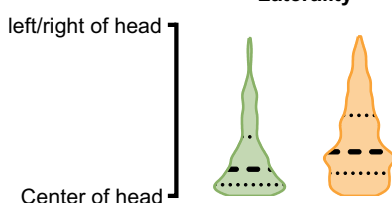
Enrichment PSD



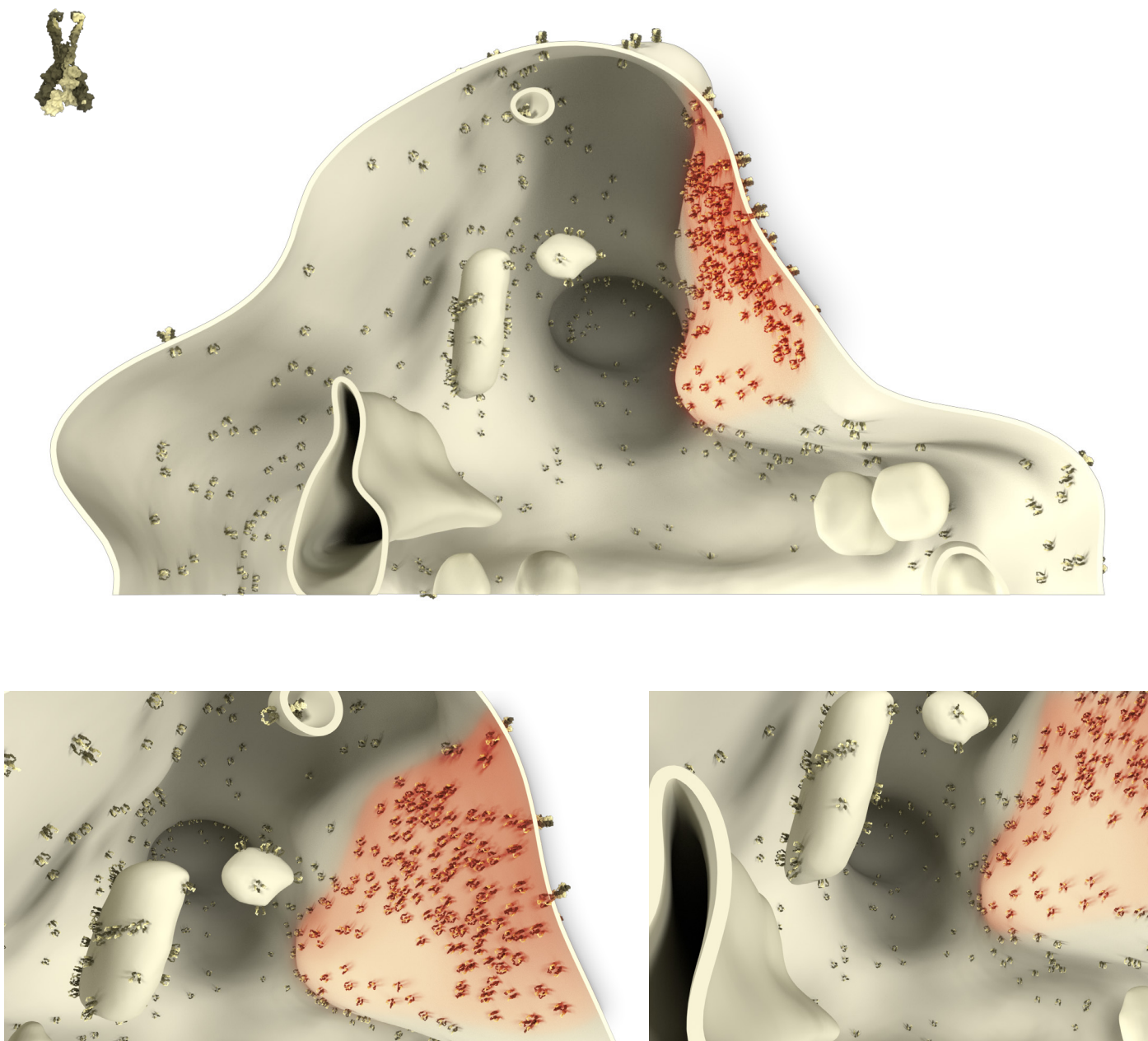
Distance to PSD



Laterality



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	872.0 ± 79.3	$0.4 \pm 0.0\%$	11.1 ± 1.0	204 ± 18.6
Stubby	1411.0 ± 128.3	$0.6 \pm 0.1\%$	13.3 ± 1.2	230 ± 20.9



References

Antibody: Alomone Labs AGC-005

PDB Identifier: 5l1h

Literature:

MacGillavry et al., 2013, Neuron

Nair et al., 2013, J. Neurosci.

Kato et al., 2008, Neuron

Lu and Ziff, 2005, Neuron

Osten et al., 1998, Neuron

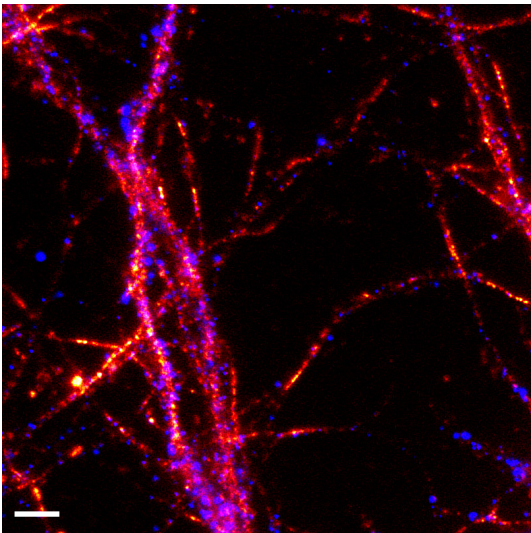
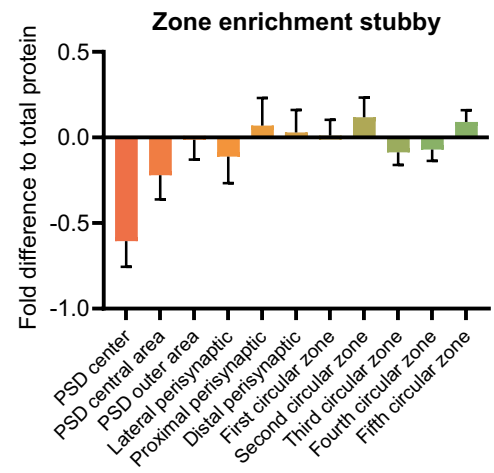
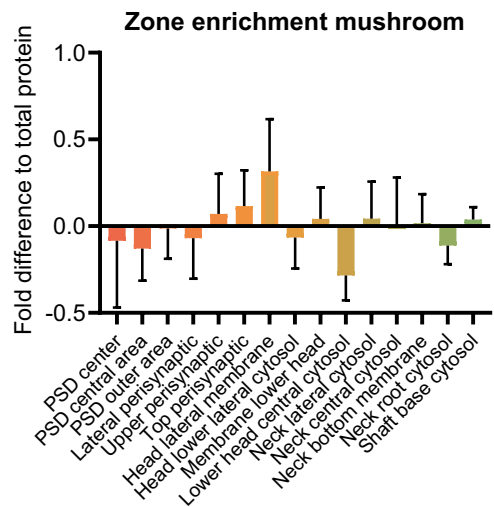
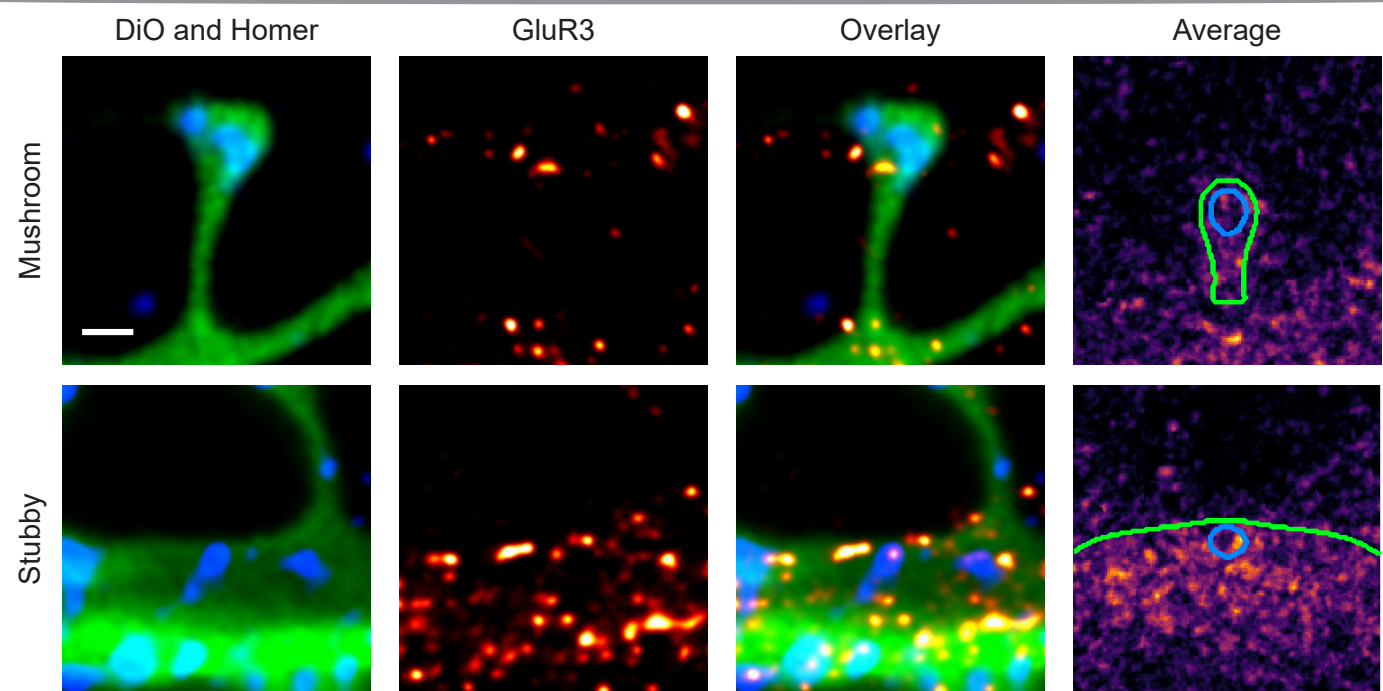
Hirbec et al., 2002, J. Biol. Chem.

GluR3 (GluA3, Gene: Gria3, Uniprot ID: P19492)

Known function: Part of primary glutamate receptor, Important for plasticity, Constitutively trafficks between synaptic membrane and endosomes

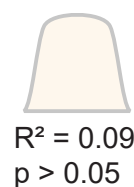
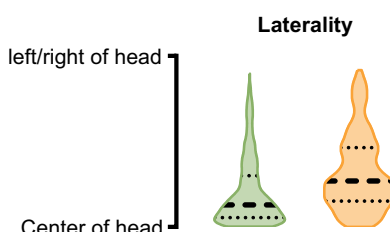
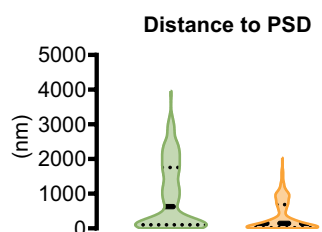
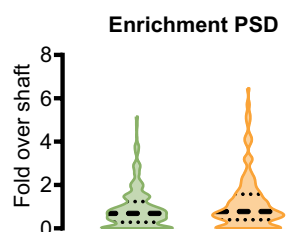
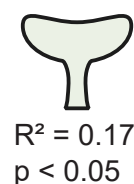
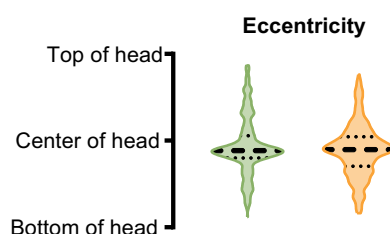
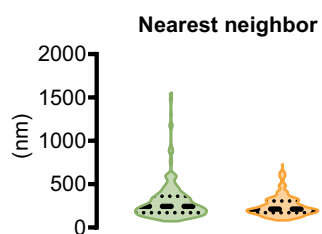
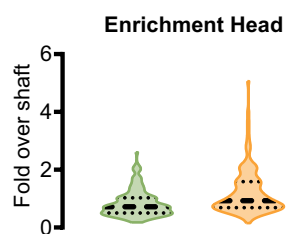
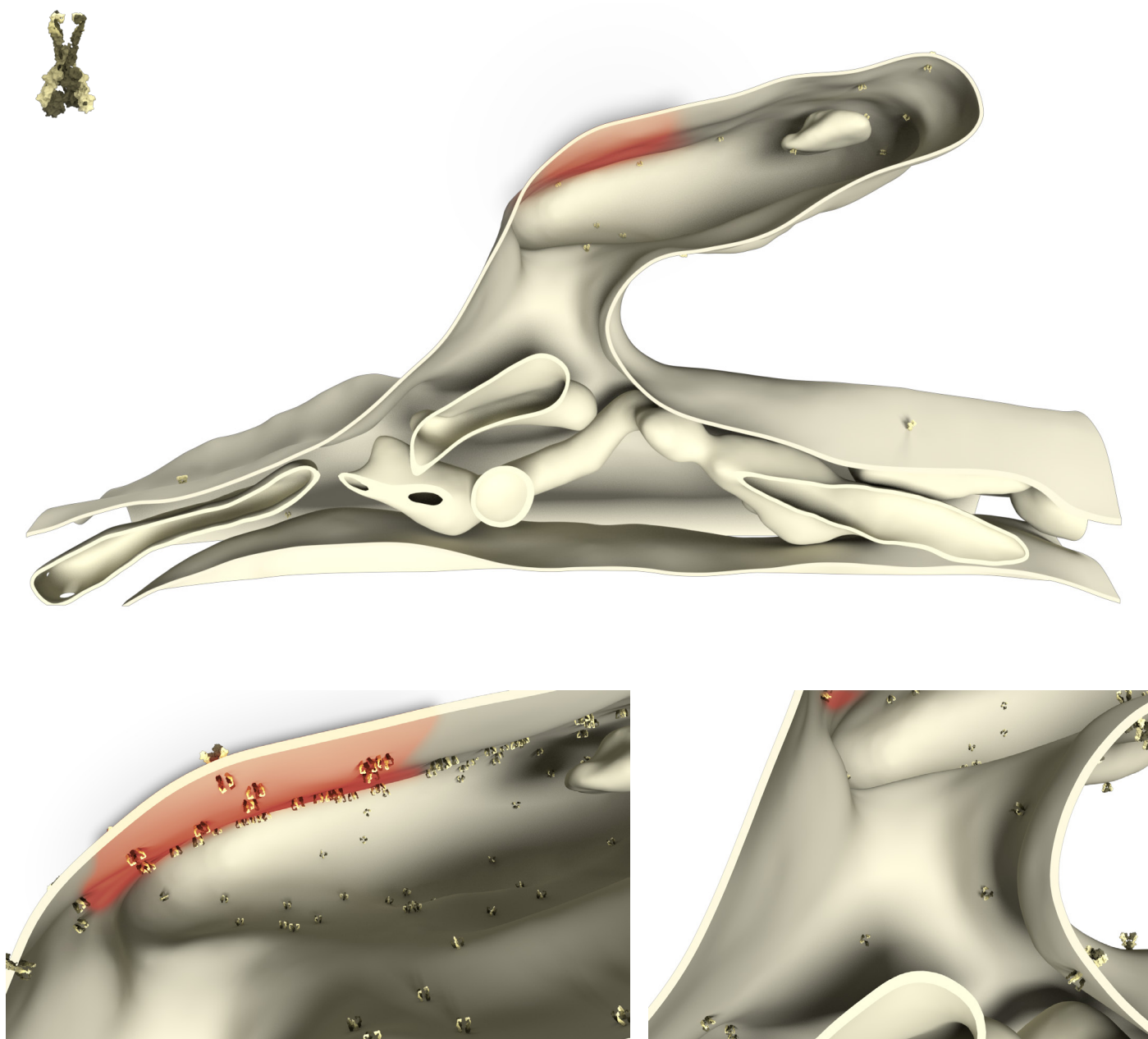
Known organization: Transmembrane proteine, Heterotetramers, Forms 80 nm clusters

Known Interactions: GRIP

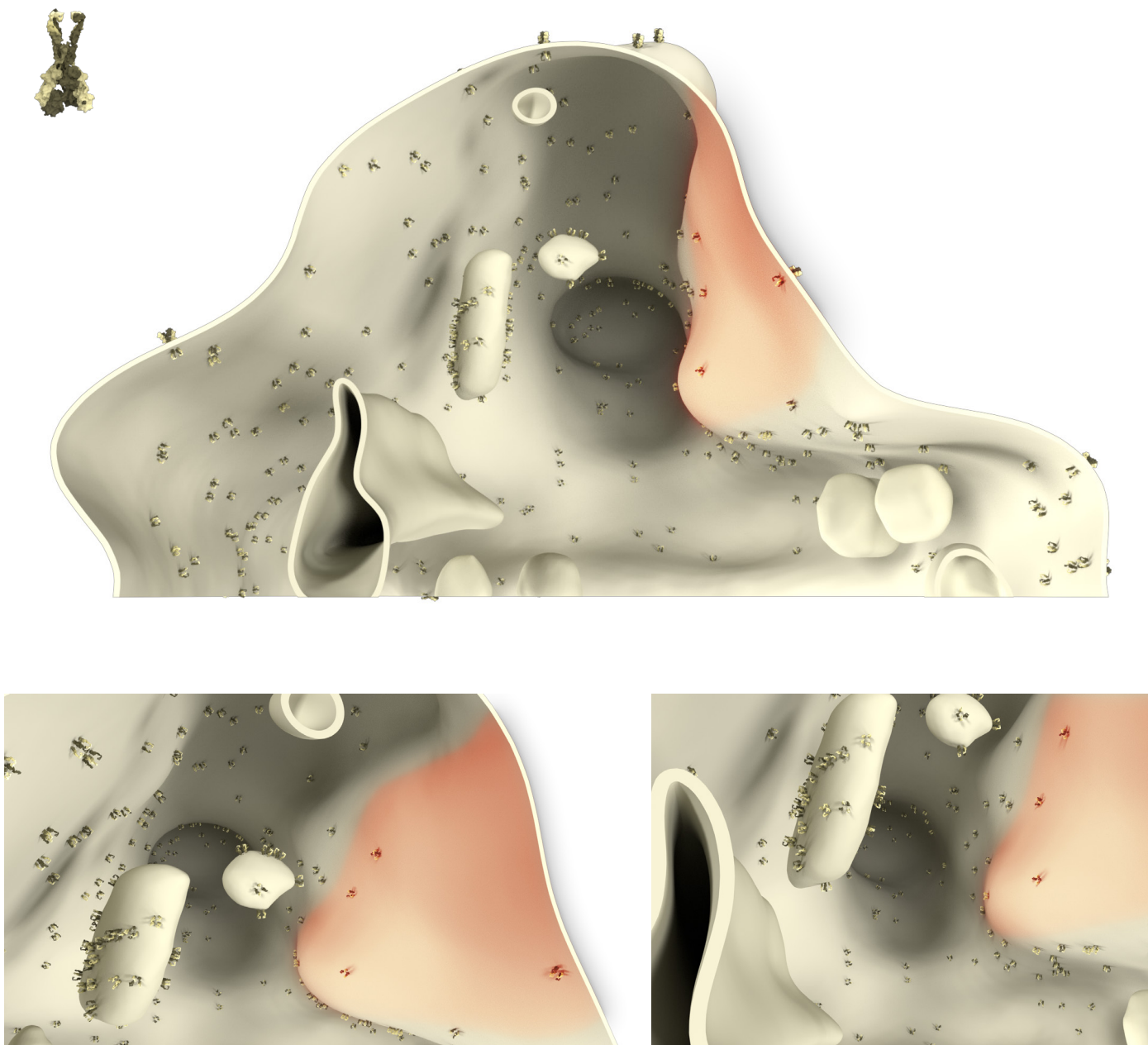


Whole cell copy number	9500147.4 ± 3457585.3 (extrapolated)	
Spine copy number	992.4 ± 198.5	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	792.2 ± 158.5	1361.1 ± 272.3
% of total protein	0.4 ± 0.1%	0.6 ± 0.1%
Molarity (µM)	10.1 ± 2.0	12.9 ± 2.6
PSD copy number	56 ± 11.2	101 ± 20.2
% in PSD	7.1 ± 1.4%	7.4 ± 1.5%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	792.2 ± 158.5	$0.4 \pm 0.1\%$	10.1 ± 2.0	56 ± 11.2
Stubby	1361.1 ± 272.3	$0.6 \pm 0.1\%$	12.9 ± 2.6	101 ± 20.2



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	792.2 ± 158.5	$0.4 \pm 0.1\%$	10.1 ± 2.0	56 ± 11.2
Stubby	1361.1 ± 272.3	$0.6 \pm 0.1\%$	12.9 ± 2.6	101 ± 20.2



References

Antibody: Invitrogen 32-0400

PDB Identifier: modified GluR2

Literature:

Nair et al., 2013, J. Neurosci.

Xia et al., 1999, Neuron

Hirbec et al., 2002, J. Biol. Chem.

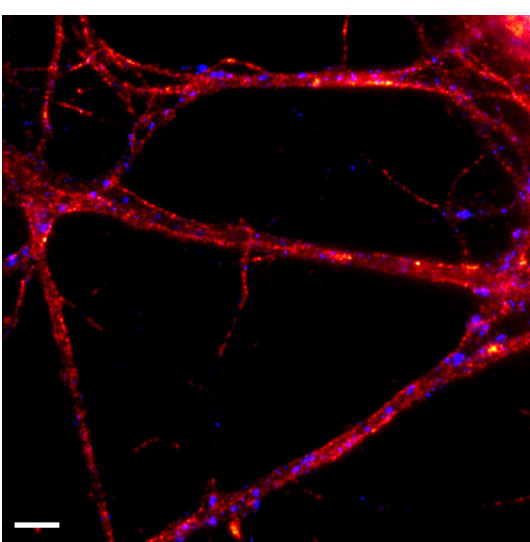
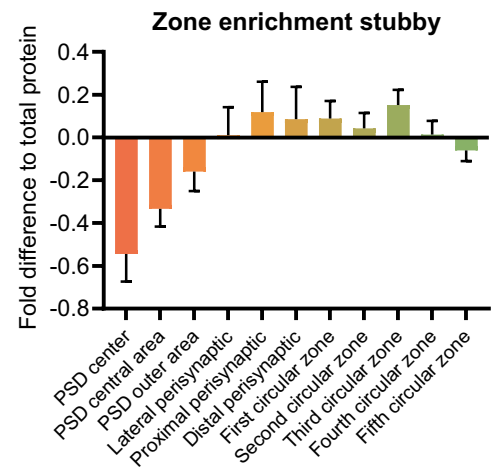
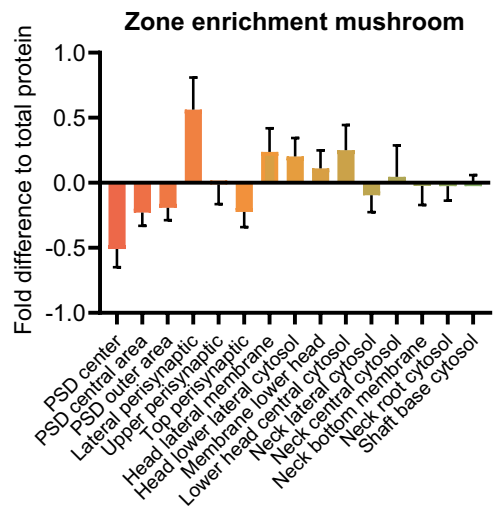
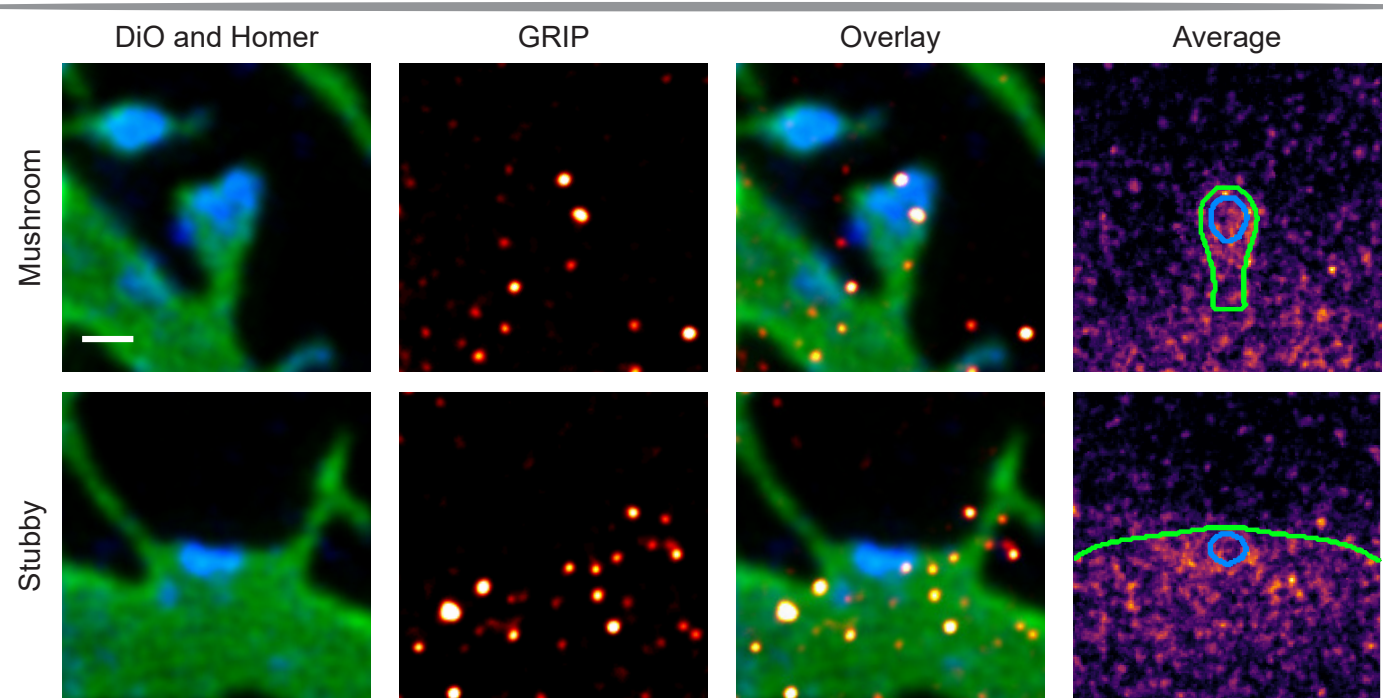
MacGillavry et al., 2013, Neuron

GRIP1/2 (Genes: Grip1, Grip2, Uniprot ID: P97879, Q9WTW1)

Known function: Controls AMPA and kainate receptor trafficking

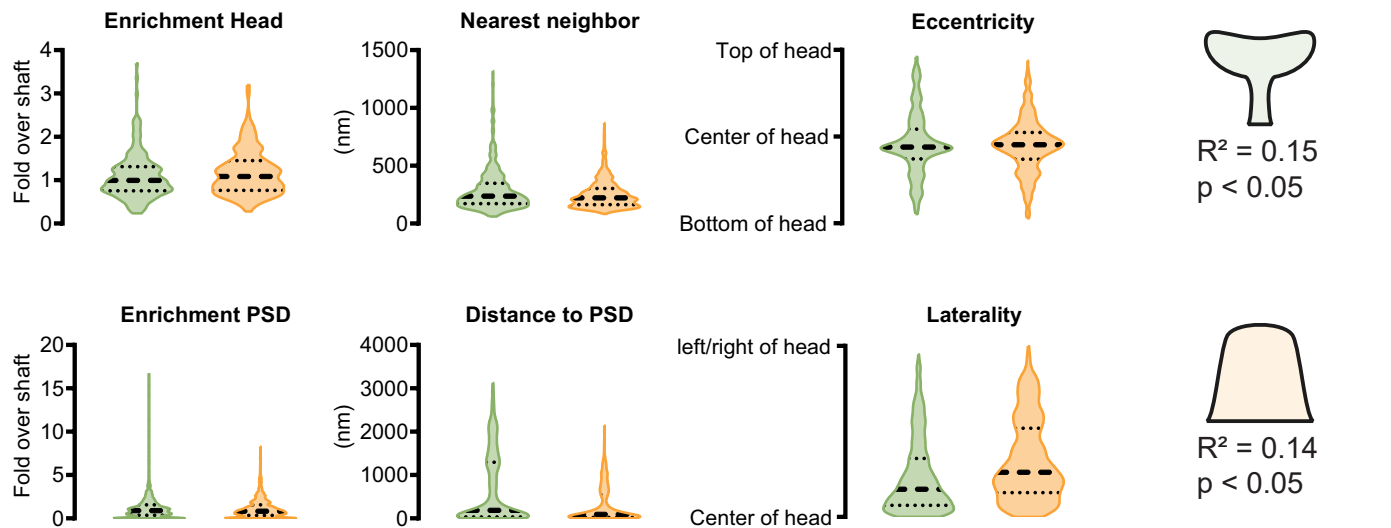
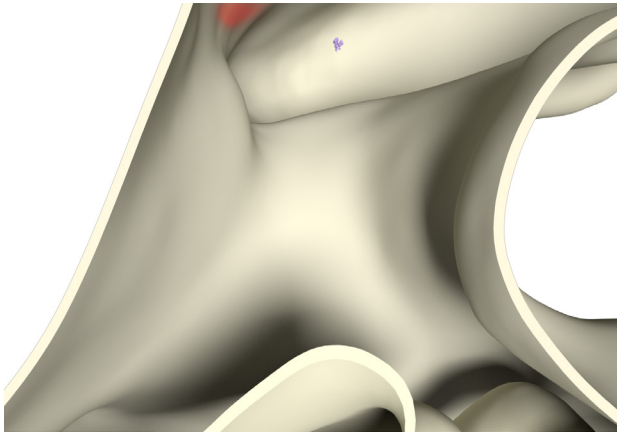
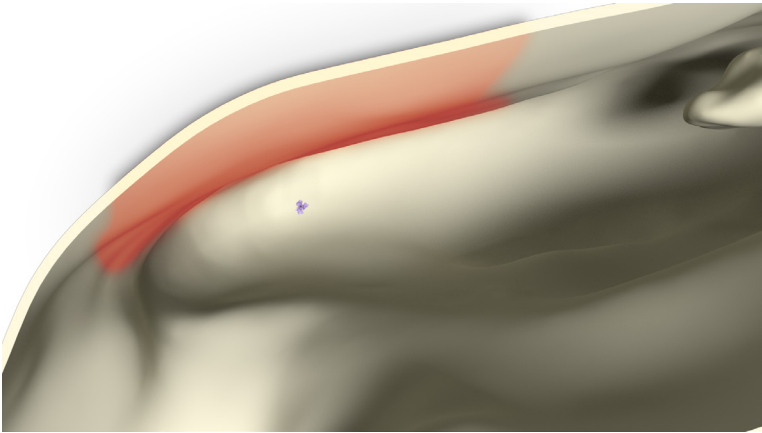
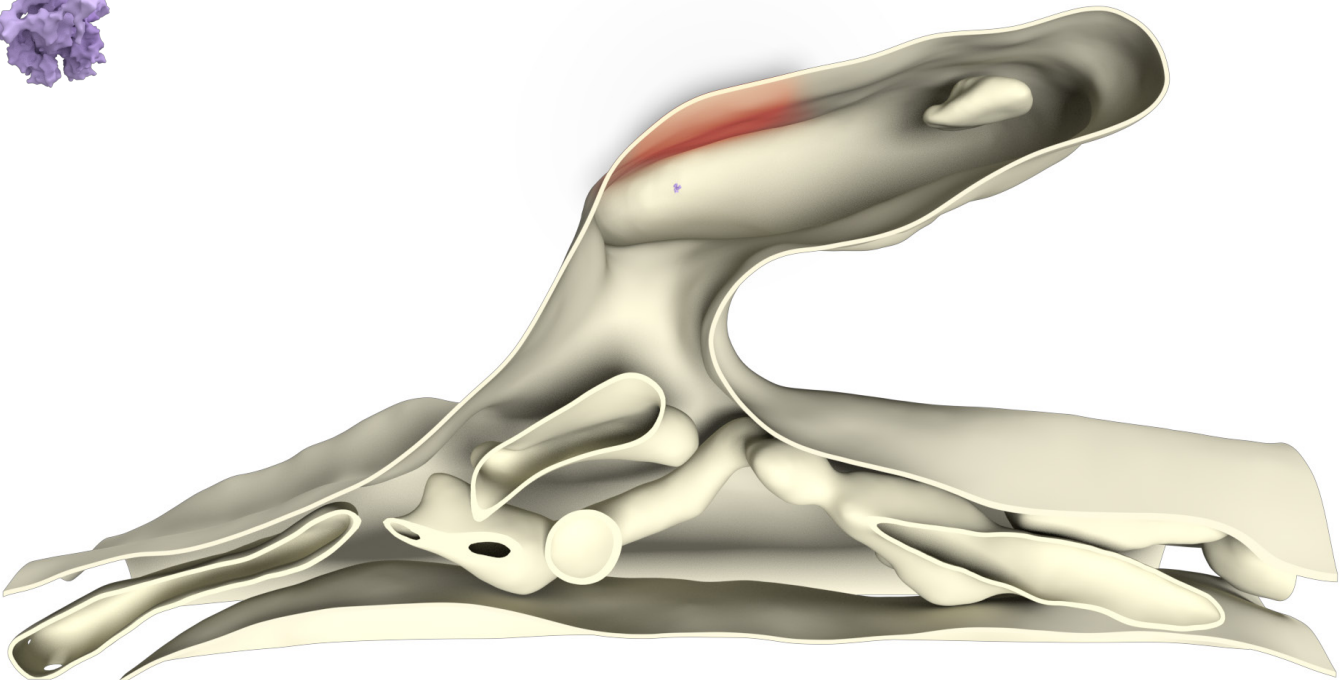
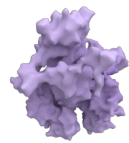
Known organization: Cytosolic

Known Interactions: AMPA and kainate receptors

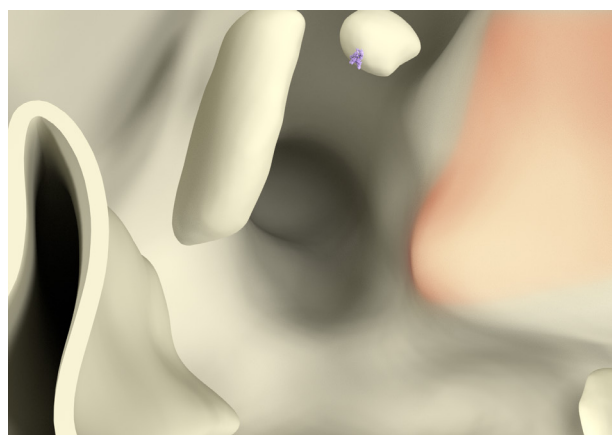
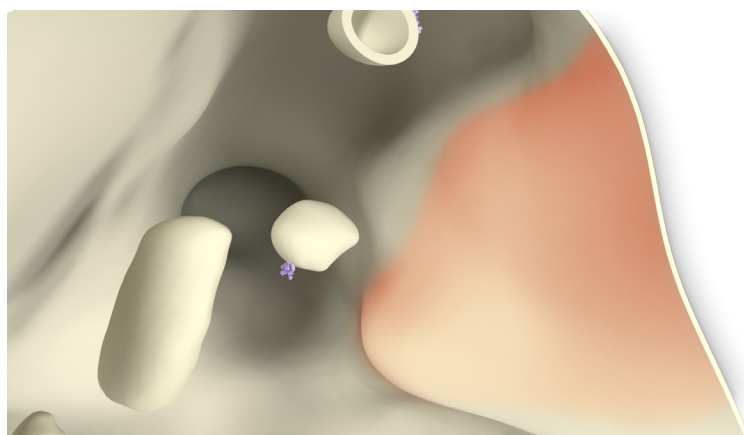
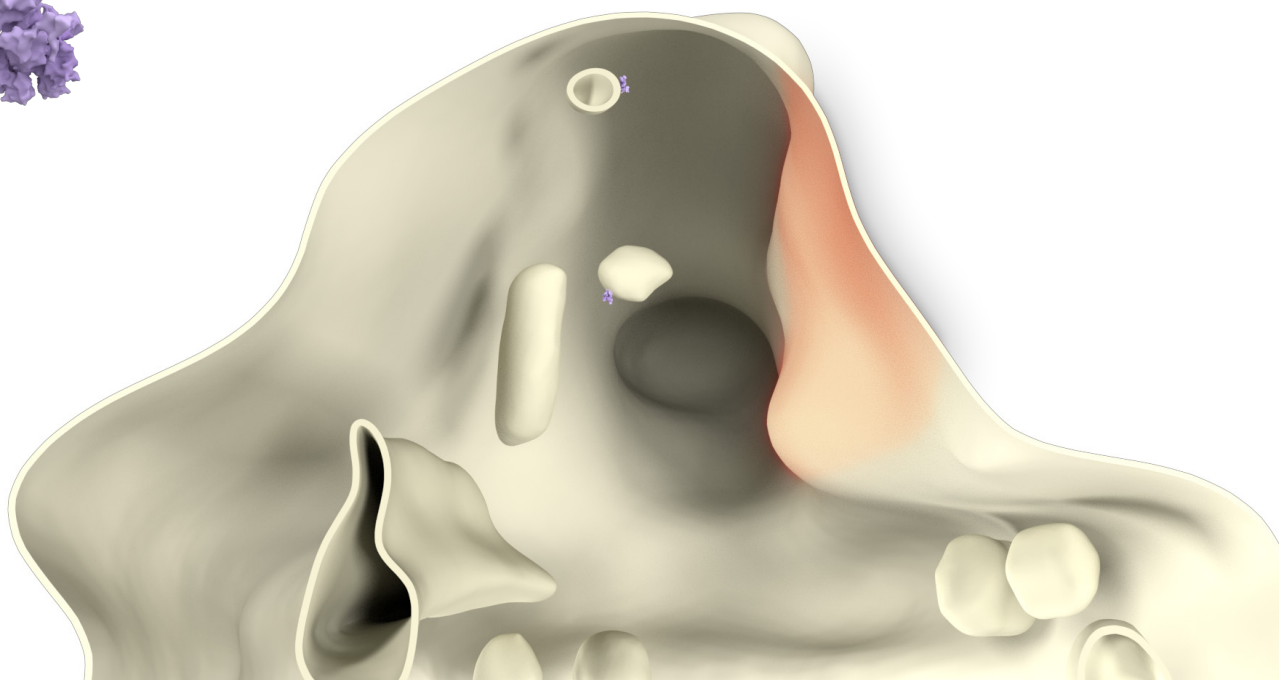
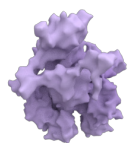


Whole cell copy number	77266.0 ± 16985.7	
Spine copy number	5.0 ± 1.8	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	4.4 ± 1.5	6.1 ± 2.1
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (µM)	0.1 ± 0.0	0.1 ± 0.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	4.4 ± 1.5	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0
Stubby	6.1 ± 2.1	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	4.4 ± 1.5	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0
Stubby	6.1 ± 2.1	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



References

Antibody: Synaptic Systems 151 003

PDB Identifier: 2qt5, 1p1d, 1n7e, 1m5z

Literature:

Braithwaite et al., 2002, Proc. Natl. Acad. Sci. U S A

Dong et al., 1997, Nature

Dong et al., 1999, Ann. N Y Acad. Sci.

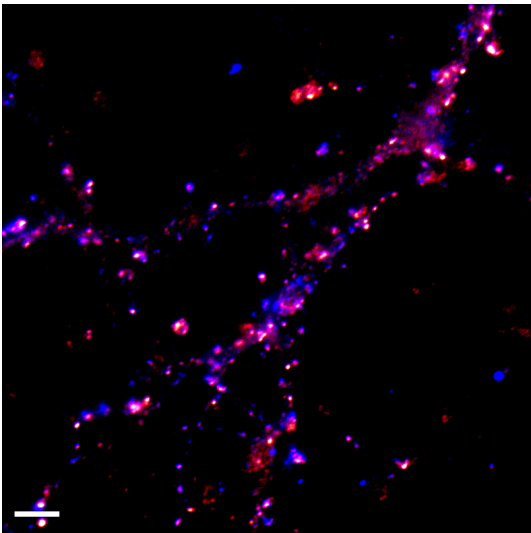
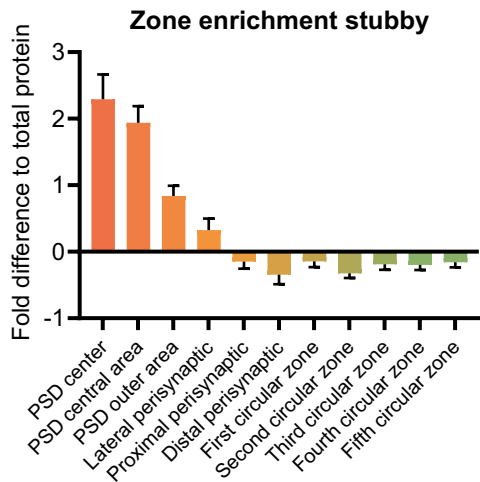
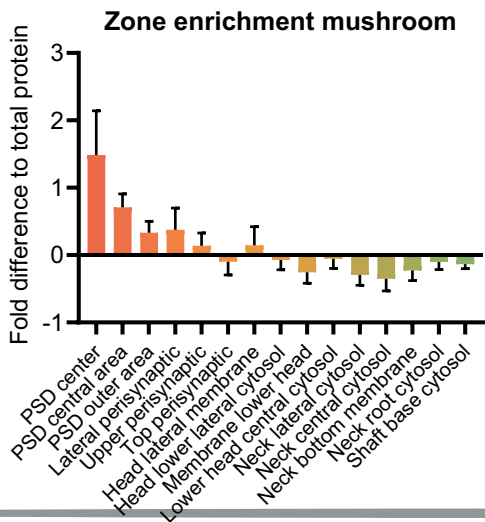
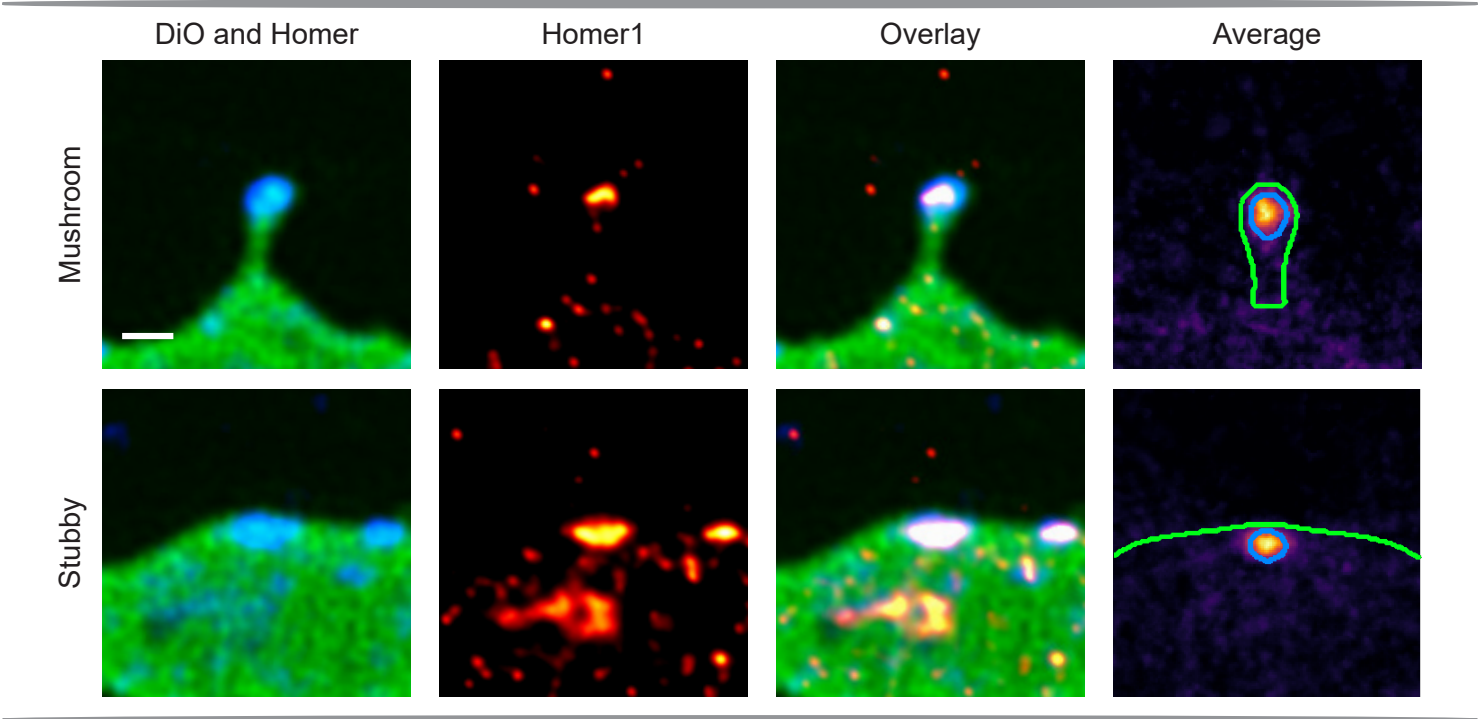
Hanley and Henley, 2010, Neurosci. Lett.

Homer1 (PSD-Zip45, Ves11, Gene: Homer1, Uniprot: Q9Z214)

Known function: Scaffold protein, Links mGluR to downstream targets, Homer1a regulates this interaction as a dominant negative isoform

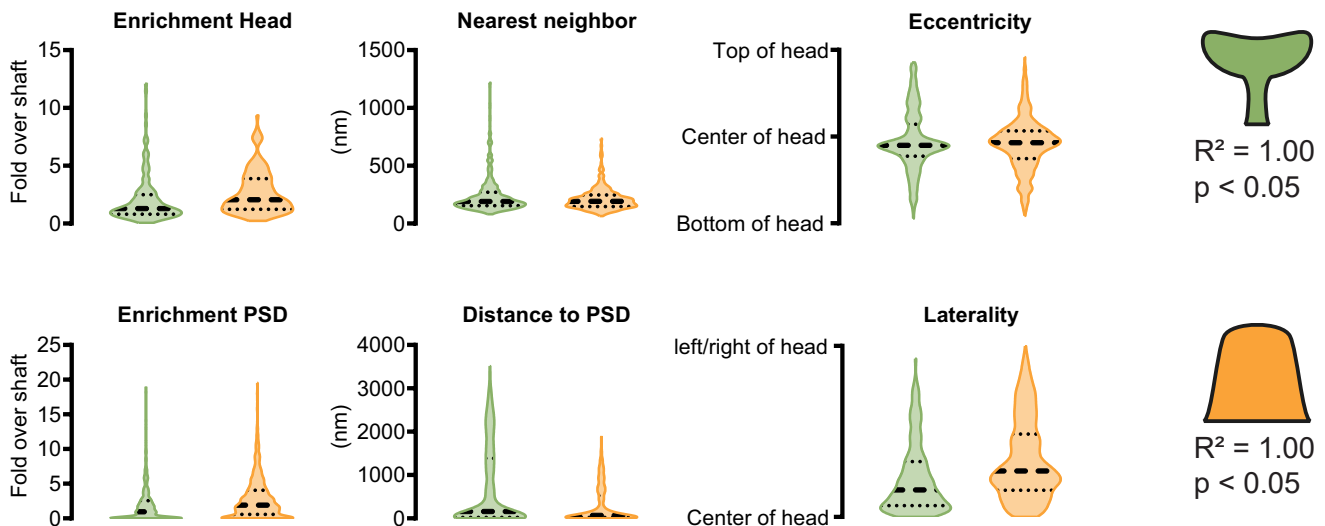
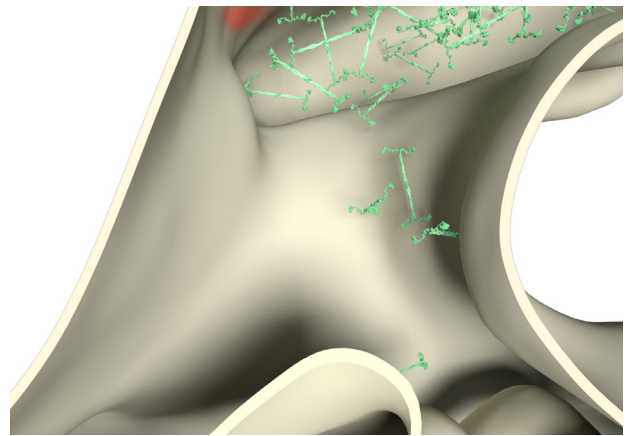
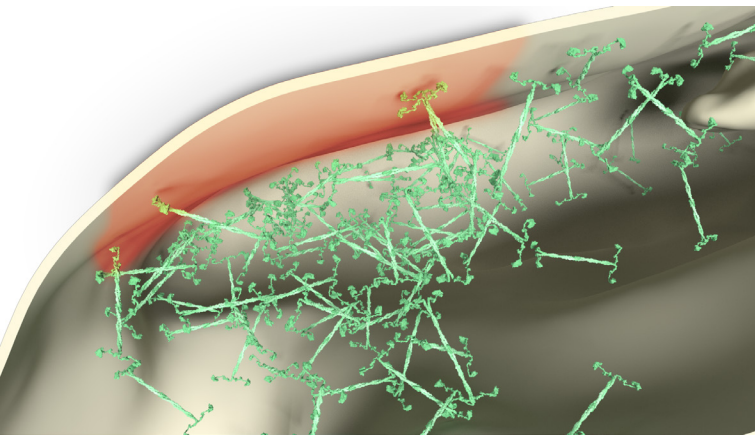
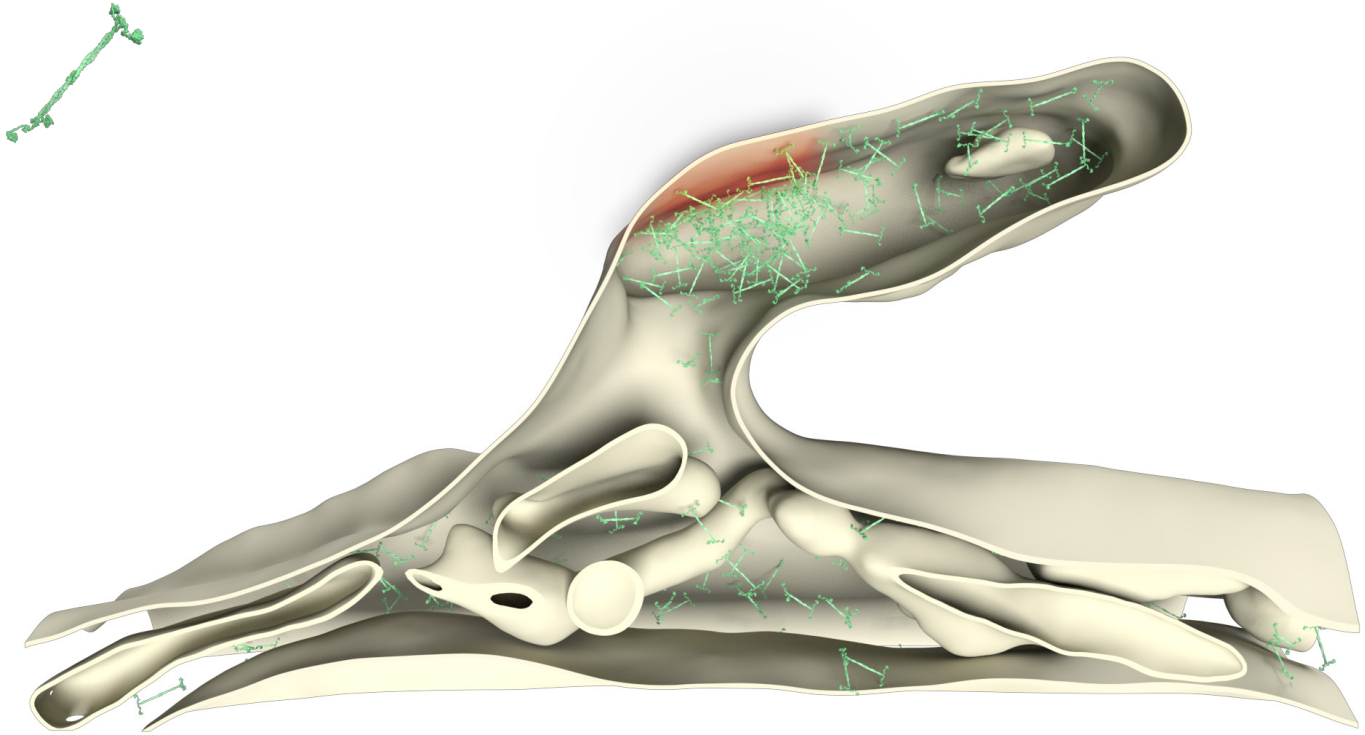
Known organization: Cytosolic, Directly below PSD, Selfmultimerizes, Forms mesh with Shank proteins

Known Interactions: mGluR, Shank proteins, Dynamin 3

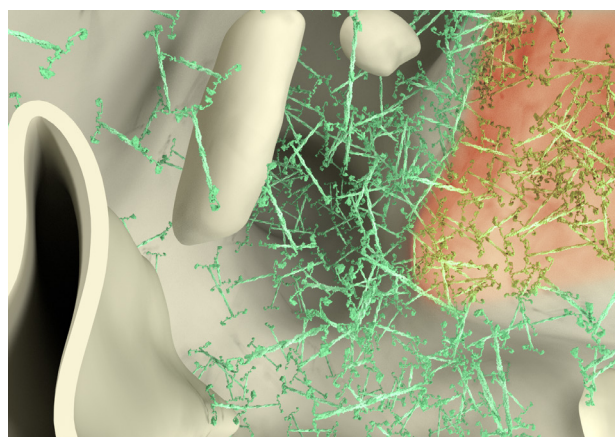
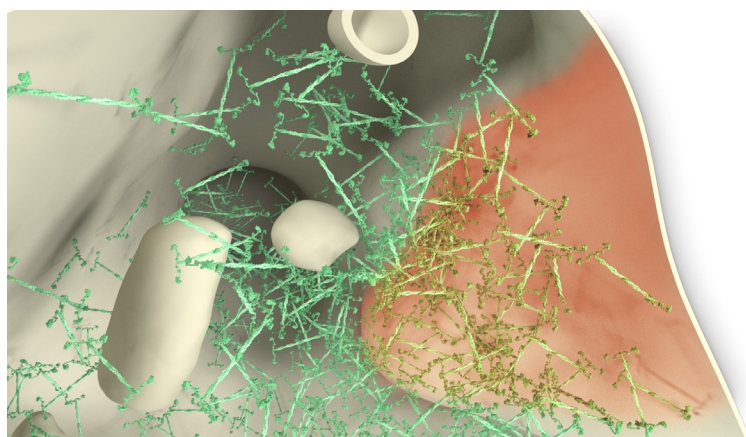
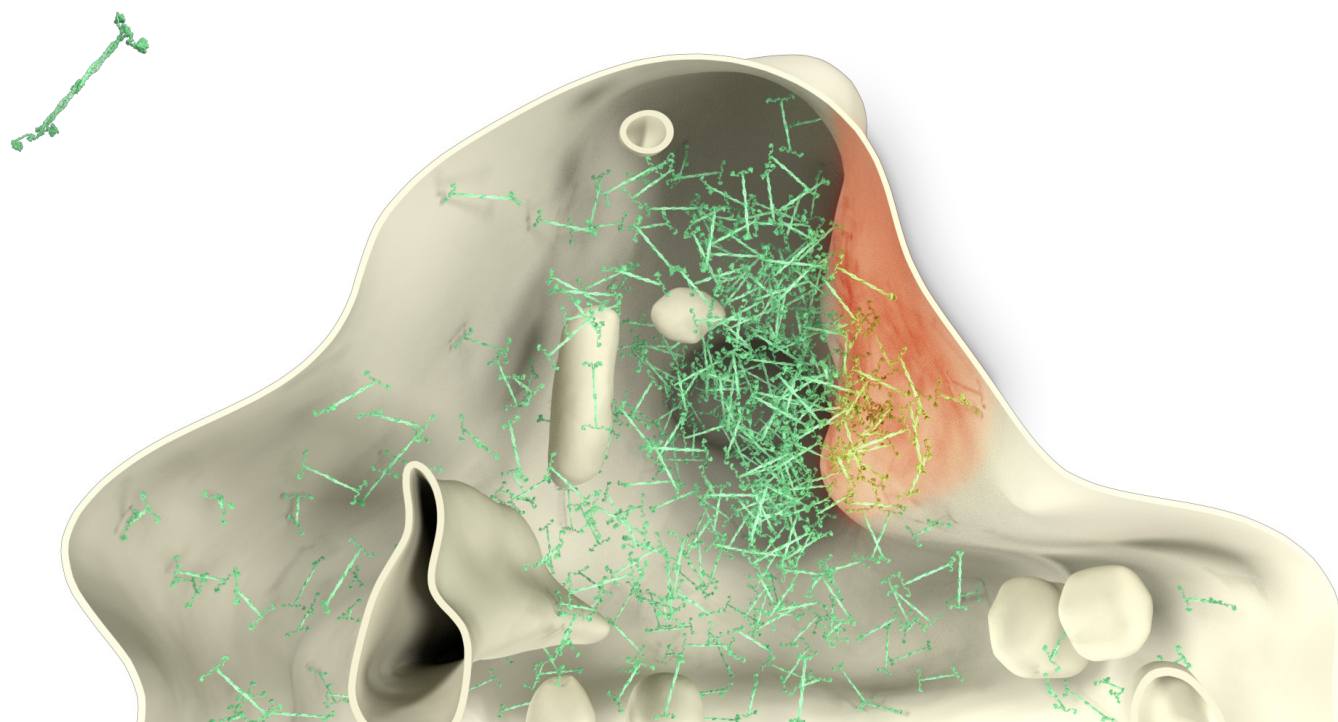


Whole cell copy number	1523247.1 ± 206153.6	
Spine copy number	1729.9 ± 270.1	
Function	PSD Scaffold	
	Mushroom	Stubby
Spine copy number	1255.4 ± 196.0	2700.6 ± 421.6
% of total protein	0.3 ± 0.0%	0.5 ± 0.1%
Molarity (μM)	15.9 ± 2.5	25.5 ± 4.0
PSD copy number	747 ± 116.6	1879 ± 293.3
% in PSD	59.5 ± 9.3%	69.6 ± 10.9%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1255.4 ± 196.0	$0.3 \pm 0.0\%$	15.9 ± 2.5	747 ± 116.6
Stubby	2700.6 ± 421.6	$0.5 \pm 0.1\%$	25.5 ± 4.0	1879 ± 293.3



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1255.4 ± 196.0	$0.3 \pm 0.0\%$	15.9 ± 2.5	747 ± 116.6
Stubby	2700.6 ± 421.6	$0.5 \pm 0.1\%$	25.5 ± 4.0	1879 ± 293.3



References

Antibody: Synaptic Systems 160 011 and 160 003 **PDB Identifier:** 3cve

Literature:

Dani et al., 2010, Neuron

Hayashi et al., 2006, J. Neurosci.

Hayashi et al., 2009, Cell

Kato et al., 1998, J. Biol. Chem.

Lu et al., 2007, Neuron

MacGillavry et al., 2013, Neuron

Newpher and Ehlers, 2008, Neuron

Roche et al., 1999, J. Biol. Chem.

Tao-Cheng et al., 2014, Neuroscience

Tu et al., 1998, Neuron

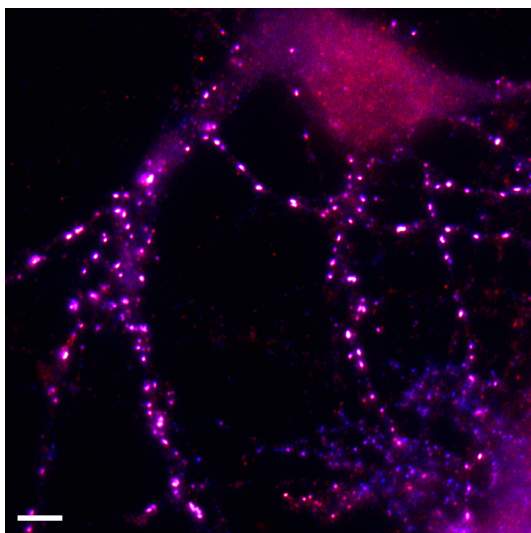
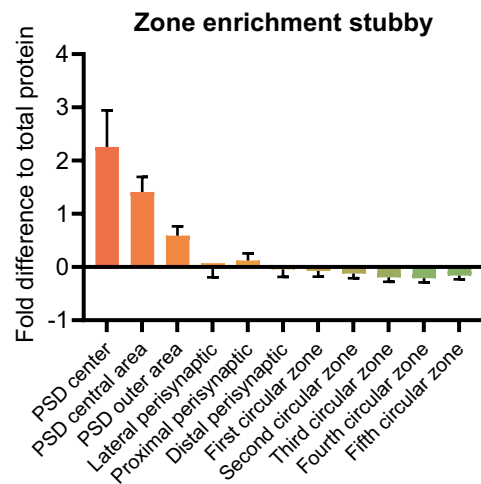
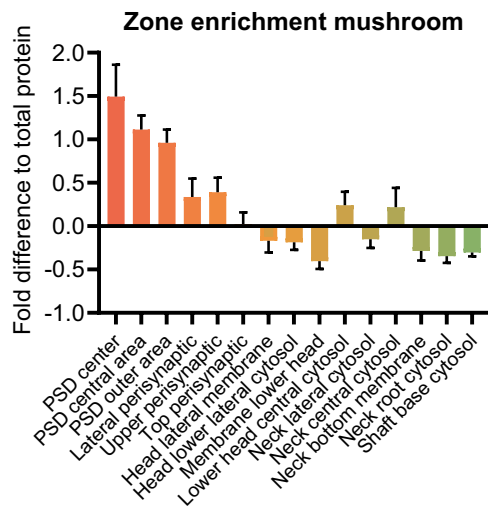
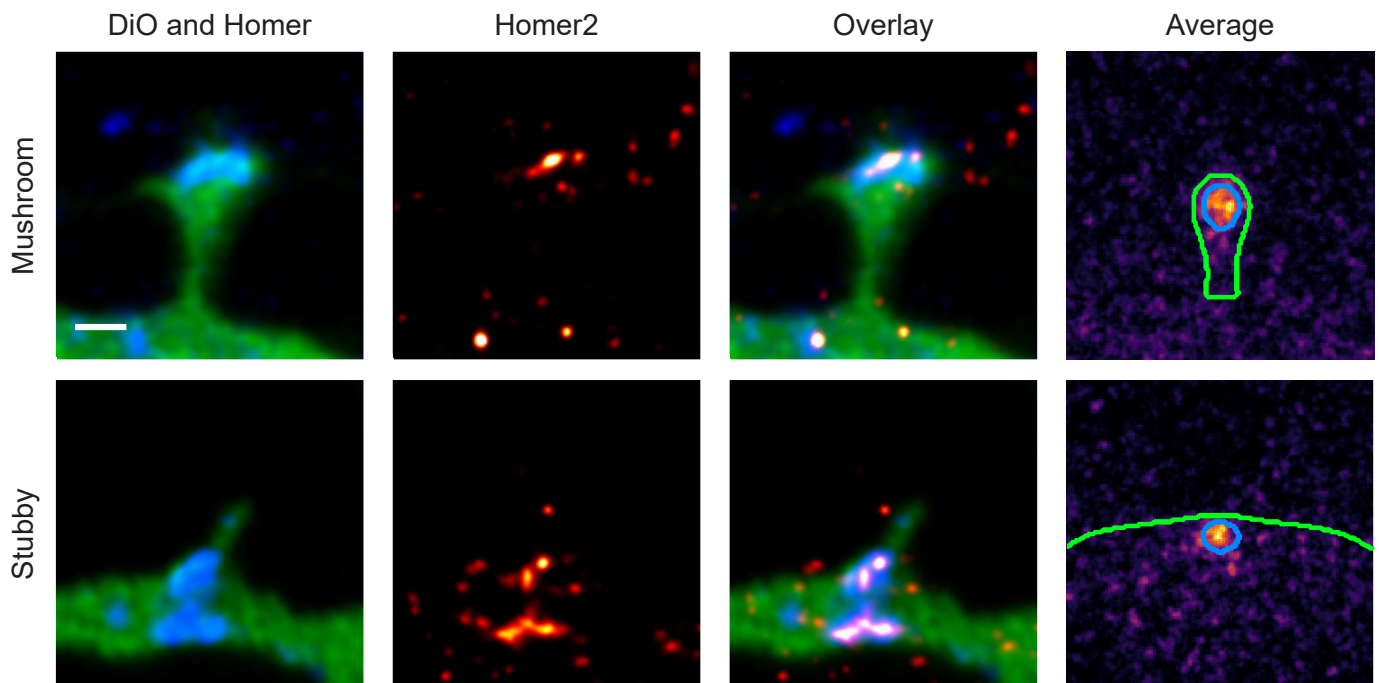
Xiao et al., 1998, Neuron

Homer2 (Vesl2, Cupidin, Gene: Homer2 , Uniprot ID: O88801)

Known function: Scaffold protein, Links mGluR to downstream targets

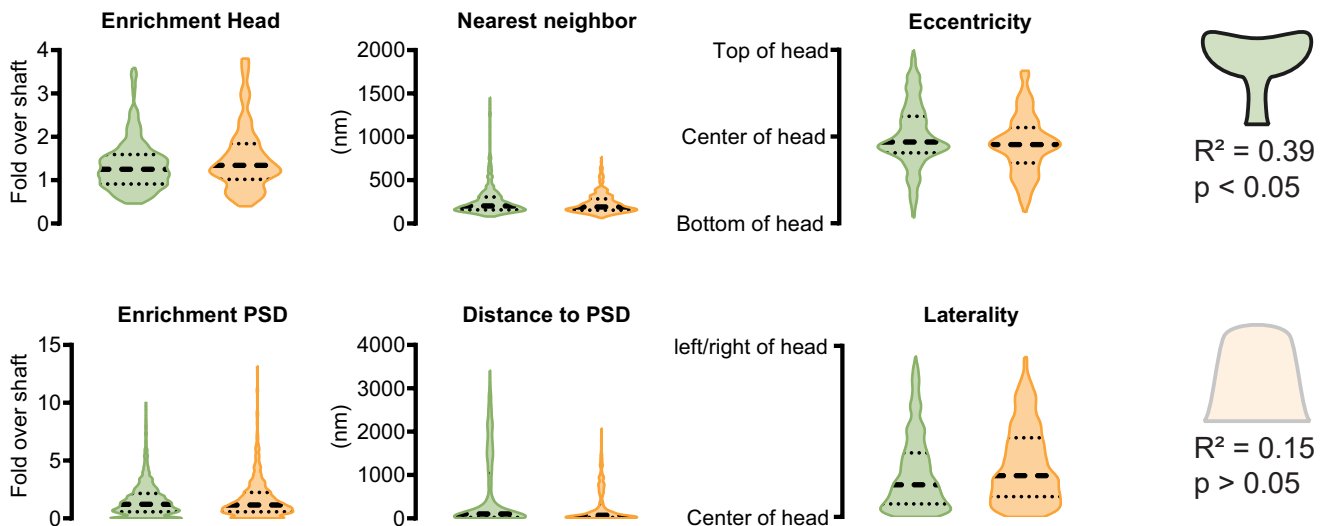
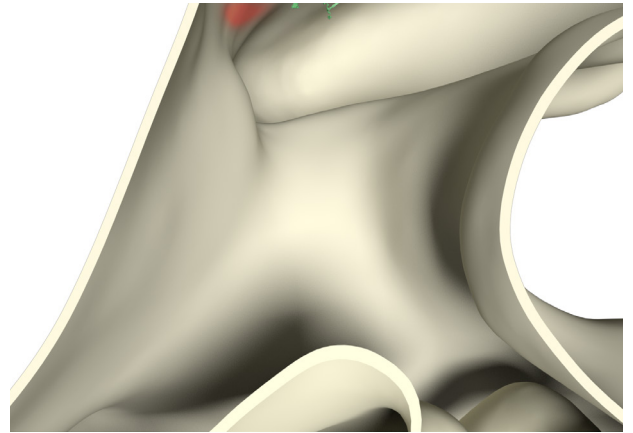
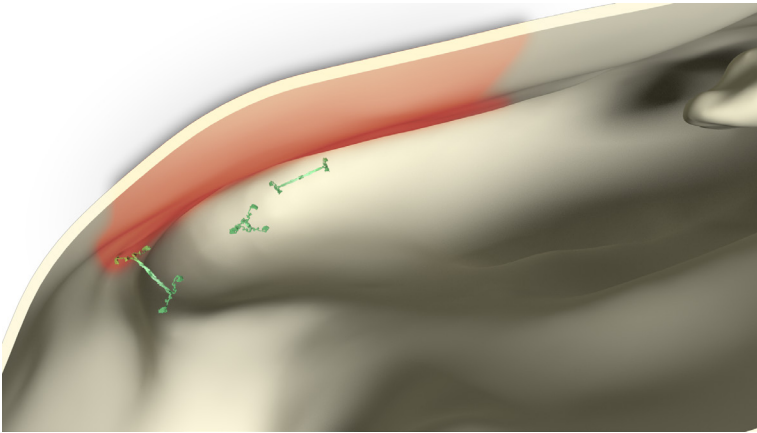
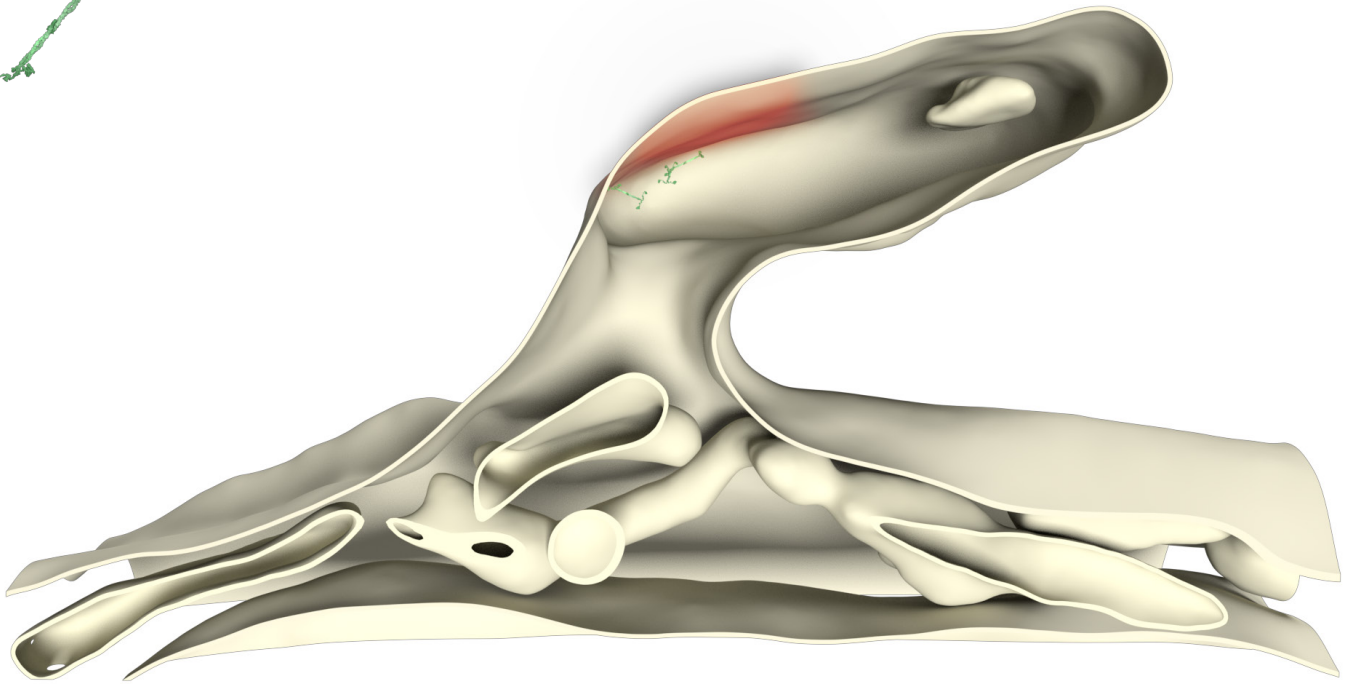
Known organization: Cytosolic, Directly below PSD, Selfmultimerizes (Dimer of dimers), Forms mesh like structure with Shank proteins

Known Interactions: mGluR, Shank proteins, Dynamin 3

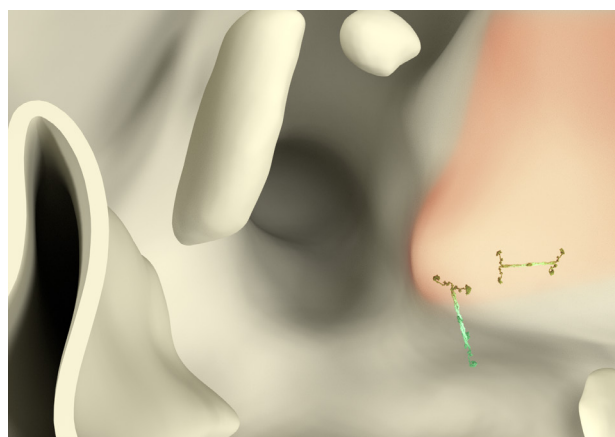
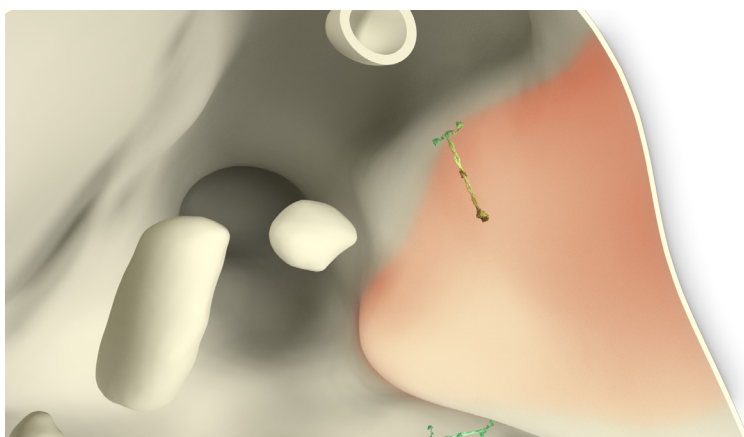
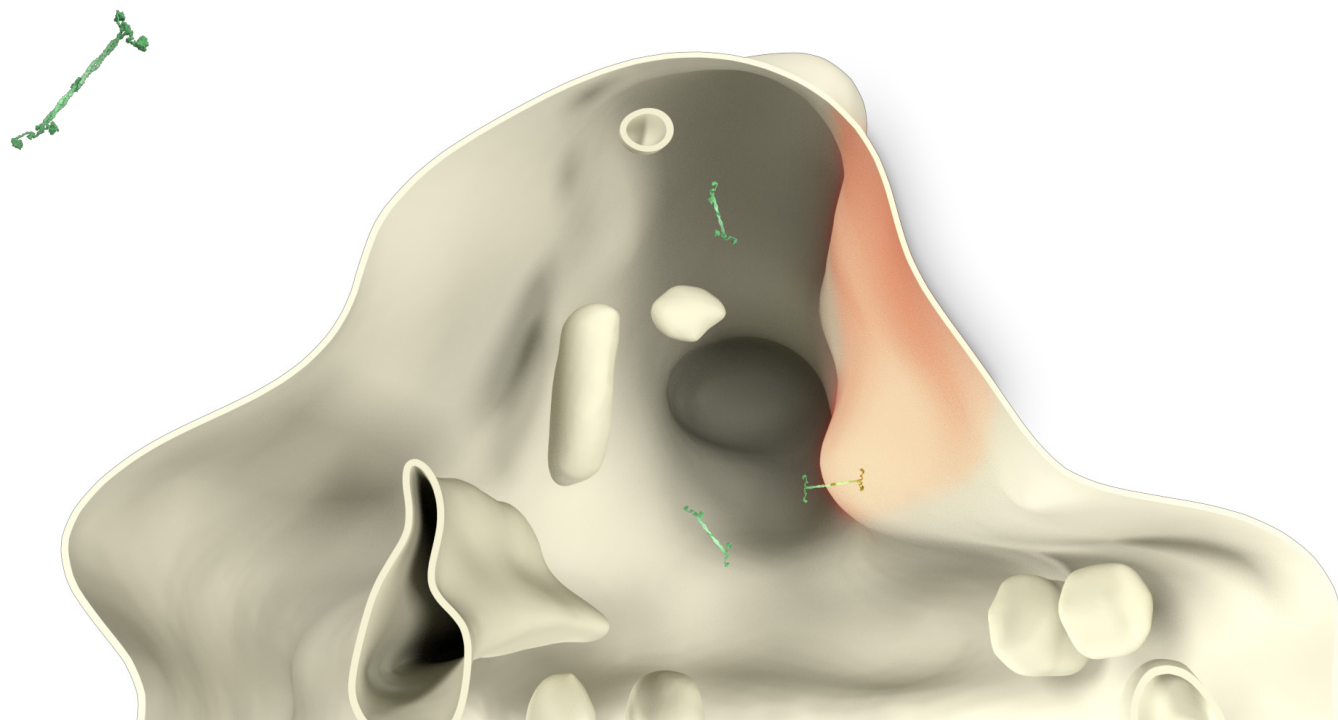


Whole cell copy number	36366.1 ± 17530.4	
Spine copy number	11.5 ± 5.6	
Function	PSD Scaffold	
	Mushroom	Stubby
Spine copy number	9.7 ± 4.8	14.6 ± 7.2
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.1 ± 0.1	0.1 ± 0.1
PSD copy number	5 ± 2.5	7 ± 3.4
% in PSD	51.5 ± 25.3%	48.0 ± 23.6%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	9.7 ± 4.8	$0.0 \pm 0.0\%$	0.1 ± 0.1	5 ± 2.5
Stubby	14.6 ± 7.2	$0.0 \pm 0.0\%$	0.1 ± 0.1	7 ± 3.4



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	9.7 ± 4.8	$0.0 \pm 0.0\%$	0.1 ± 0.1	5 ± 2.5
Stubby	14.6 ± 7.2	$0.0 \pm 0.0\%$	0.1 ± 0.1	7 ± 3.4



References

Antibody: Synaptic Systems 160 203

Literature:

Dani et al., 2010, Neuron

Hayashi et al., 2006, J. Neurosci.

Hayashi et al., 2009, Cell

Kato et al., 1998, J. Biol. Chem.

Lu et al., 2007, Neuron

MacGillavry et al., 2013, Neuron

Newpher and Ehlers, 2008, Neuron

Roche et al., 1999, J. Biol. Chem.

PDB Identifier: 3cve (modified)

Tao-Cheng et al., 2014, Neuroscience

Tu et al., 1998, Neuron

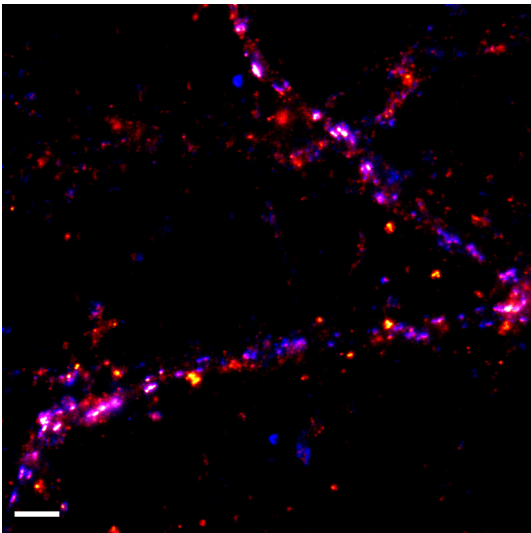
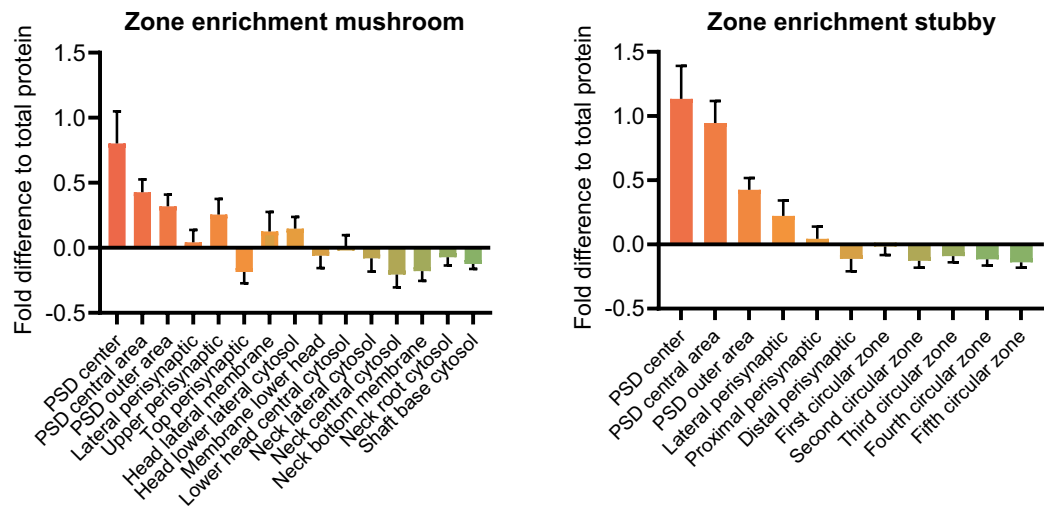
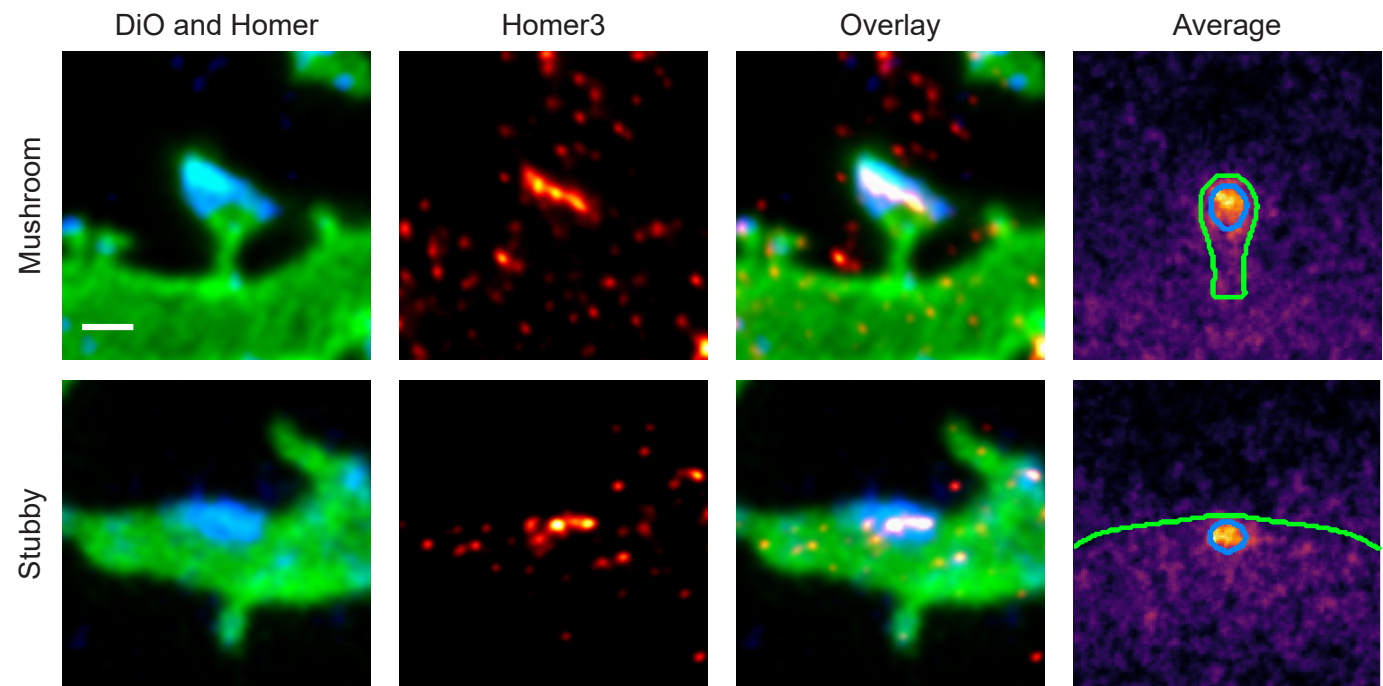
Xiao et al., 1998, Neuron

Homer3 (Vesl3, Gene: Homer3, Uniprot ID: Q9Z2X5)

Known function: Scaffold protein, Links mGluR to downstream targets

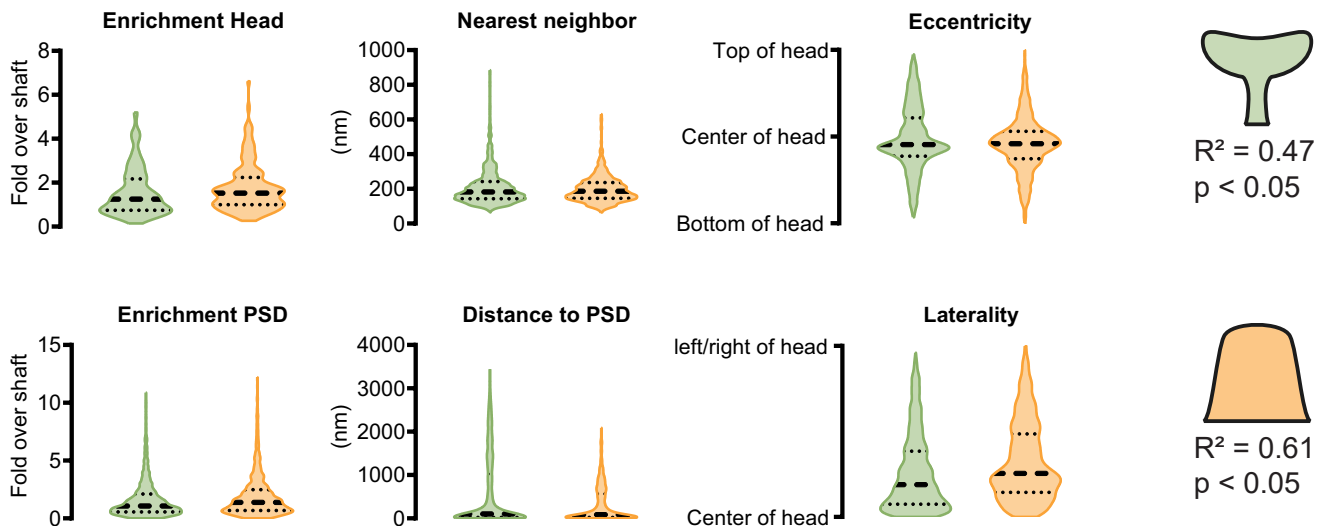
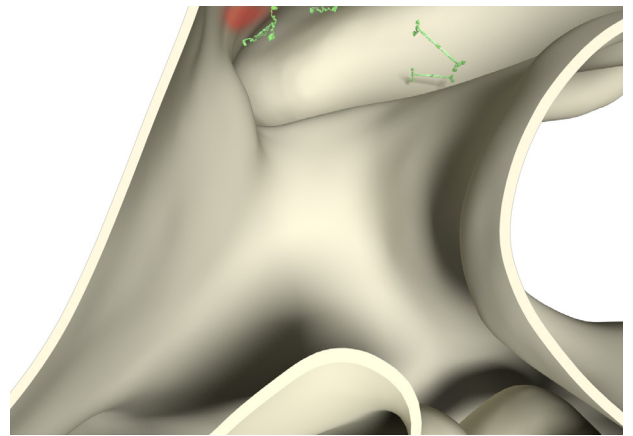
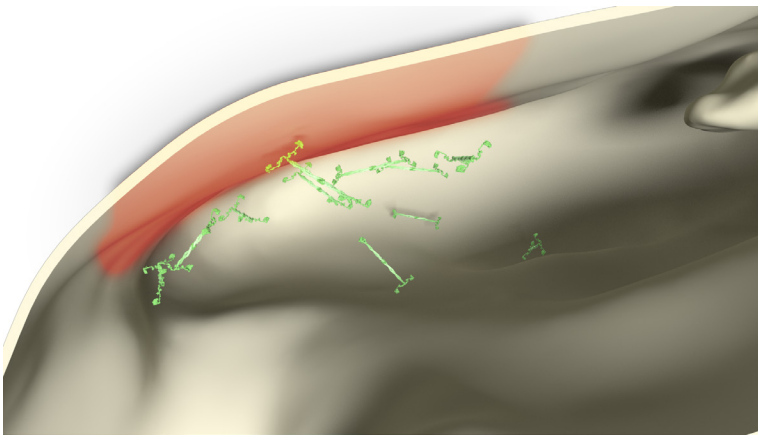
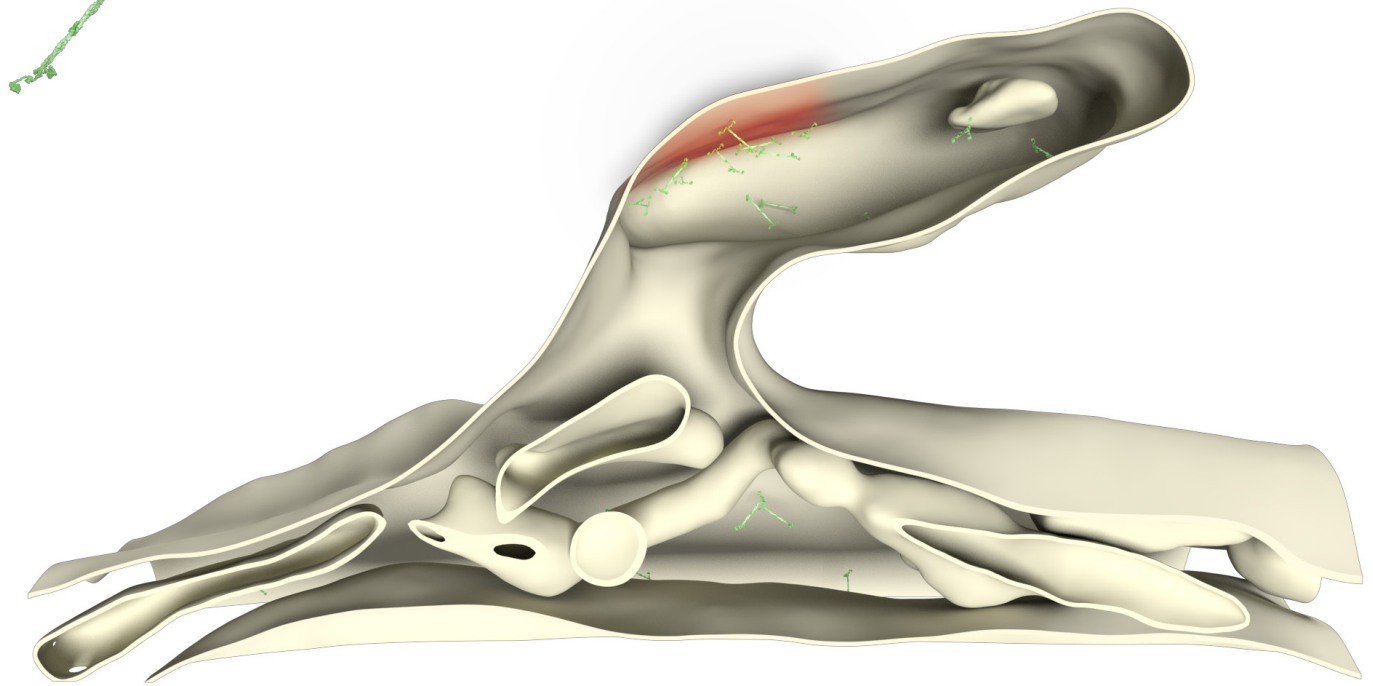
Known organization: Cytosolic, Directly below PSD, Selfmultimerizes (Dimer of dimers), Forms mesh like structure with Shank proteins

Known Interactions: mGluR, IP3R, RyR, Shank proteins, Dynamin 3

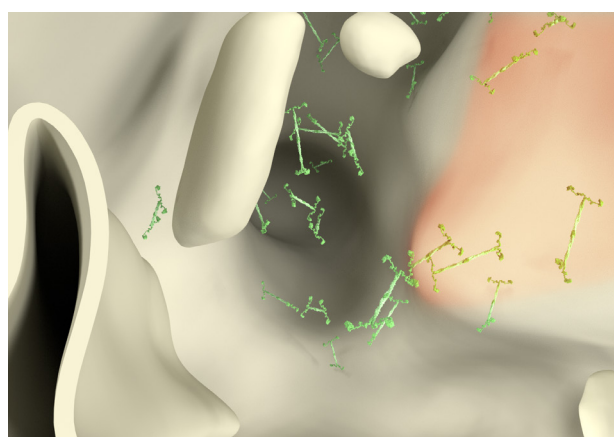
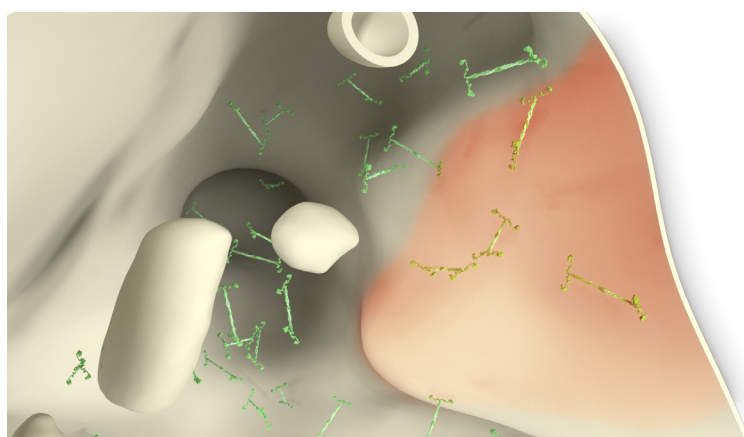
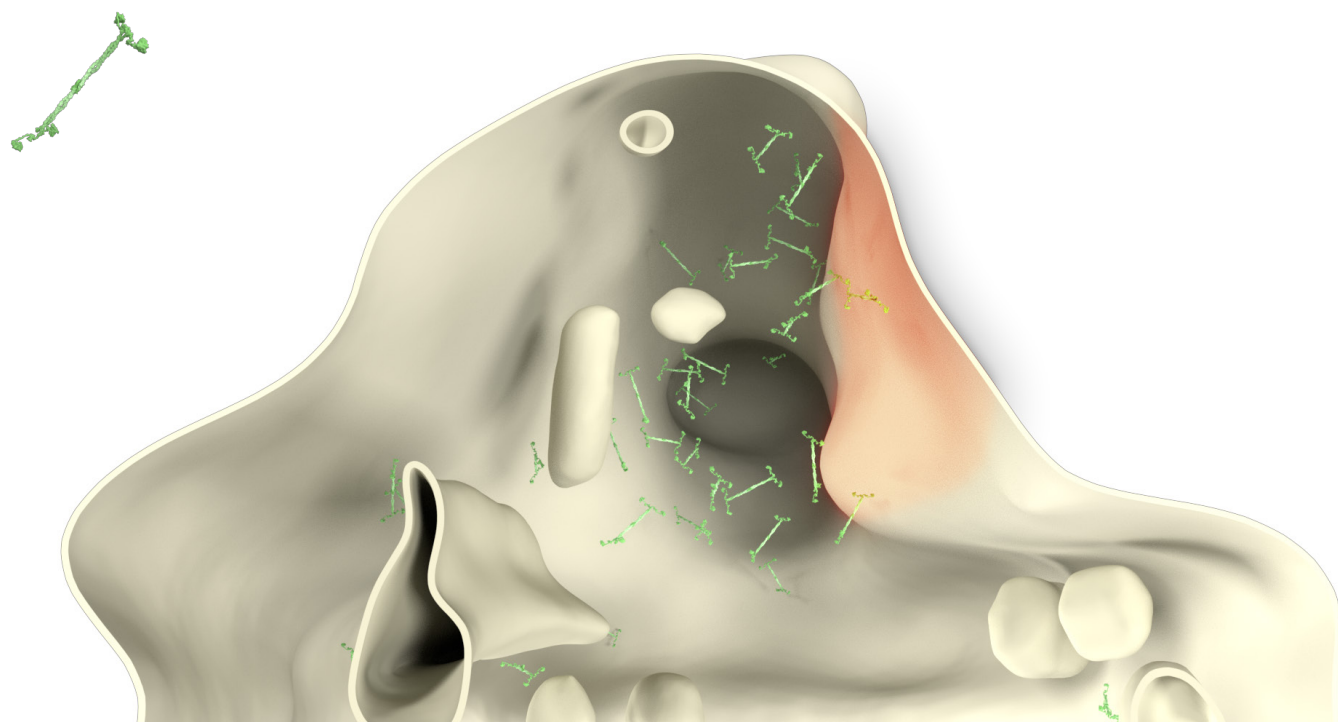


Whole cell copy number	265383.1 ± 60615.3	
Spine copy number	169.7 ± 41.2	
Function	PSD Scaffold	
	Mushroom	Stubby
Spine copy number	160.5 ± 39.0	199.4 ± 48.4
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (µM)	2.0 ± 0.5	1.9 ± 0.5
PSD copy number	76 ± 18.4	92 ± 22.3
% in PSD	47.3 ± 11.5%	46.1 ± 11.2%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	160.5 ± 39.0	$0.0 \pm 0.0\%$	2.0 ± 0.5	76 ± 18.4
Stubby	199.4 ± 48.4	$0.0 \pm 0.0\%$	1.9 ± 0.5	92 ± 22.3



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	160.5 ± 39.0	$0.0 \pm 0.0\%$	2.0 ± 0.5	76 ± 18.4
Stubby	199.4 ± 48.4	$0.0 \pm 0.0\%$	1.9 ± 0.5	92 ± 22.3



References

Antibody: Synaptic Systems 160 303

PDB Identifier: 3cvf

Literature:

Dani et al., 2010, Neuron

Hayashi et al., 2006, J. Neurosci.

Hayashi et al., 2009, Cell

Kato et al., 1998, J. Biol. Chem.

Lu et al., 2007, Neuron

MacGillavry et al., 2013, Neuron

Newpher and Ehlers, 2008, Neuron

Roche et al., 1999, J. Biol. Chem.

Tao-Cheng et al., 2014, Neuroscience

Tu et al., 1998, Neuron

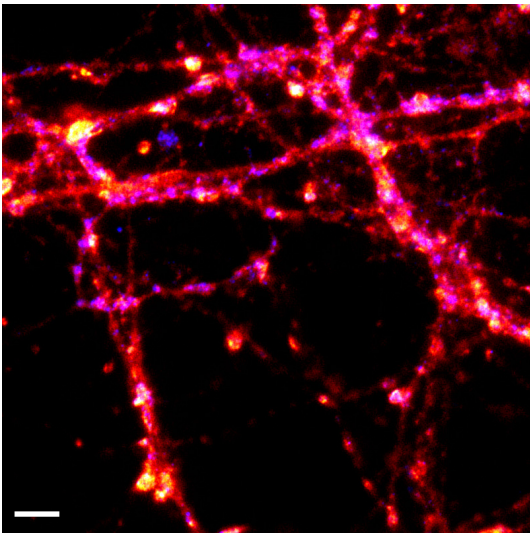
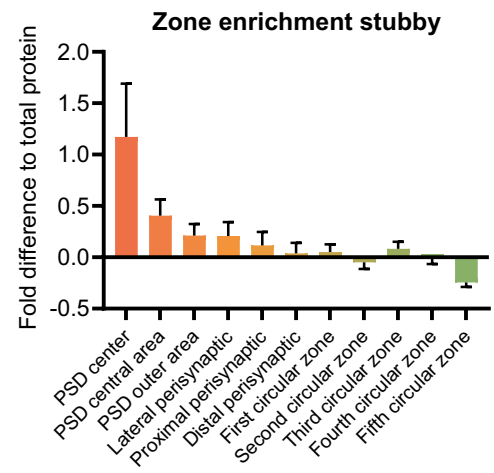
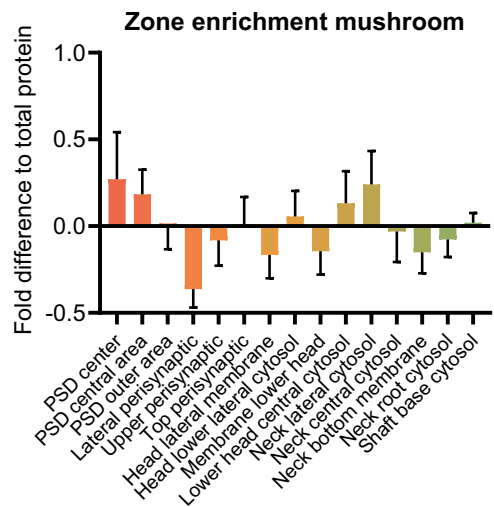
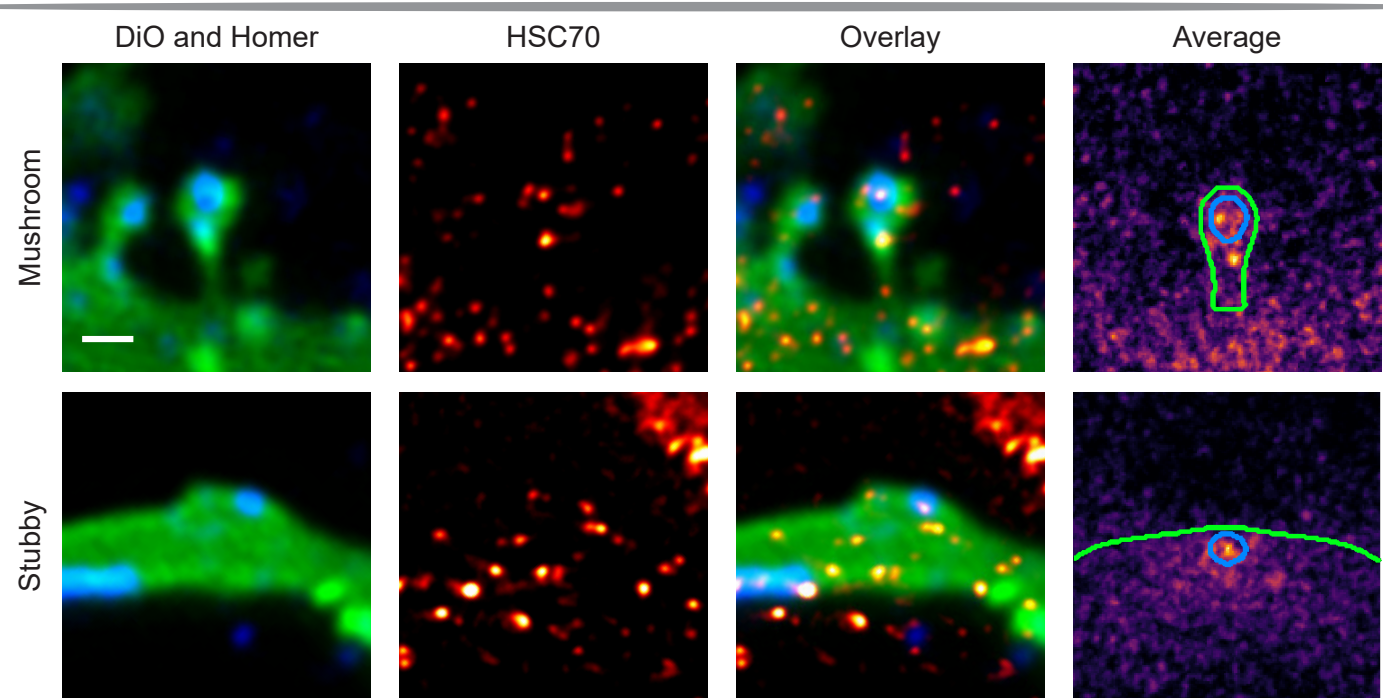
Xiao et al., 1998, Neuron

HSC70 (Gene: Hspa8, Uniprot ID: P63018)

Known function: Clathrin uncoating, ERAD associated chaperone

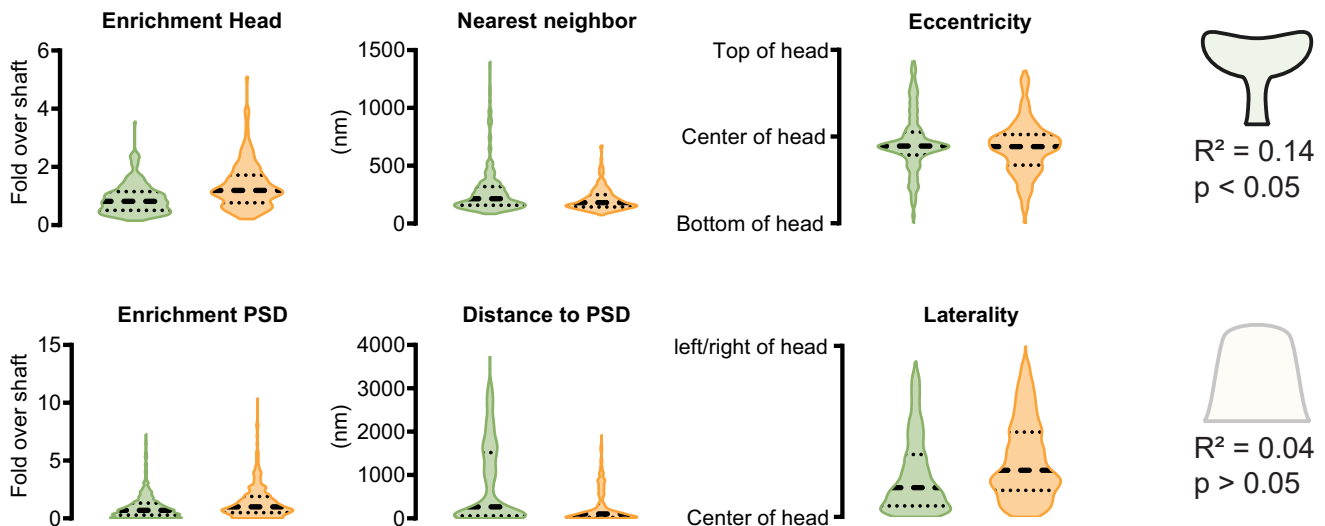
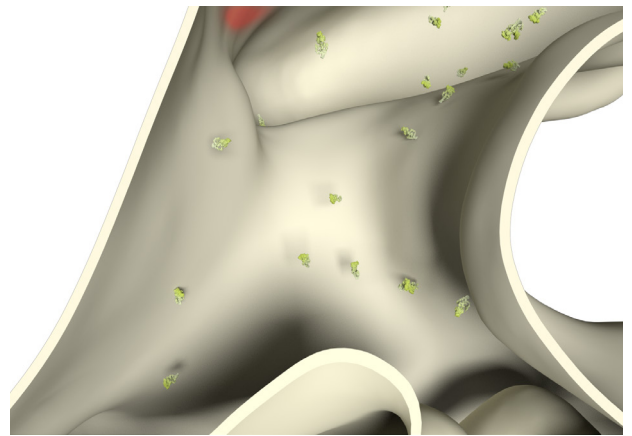
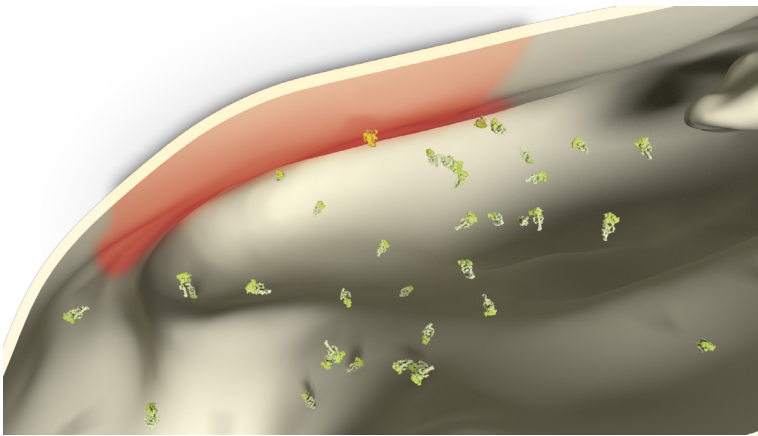
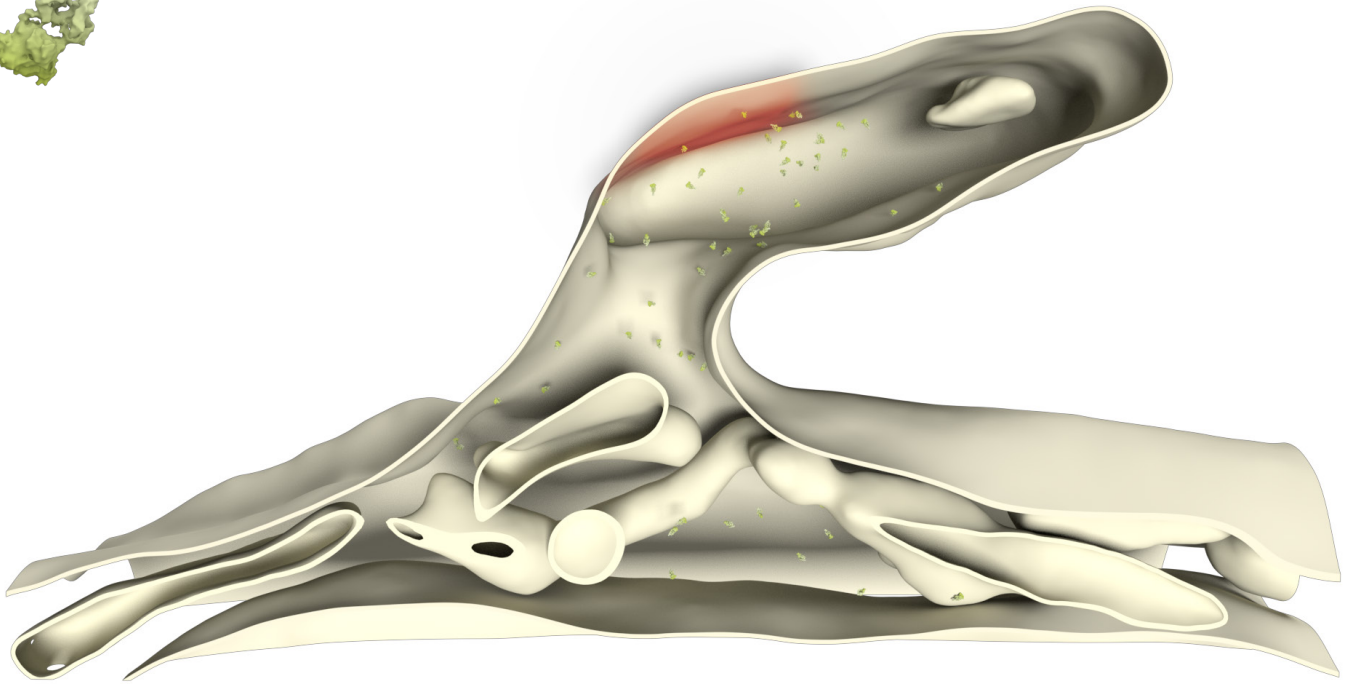
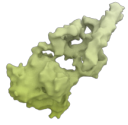
Known organization: Cytosolic

Known Interactions: Clathrin (via auxilin)

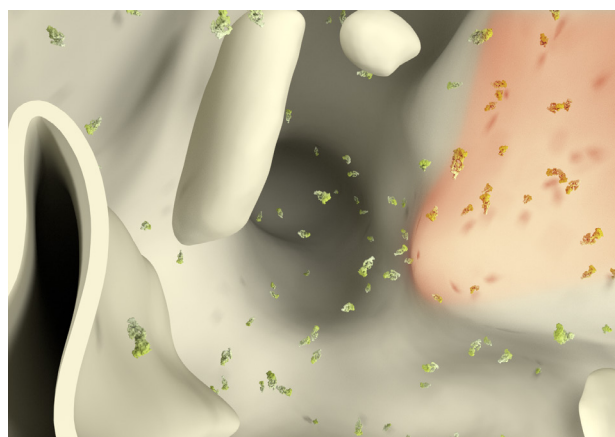
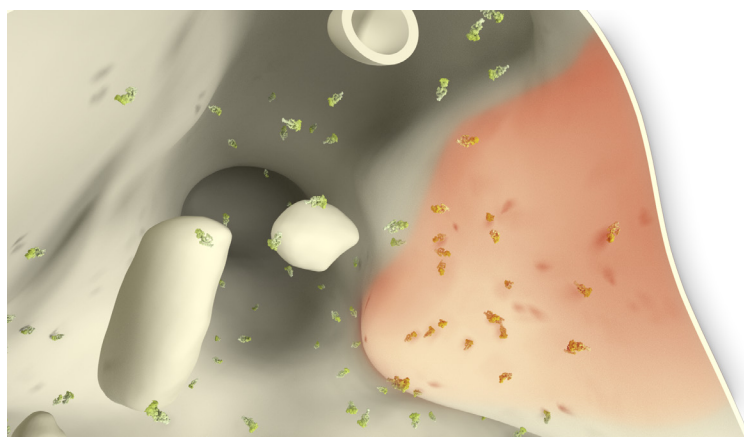
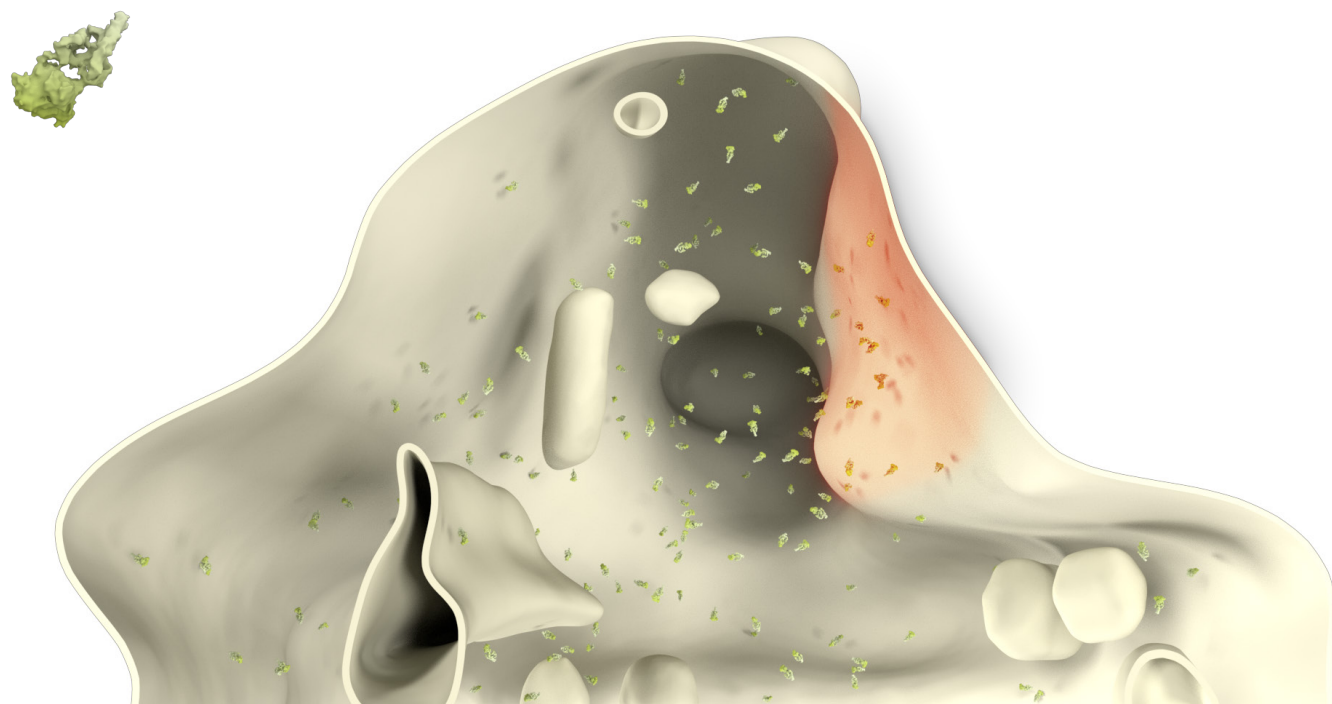


Whole cell copy number	551216.8 ± 107438.0	
Spine copy number	199.2 ± 44.9	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	137.3 ± 30.9	276.0 ± 62.1
% of total protein	0.0 ± 0.0%	0.1 ± 0.0%
Molarity (μM)	1.7 ± 0.4	2.6 ± 0.6
PSD copy number	24 ± 5.4	71 ± 16.0
% in PSD	17.5 ± 3.9%	25.7 ± 5.8%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	137.3 ± 30.9	$0.0 \pm 0.0\%$	1.7 ± 0.4	24 ± 5.4
Stubby	276.0 ± 62.1	$0.1 \pm 0.0\%$	2.6 ± 0.6	71 ± 16.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	137.3 ± 30.9	$0.0 \pm 0.0\%$	1.7 ± 0.4	24 ± 5.4
Stubby	276.0 ± 62.1	$0.1 \pm 0.0\%$	2.6 ± 0.6	71 ± 16.0



References

Antibody: Santa Cruz sc-7298

PDB Identifier: 4h5t, 1hx1, 3ldq, 1udo

Literature:

Eisenberg and Greene, 2007, Traffic

Grove et al., 2011, Mol. Biol. Cell.

Huang et al., 1993, J Biol Chem.

Rothnie et al., 2011, Proc. Natl. Acad. Sci. U S A

Schlossman et al., 1984, J. Cell. Biol.

Ungewickell et al., 1997, J. Biol. Chem.

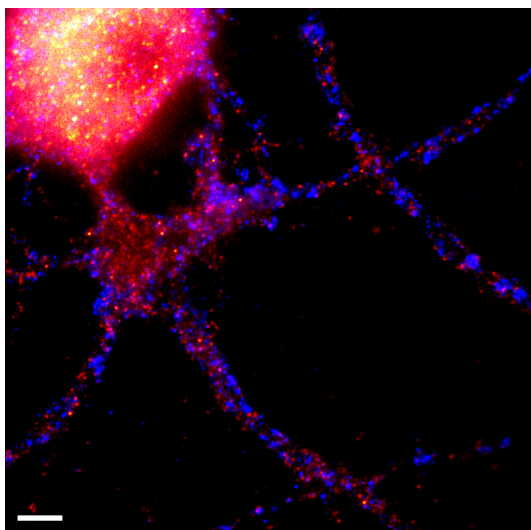
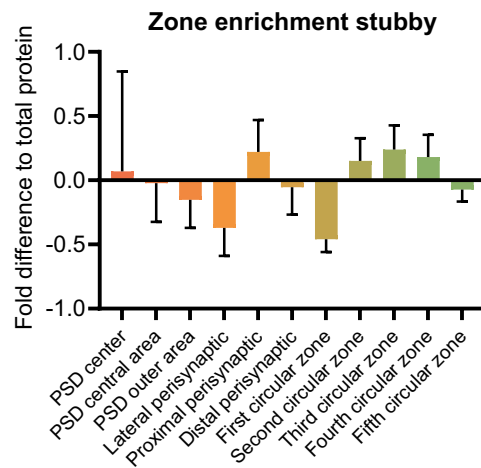
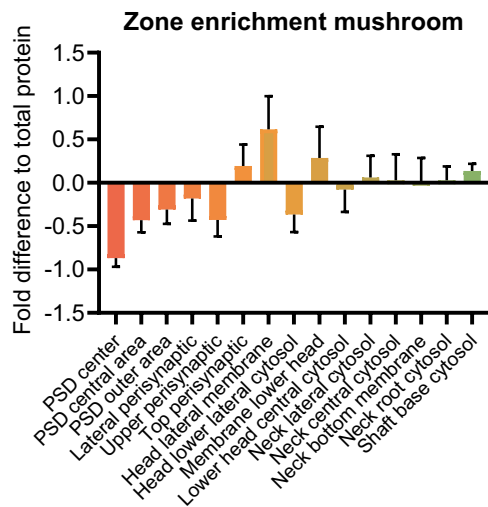
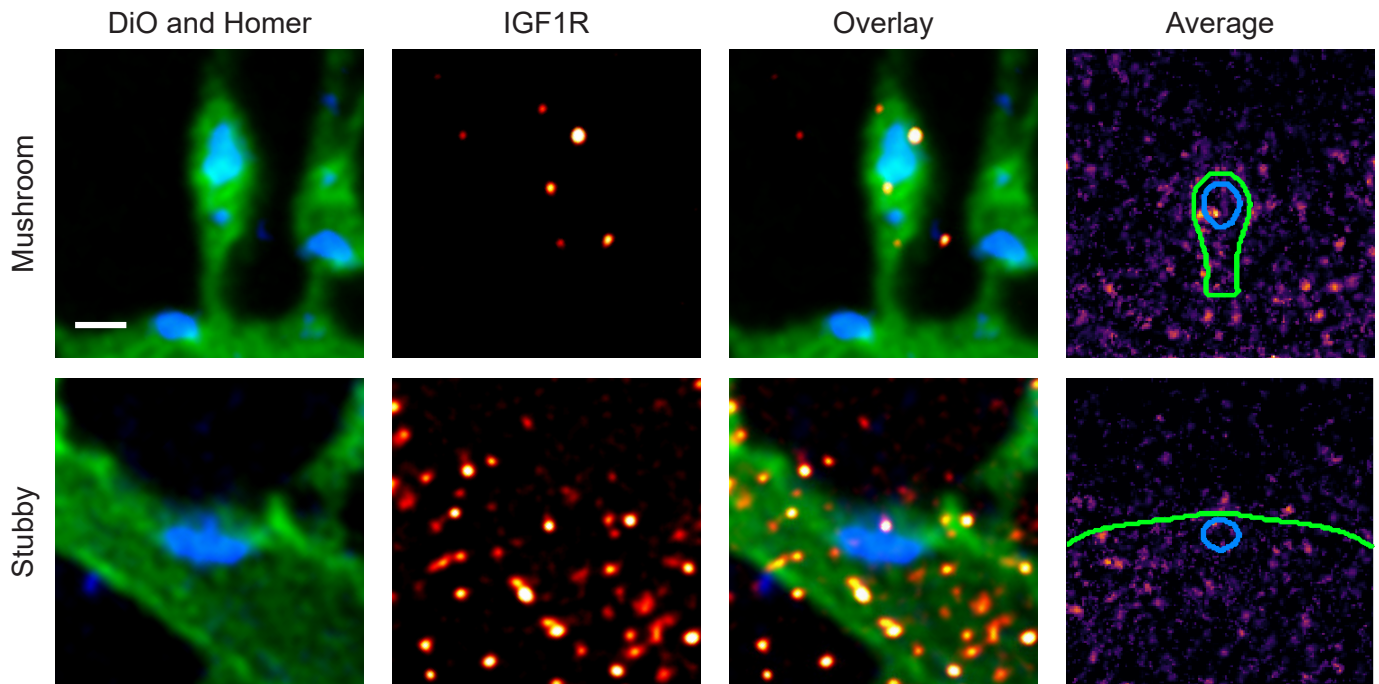
Yamamoto et al., 2010, Cell Struct. Funct.

IGF1R (CD221, Gene: Igf1r, Uniprot ID: P24062)

Known function: Required for development, growth and survival, Influences lifespan, Potentiates excitatory synaptic transmission, Regulates mitochondria

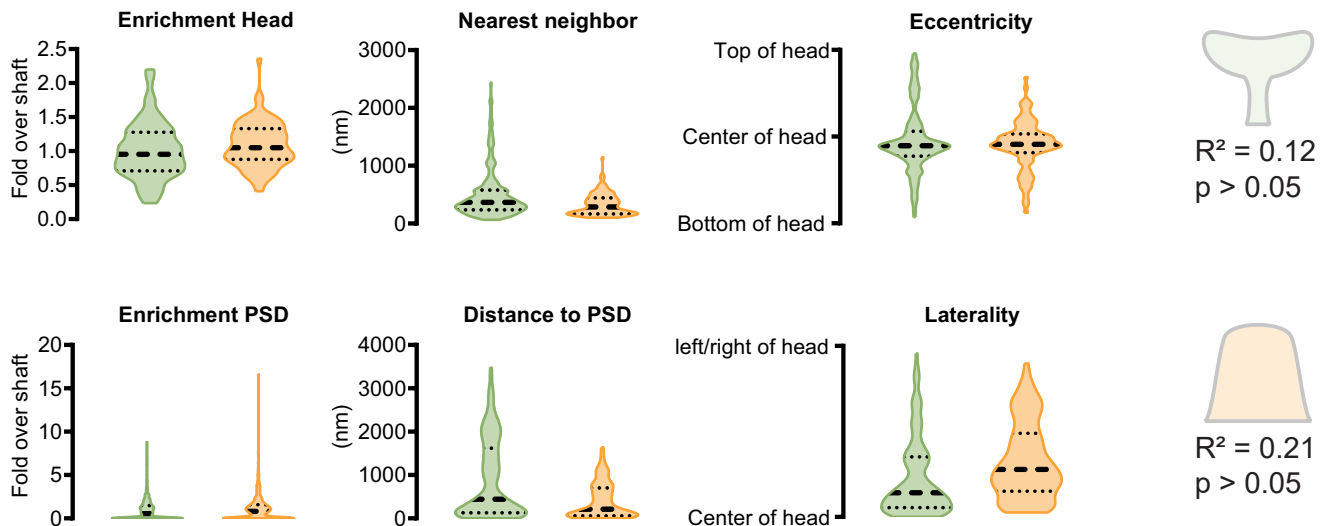
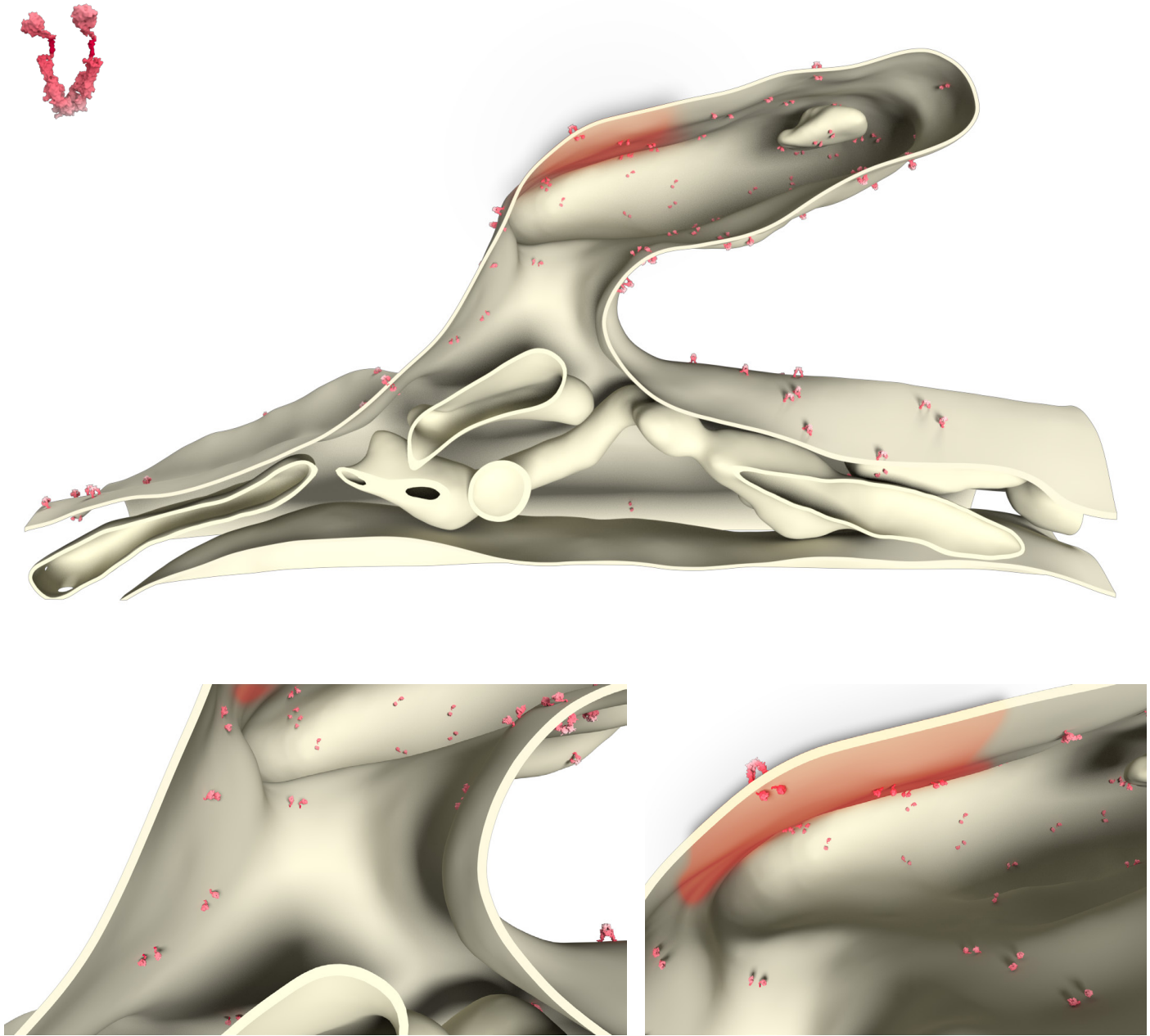
Known organization: Transmembrane proteine, Homodimers

Known Interactions: None

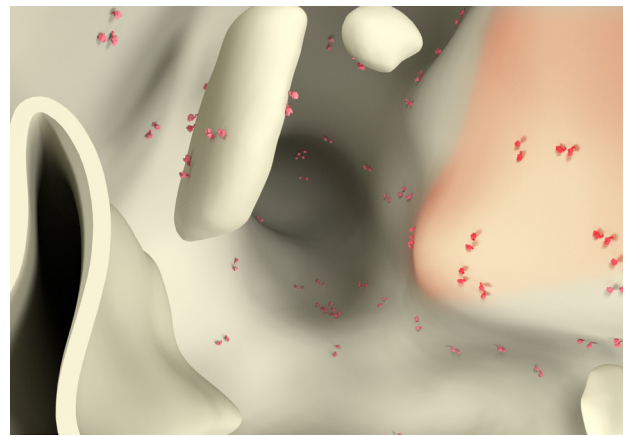
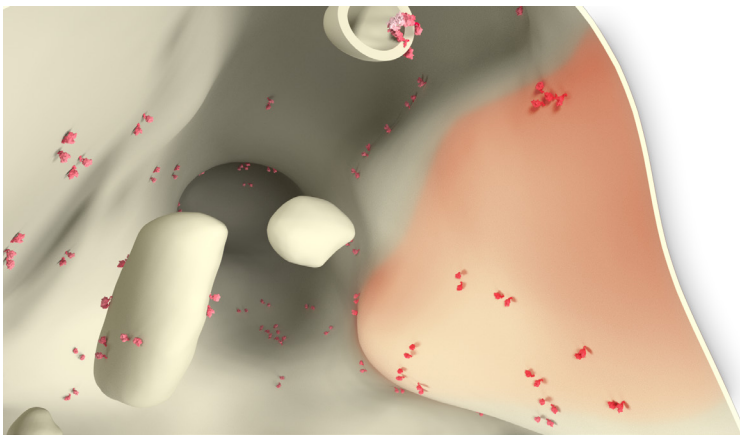
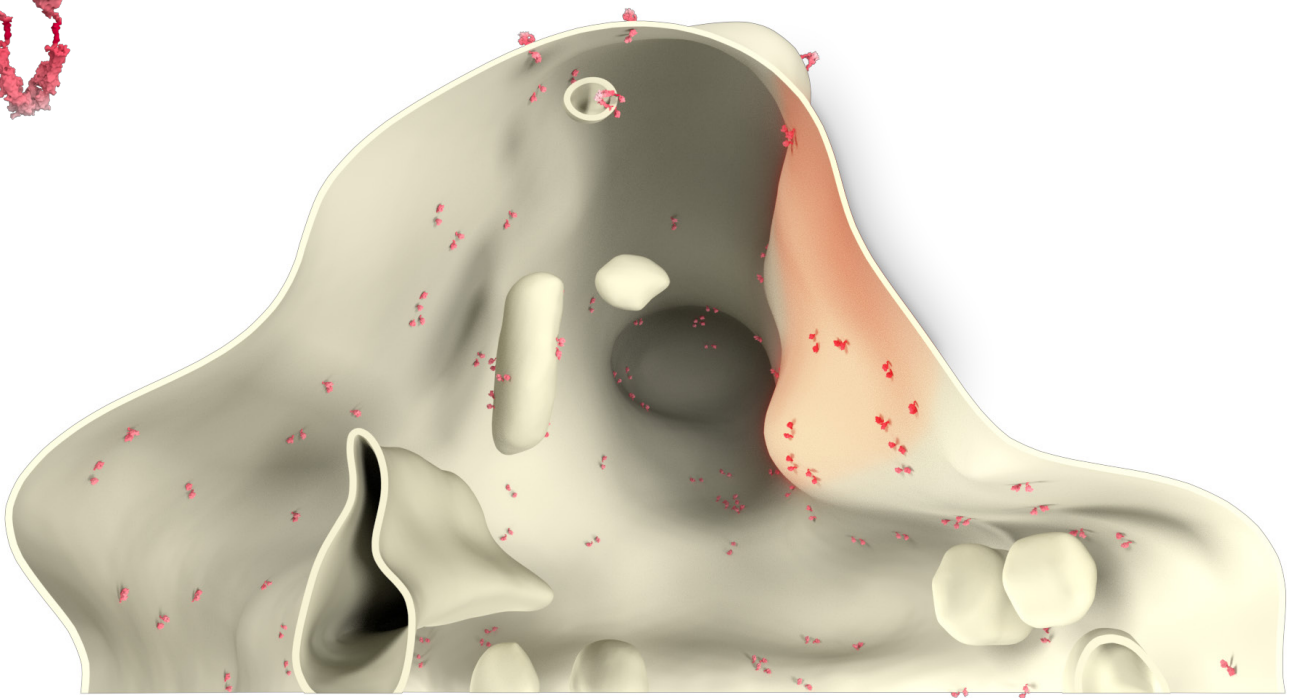
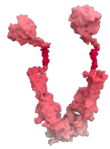


Whole cell copy number	not detected	
Spine copy number	350.2 (from literature)	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	296.2	400.8
% of total protein	0.2%	0.3%
Molarity (μ M)	3.8	3.8
PSD copy number	44	43
% in PSD	14.9%	10.7%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	296.2	0.2%	3.8	44
Stubby	400.8	0.3%	3.8	43



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	296.2	0.2%	3.8	44
Stubby	400.8	0.3%	3.8	43



References

Antibody: Cell Signaling 3027

PDB Identifier: 4zxb

Literature:

D'Ercole et al., 1996, Mol. Neurobiol.

Gazit et al., 2016, Neuron

Kenyon, 2010, Ann. N Y Acad. Sci.

Lemmon and Schlessinger, 2010, Cell

Ramsey et al., 2005, J. Neurophysiol.

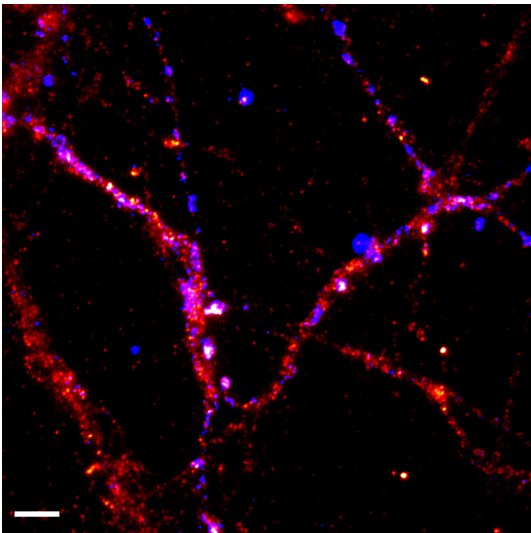
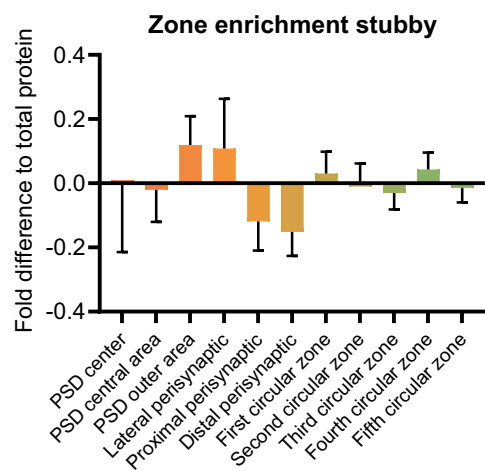
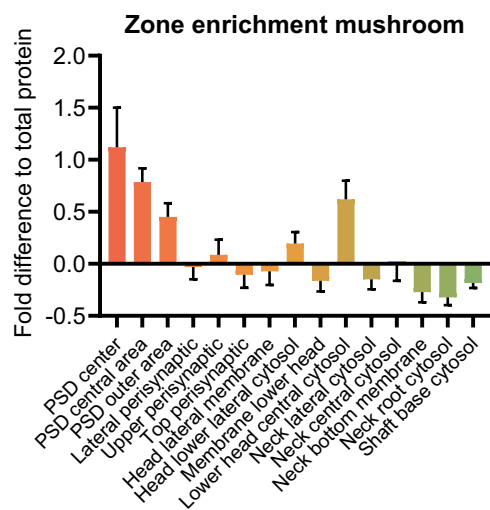
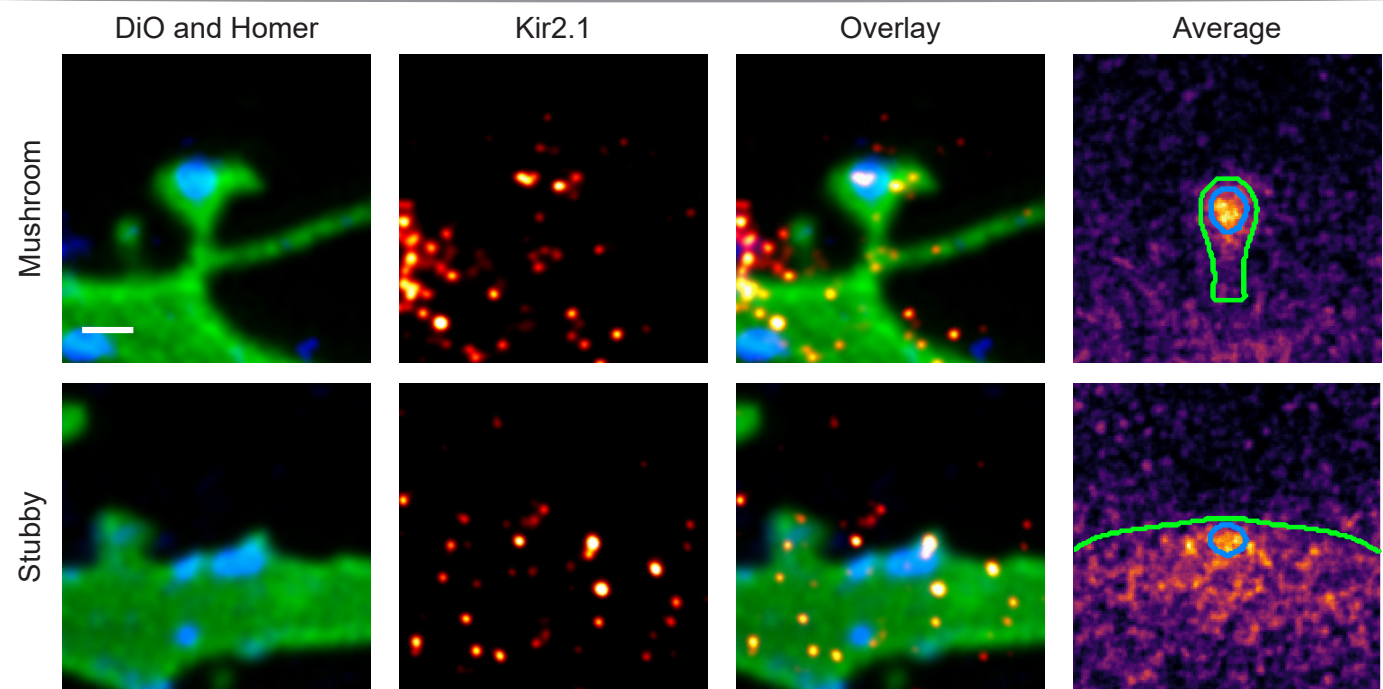
Suh et al., 2008, Proc. Natl. Acad. Sci. U S A

Kir2.1 (IRK-1, Gene: Kcnj2, Uniprot ID: Q64273)

Known function: Inwardly rectifying potassium channel

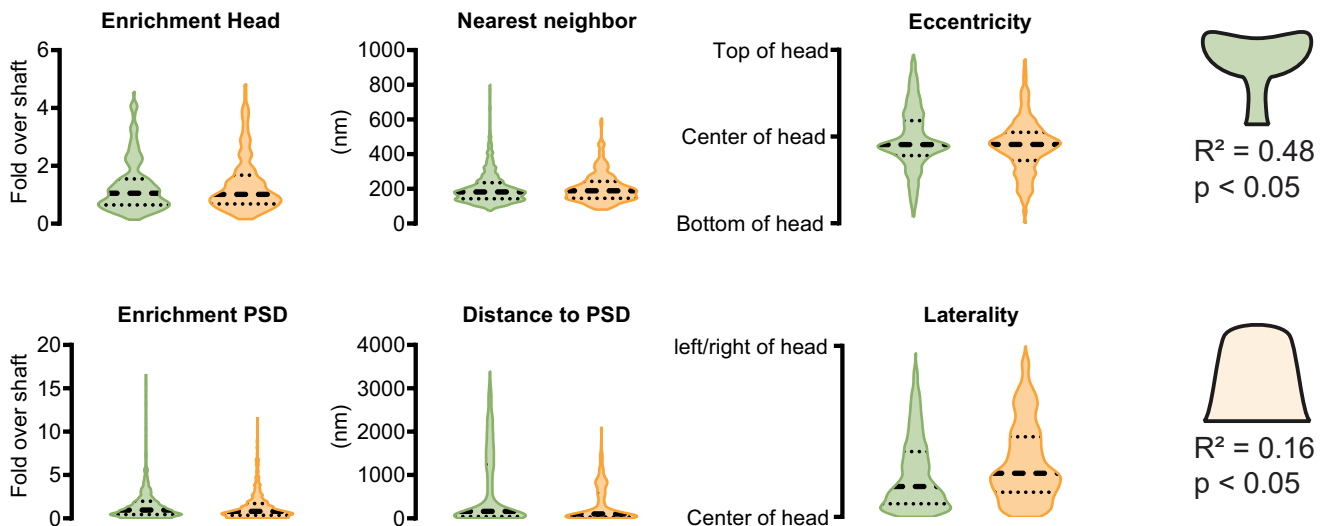
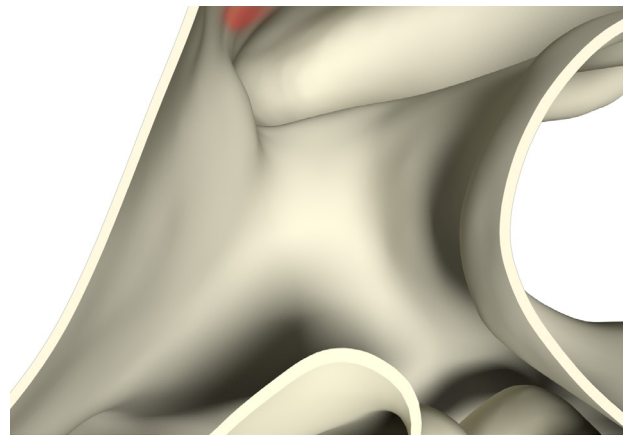
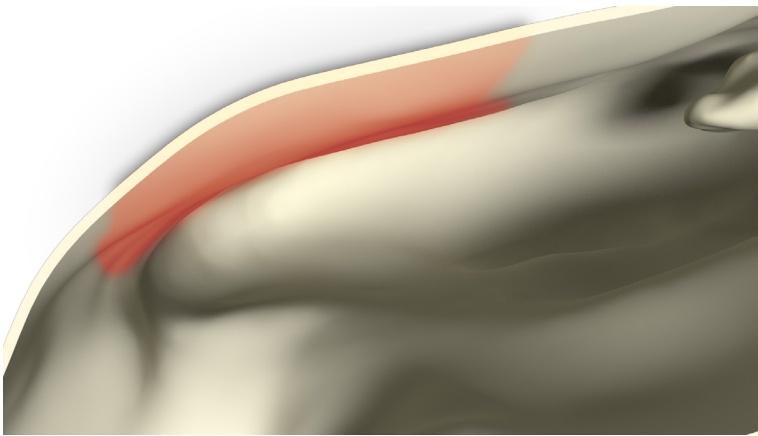
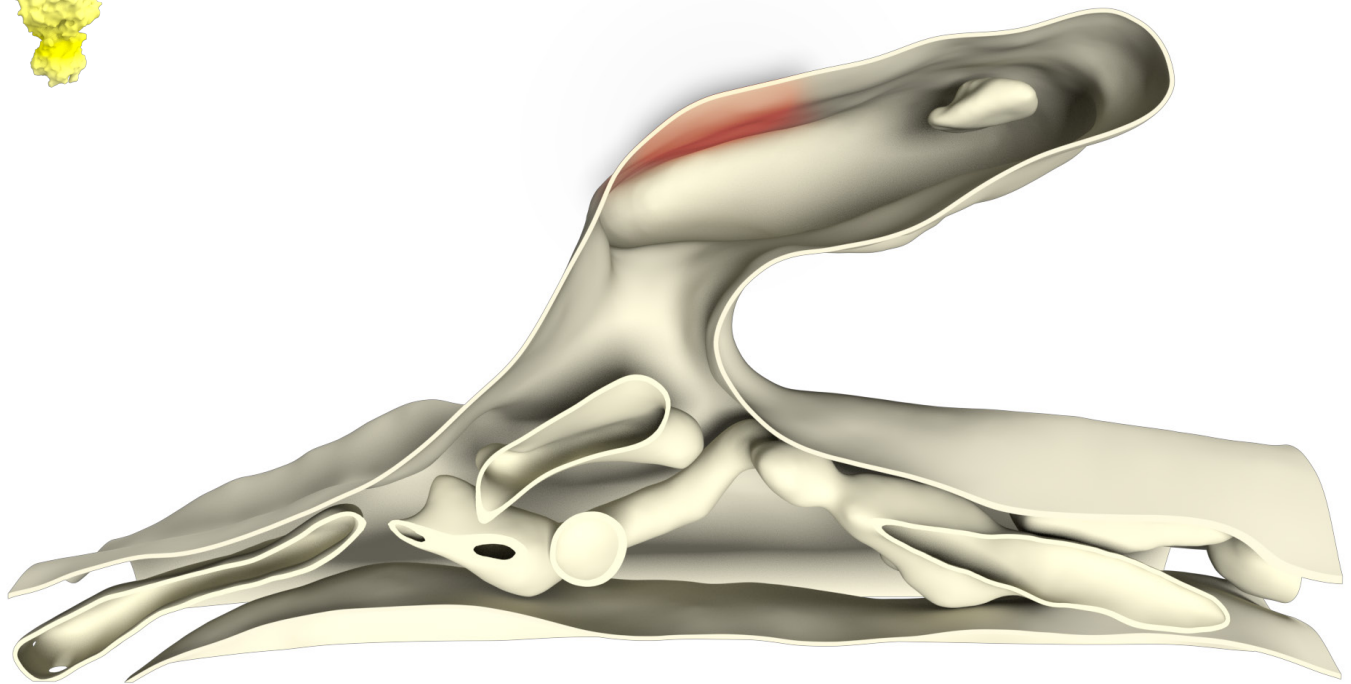
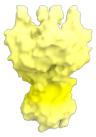
Known organization: Transmembrane protein, Present in PSD95 supercomplexes

Known Interactions: PSD95

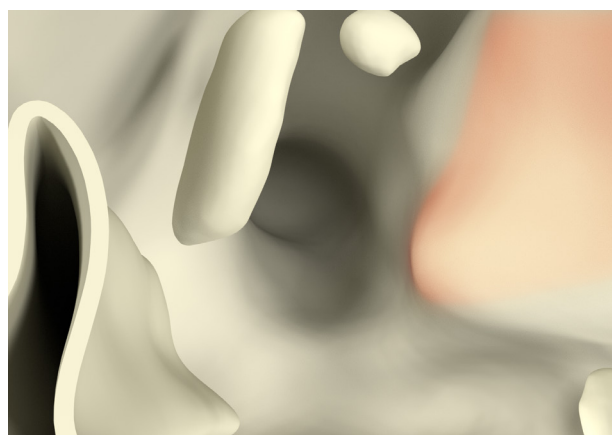
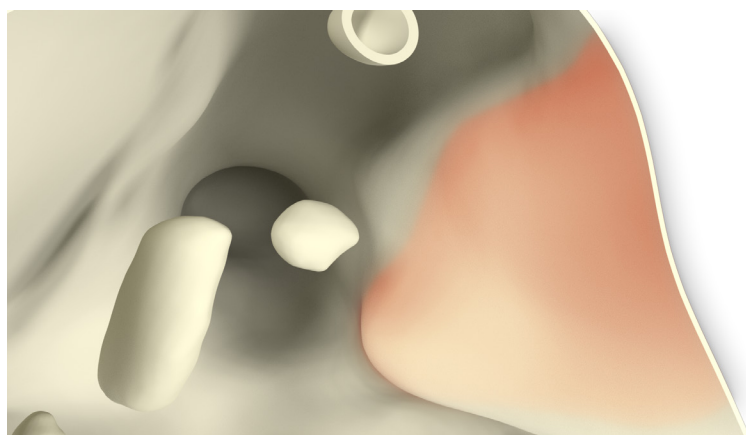
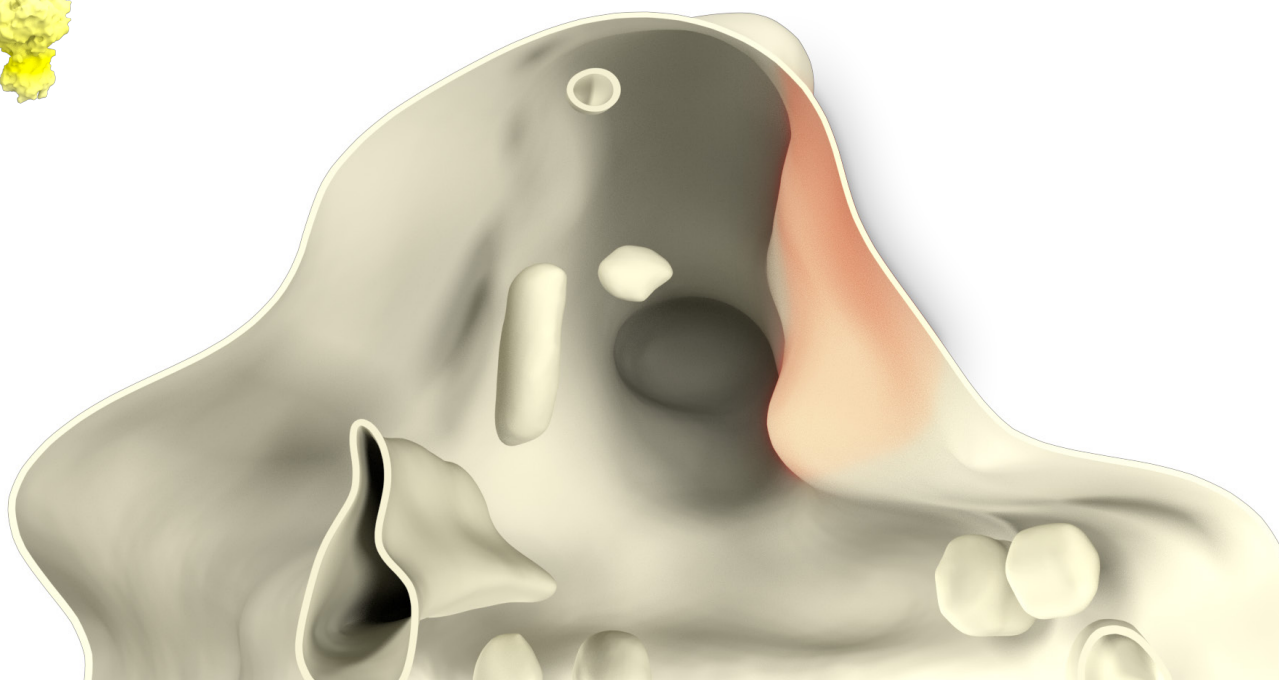
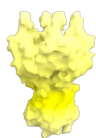


Whole cell copy number	not detected	
Spine copy number	not detected	
Function	Ion channel	
	Mushroom	Stubby
Spine copy number	not detected	not detected
% of total protein	not detected	not detected
Molarity (μM)	not detected	not detected
PSD copy number	not detected	not detected
% in PSD	not detected	not detected

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	not detected	not detected	not detected	not detected
Stubby	not detected	not detected	not detected	not detected



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	not detected	not detected	not detected	not detected
Stubby	not detected	not detected	not detected	not detected



References

Antibody: Novus Biologicals NBP1-95482

PDB Identifier: 3spi

Literature:

Fomina et al., 2011, Biochim. Biophys. Acta.

Frank et al., 2016, Nat. Commun.

Vikstrom et al., 2009, Am. J. Physiol. Heart Circ.

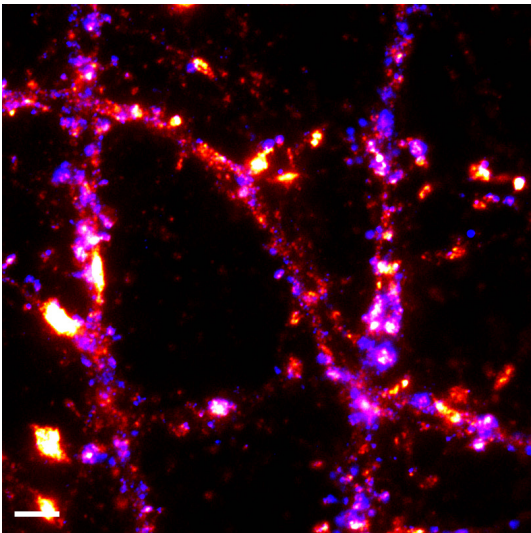
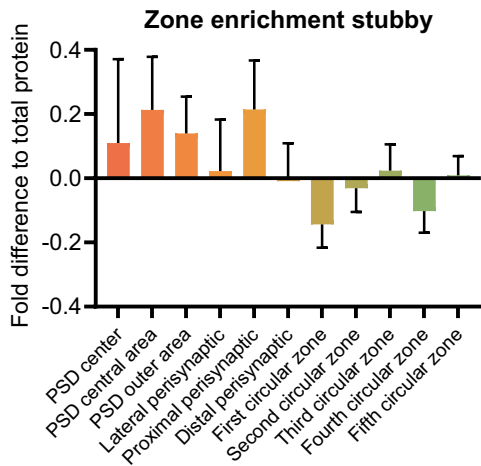
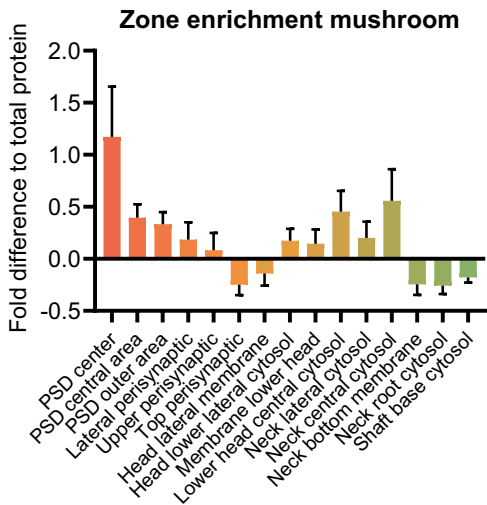
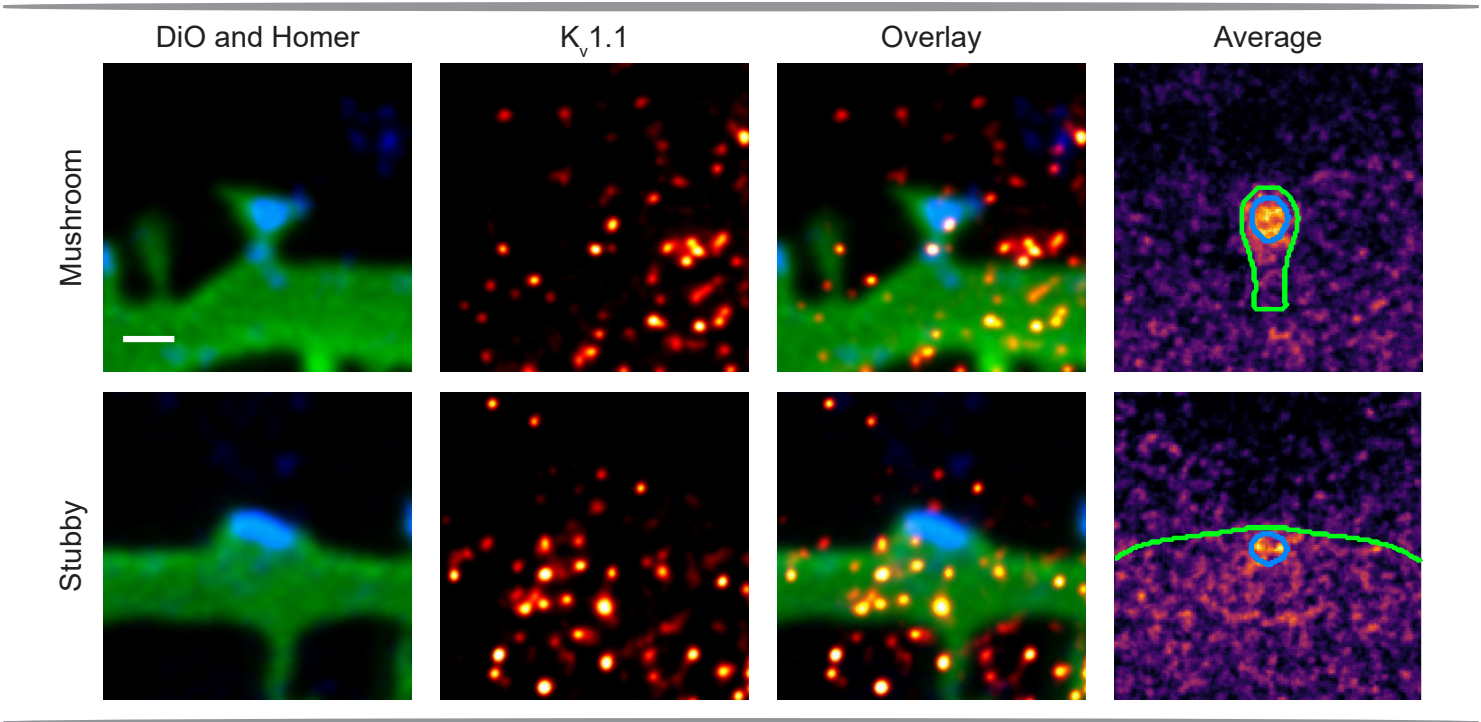
Physiol.

K_v1.1 (Gene: Kcna1, Uniprot ID: P10499)

Known function: Delayed rectifier potassium channel

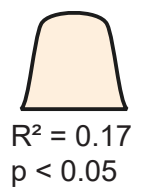
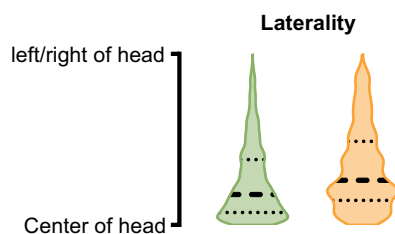
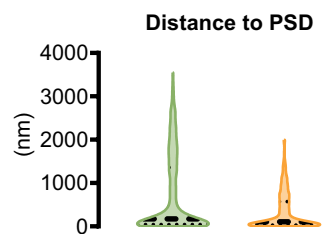
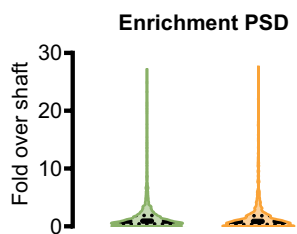
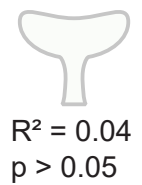
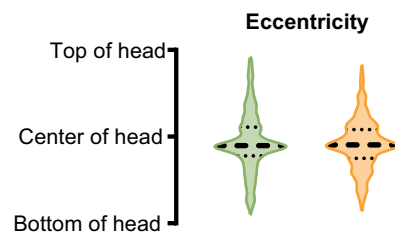
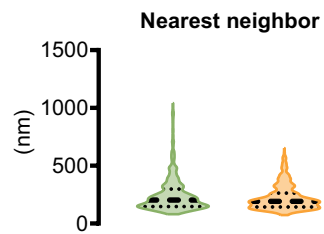
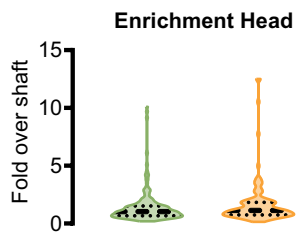
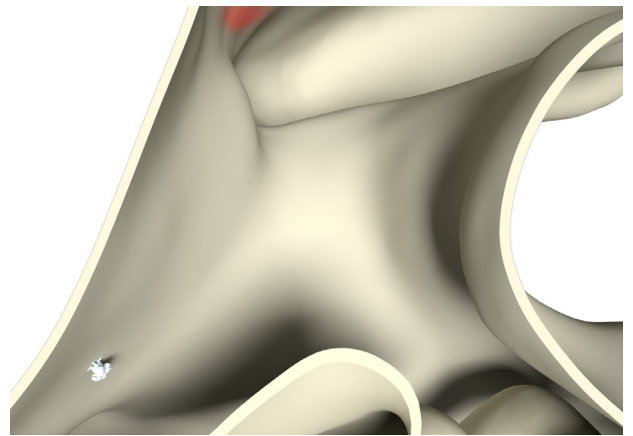
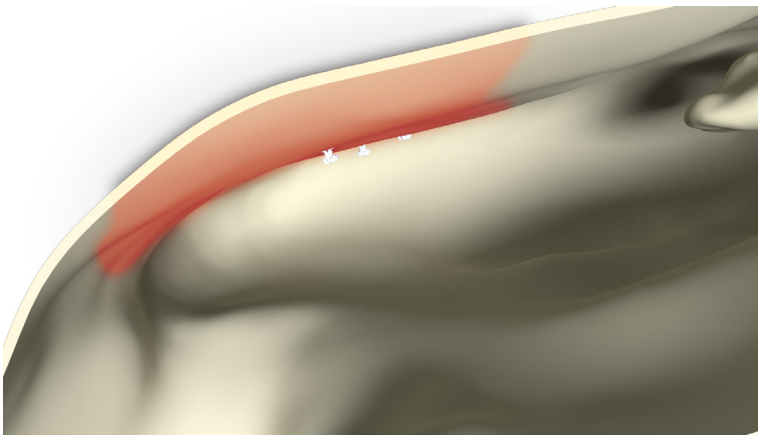
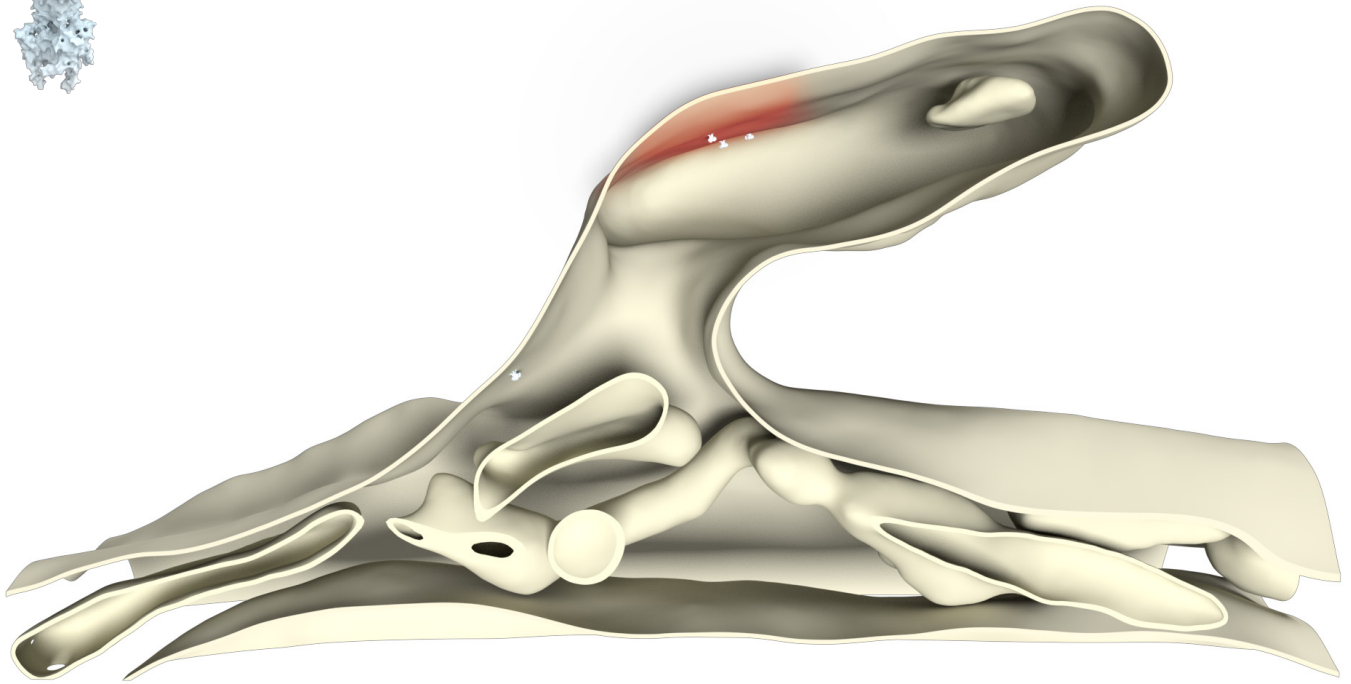
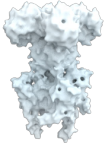
Known organization: Transmembrane protein

Known Interactions: PSD95

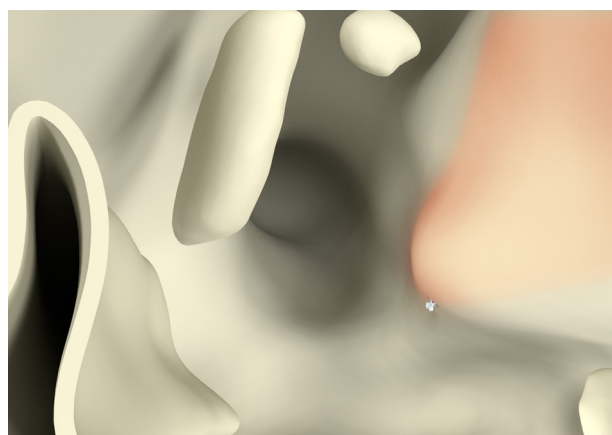
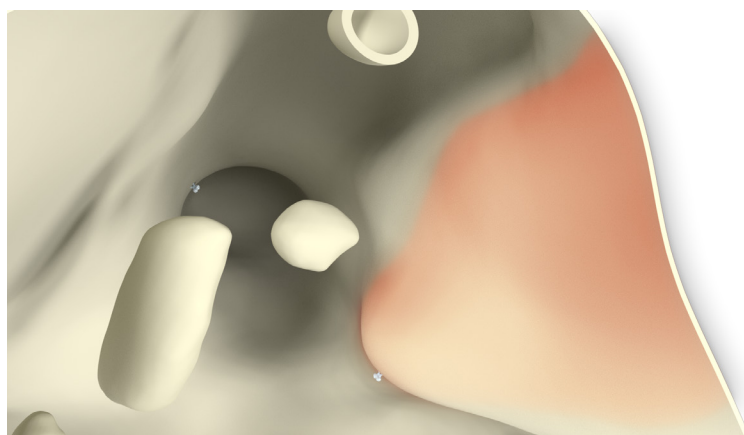
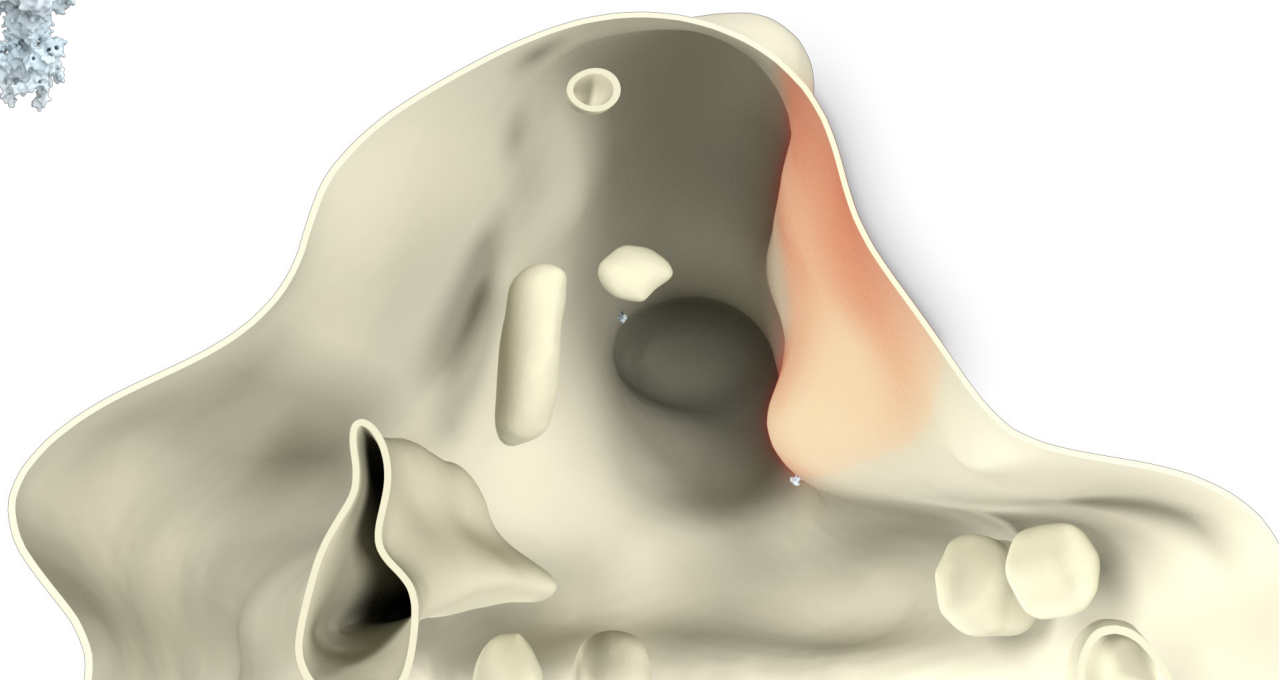
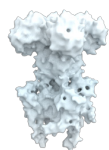


Whole cell copy number	108526.4 ± 12341.5	
Spine copy number	20.2 ± 4.2	
Function	Ion channel	
	Mushroom	Stubby
Spine copy number	18.5 ± 3.8	23.1 ± 4.8
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.2 ± 0.0	0.2 ± 0.0
PSD copy number	7 ± 1.4	4 ± 0.8
% in PSD	37.8 ± 7.8%	17.3 ± 3.6%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	18.5 ± 3.8	$0.0 \pm 0.0\%$	0.2 ± 0.0	7 ± 1.4
Stubby	23.1 ± 4.8	$0.0 \pm 0.0\%$	0.2 ± 0.0	4 ± 0.8



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	18.5 ± 3.8	$0.0 \pm 0.0\%$	0.2 ± 0.0	7 ± 1.4
Stubby	23.1 ± 4.8	$0.0 \pm 0.0\%$	0.2 ± 0.0	4 ± 0.8



References

Antibody: Thermo Scientific PA5-19593

PDB Identifier: 2a79

Literature:

Kim et al., 1995, Nature

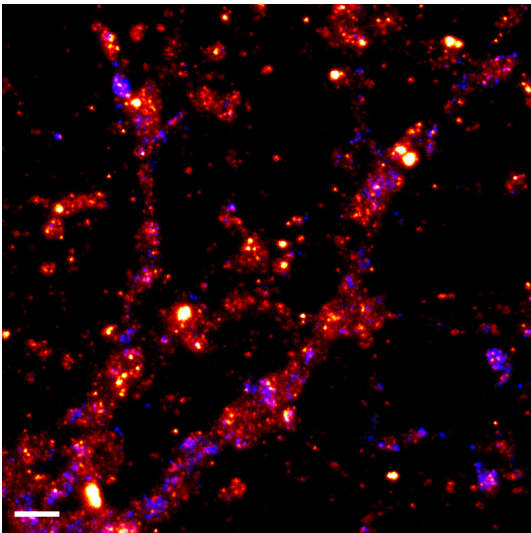
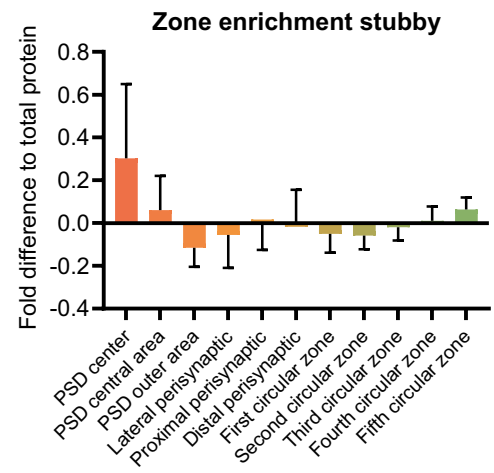
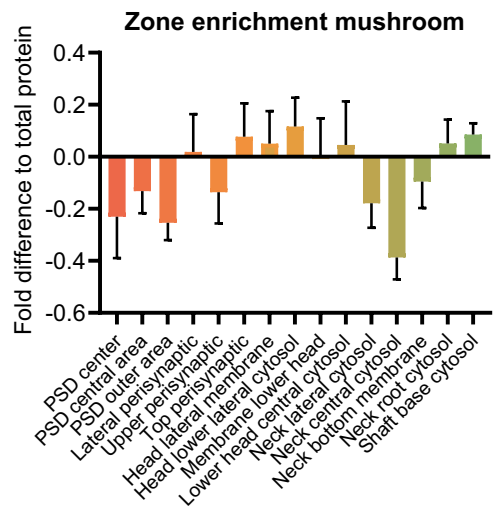
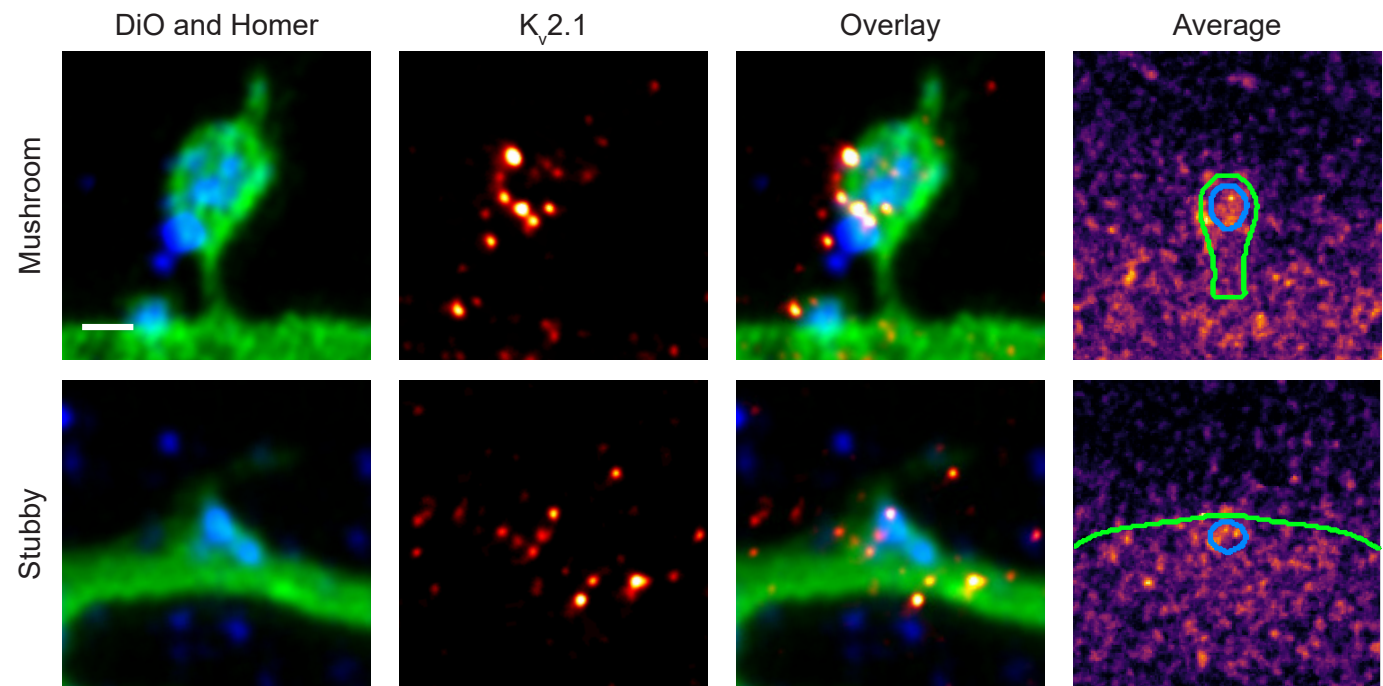
Tiffany et al., 2000, J. Cell. Biol.

K_v2.1 (Gene: Kcnb1, Uniprot ID: P15387)

Known function: Delayed rectifier potassium channel, Dominant type in hippocampus, Regulates gene transcription

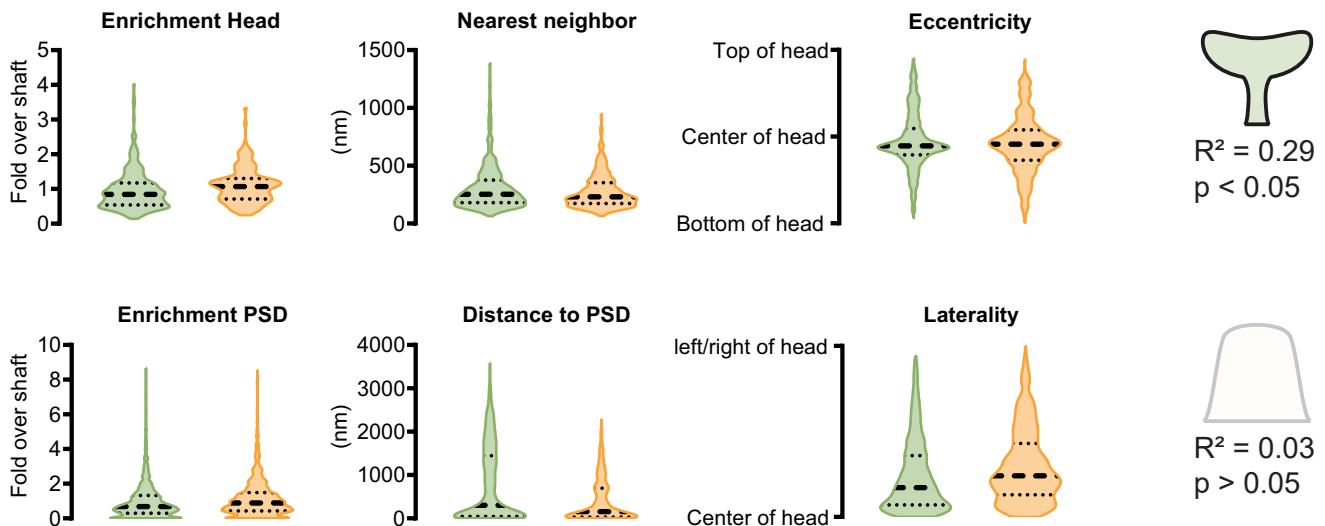
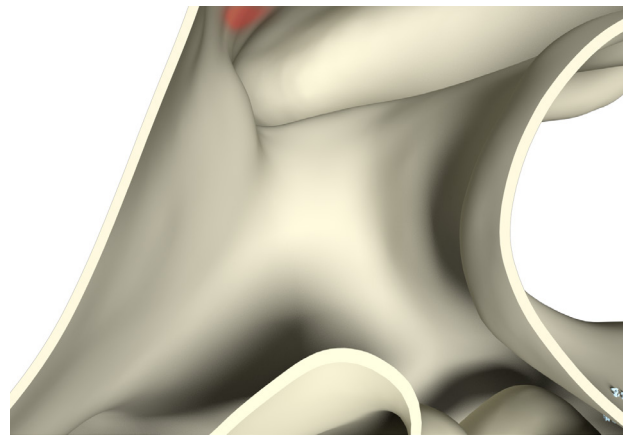
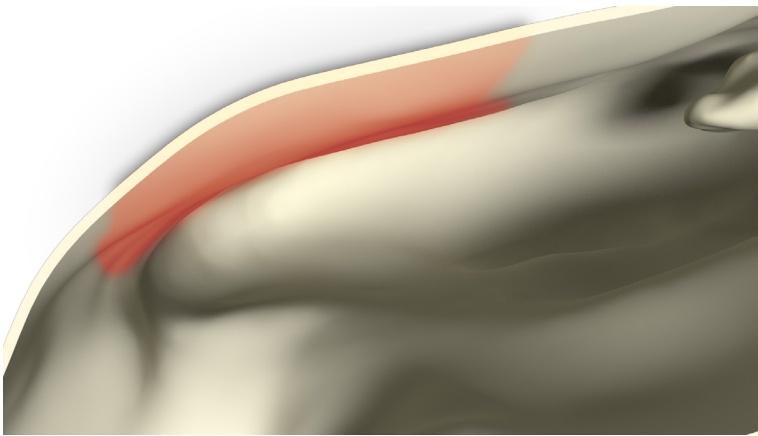
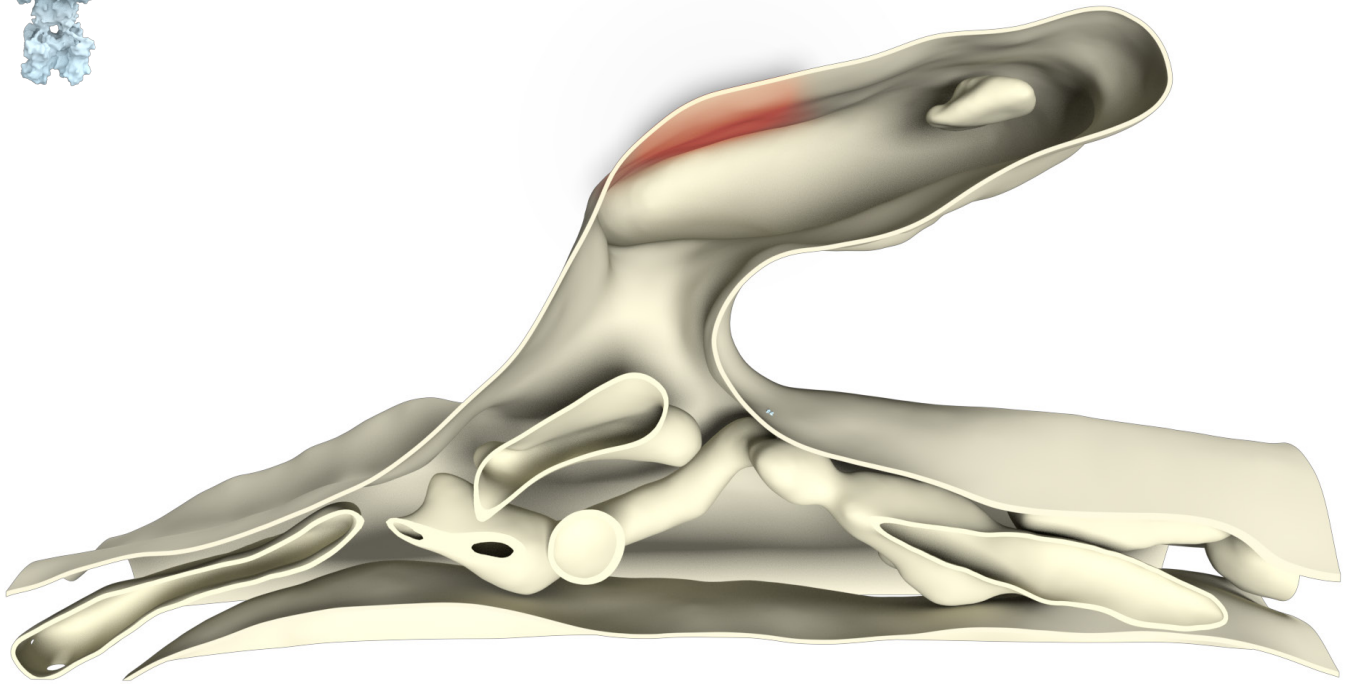
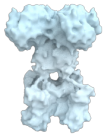
Known organization: Transmembrane protein, Forms clusters on soma

Known Interactions: Syntaxin1

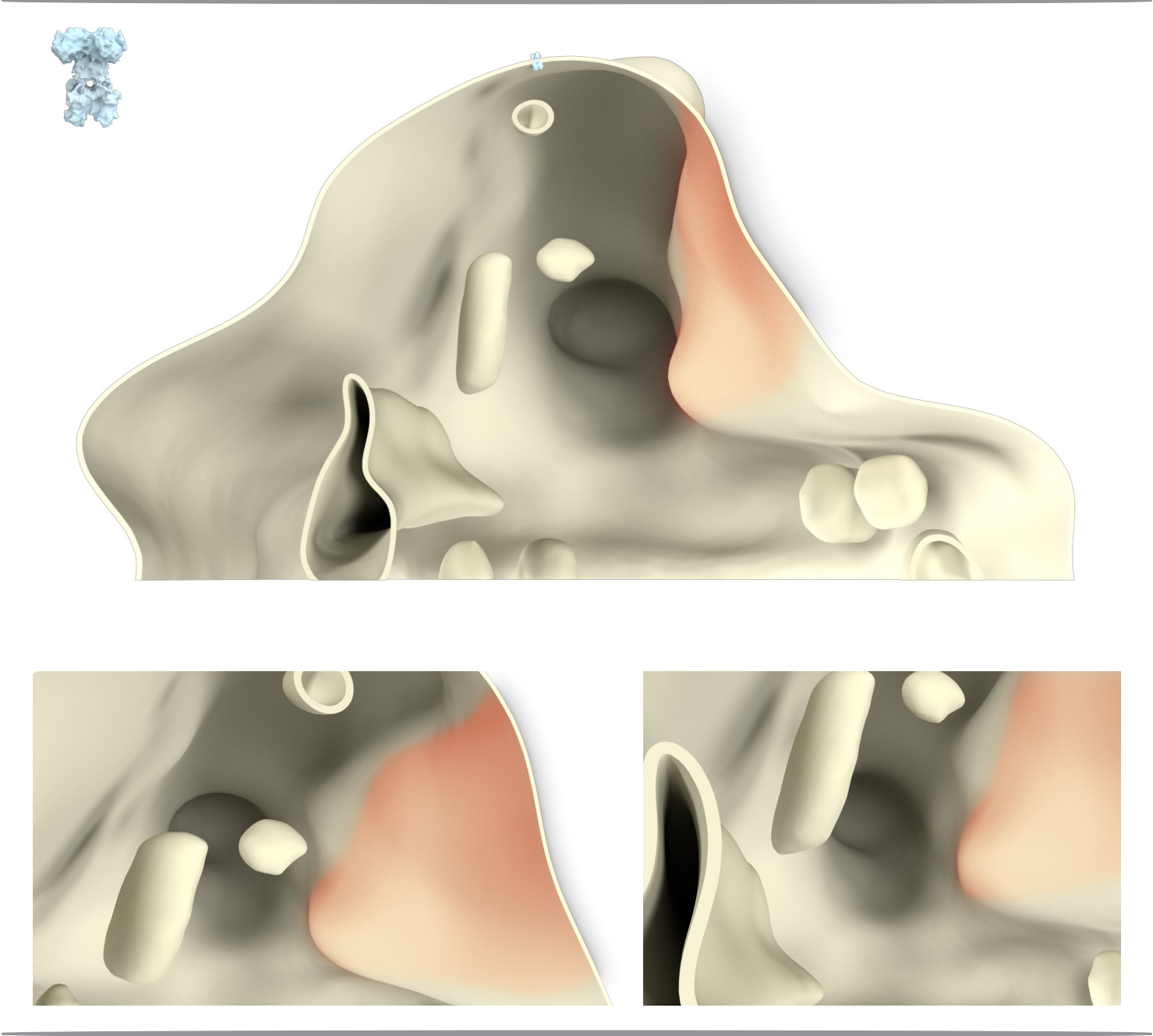


Whole cell copy number	3092.0 ± 886.1	
Spine copy number	0.4 ± 0.1	
Function	Ion channel	
	Mushroom	Stubby
Spine copy number	0.3 ± 0.1	0.4 ± 0.2
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.0 ± 0.0	0.0 ± 0.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	0.3 ± 0.1	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	0.4 ± 0.2	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	0.3 ± 0.1	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	0.4 ± 0.2	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



References

Antibody: Synaptic Systems 231 002

PDB Identifier: 4jtc

Literature:

Du et al., 2000, J Physiol.

Feinshreiber et al., 2009, Ann. N Y Acad. Sci.

Fox et al., 2013, J. Neurosci.

Lai and Jan, 2006, Nat. Rev. Neurosci.

Leung et al., 2007, Endocr. Rev.

Misonou et al., 2005, Neurotoxicology

Murakoshi and Trimmer, 1999, J. Neurosci.

O'Connell et al., 2010, Proc. Natl. Acad. Sci. U S A

Scannevin et al., 1996, J. Cell. Biol.

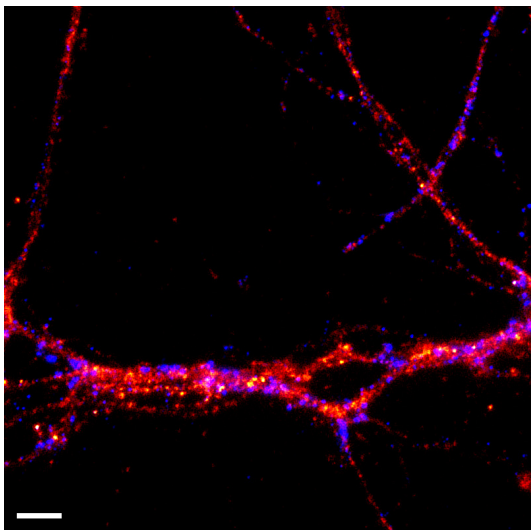
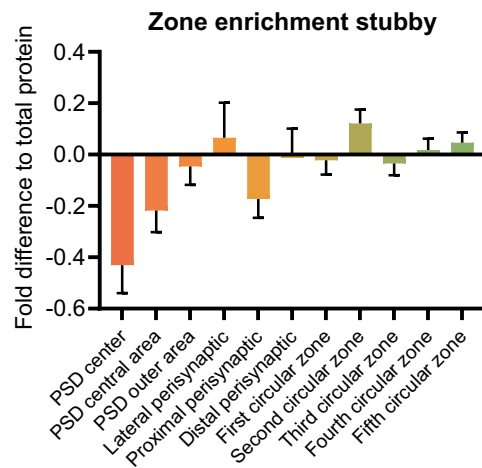
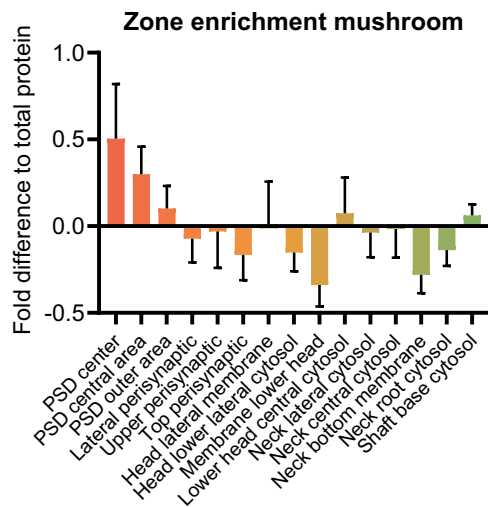
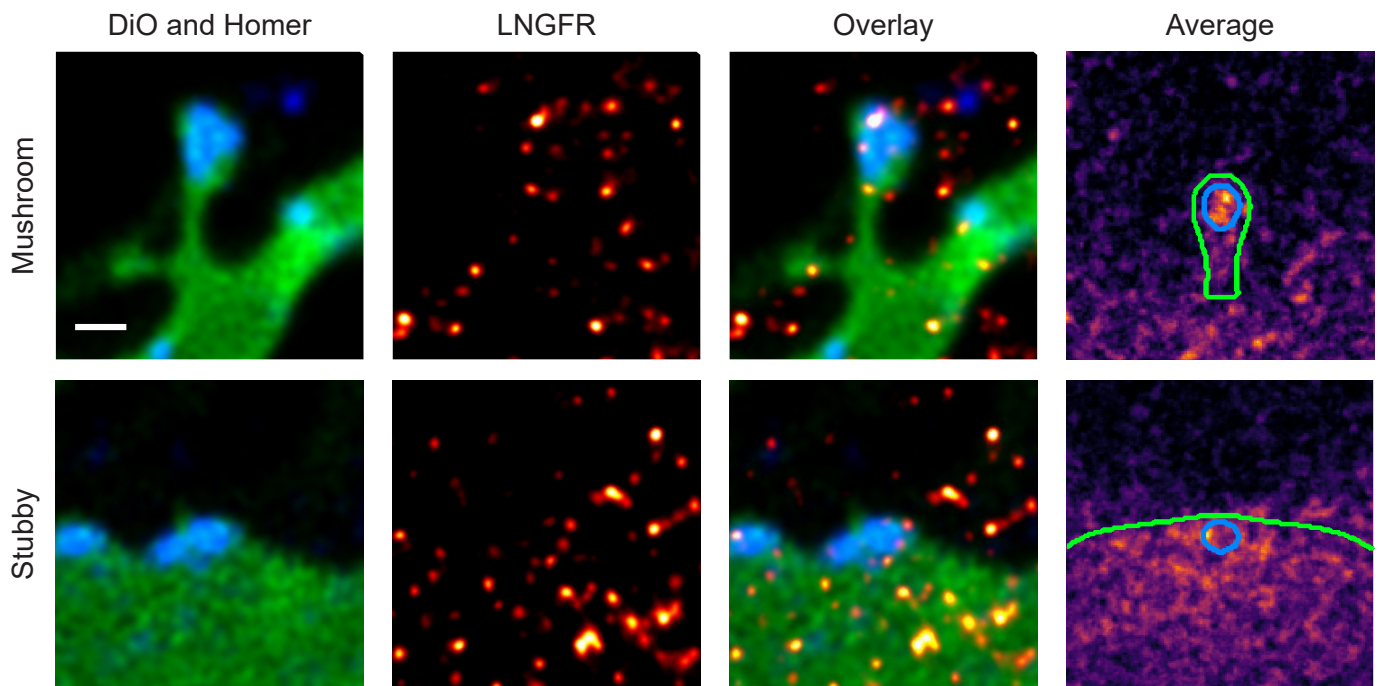
Trimmer, 1991, Proc. Natl. Acad. Sci. U S A

LNGFR (p75NTR Gene: Ngfr, Uniprot ID: P07174)

Known function: Neurotrophic signaling, Recognizes all neurotrophins, Involved in LTD

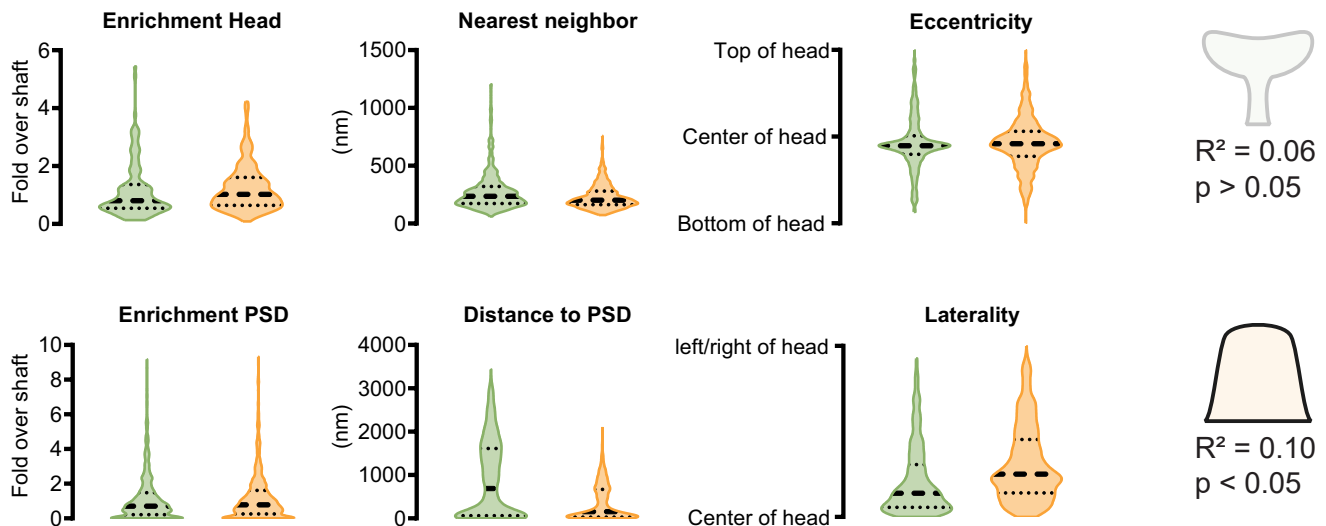
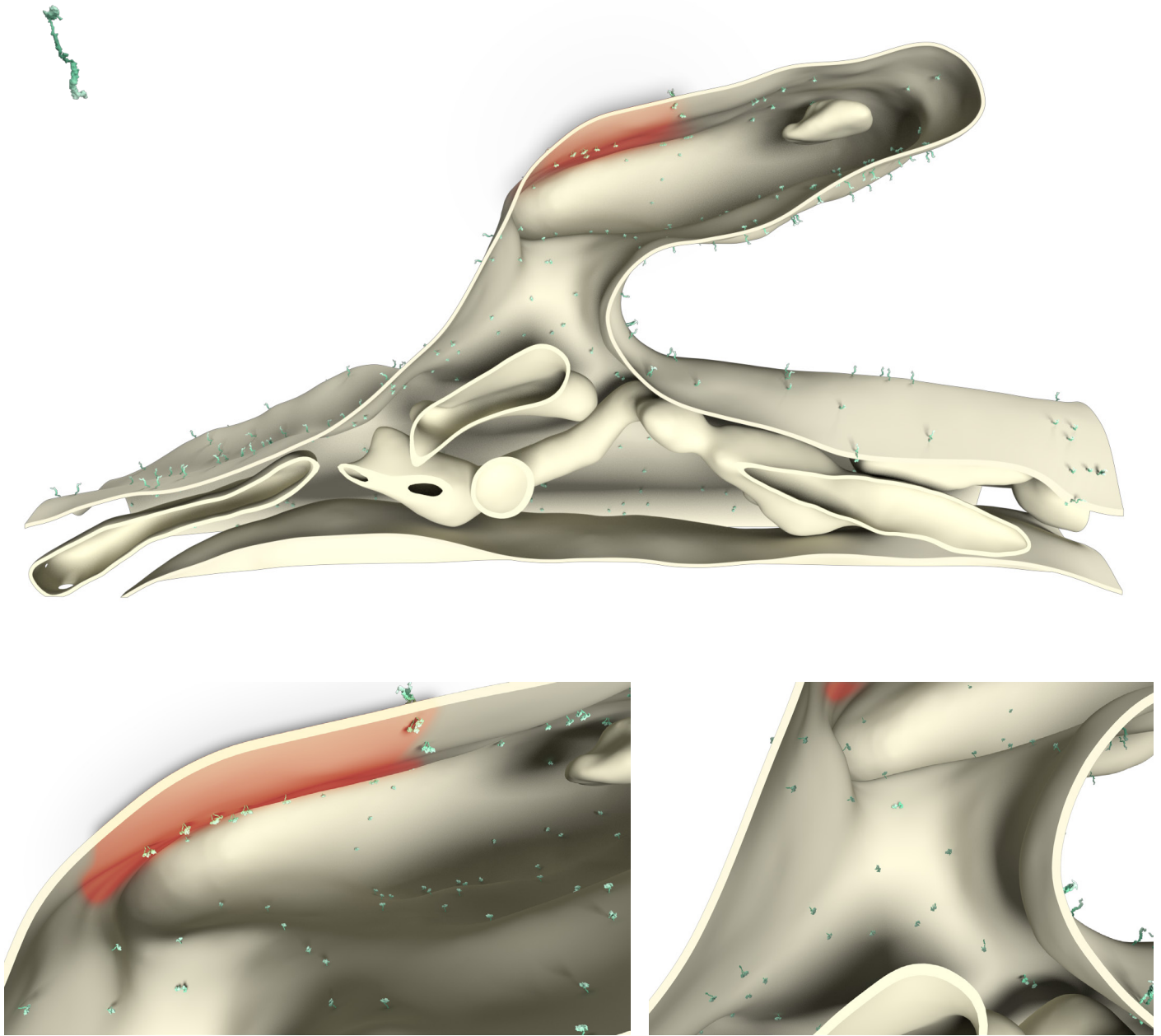
Known organization: Transmembrane protein

Known Interactions: TrkB, BDNF

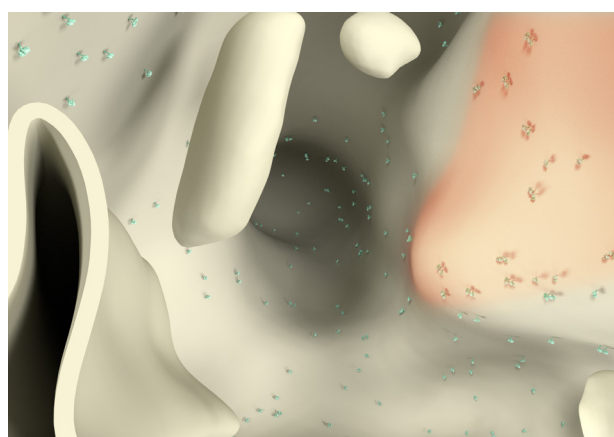
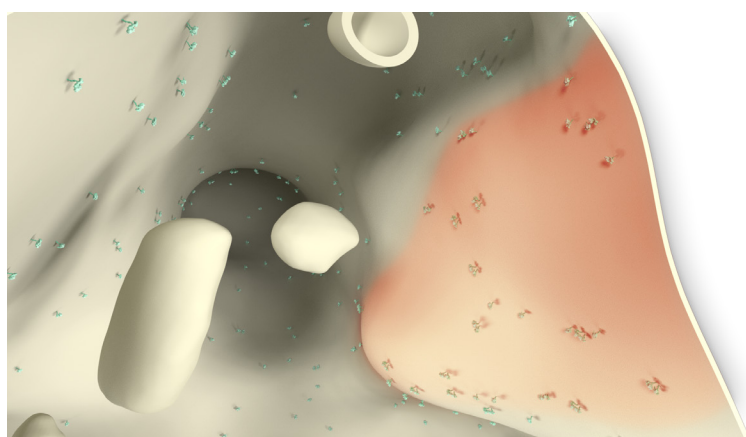
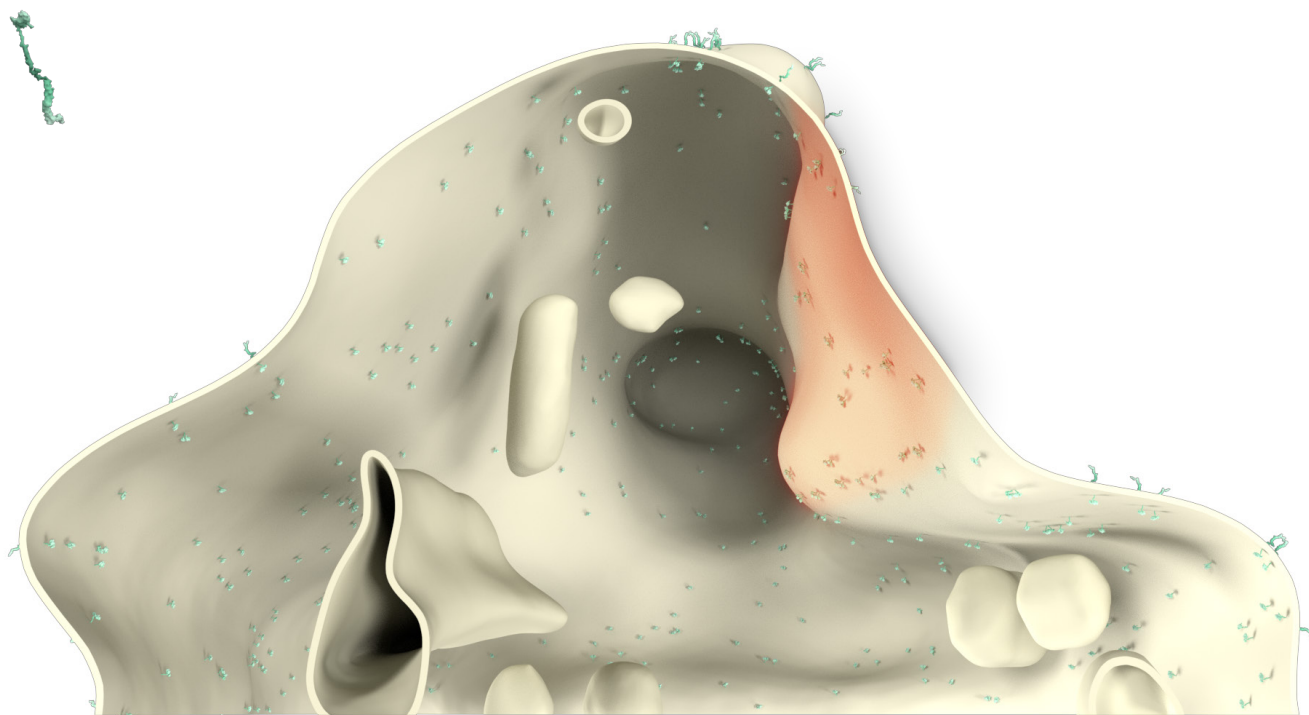


Whole cell copy number	2945133.1 ± 1352814.7 (extrapolated)	
Spine copy number	535.5 ± 262.0	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	437.0 ± 213.8	692.4 ± 338.7
% of total protein	0.1 ± 0.0%	0.1 ± 0.1%
Molarity (μM)	5.5 ± 2.7	6.5 ± 3.2
PSD copy number	136 ± 66.5	102 ± 49.9
% in PSD	31.1 ± 15.2%	14.7 ± 7.2%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	437.0 ± 213.8	$0.1 \pm 0.0\%$	5.5 ± 2.7	136 ± 66.5
Stubby	692.4 ± 338.7	$0.1 \pm 0.1\%$	6.5 ± 3.2	102 ± 49.9



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	437.0 ± 213.8	$0.1 \pm 0.0\%$	5.5 ± 2.7	136 ± 66.5
Stubby	692.4 ± 338.7	$0.1 \pm 0.1\%$	6.5 ± 3.2	102 ± 49.9



References

Antibody: Cell Signaling 8238

PDB Identifier: 2mic, 4f44, 3buk

Literature:

Barker, 1998, Cell Death Differ.

Ernfors et al., 1990, Proc. Natl. Acad. Sci. U S A

Leal et al., 2015, Brain Res.

Rodriguez-Tébar et al., 1990, Neuron

Yang et al., 2009, Na. Neurosci.

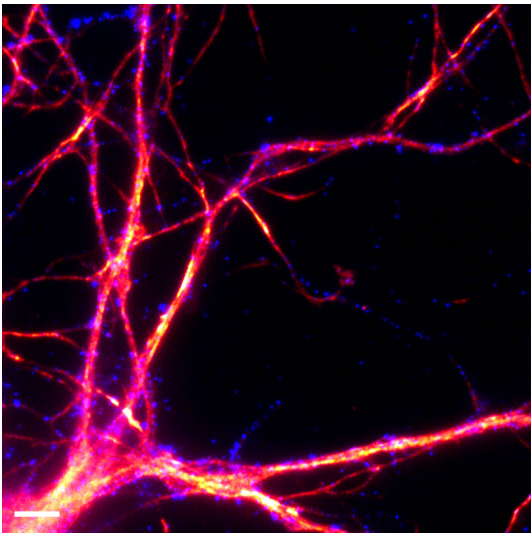
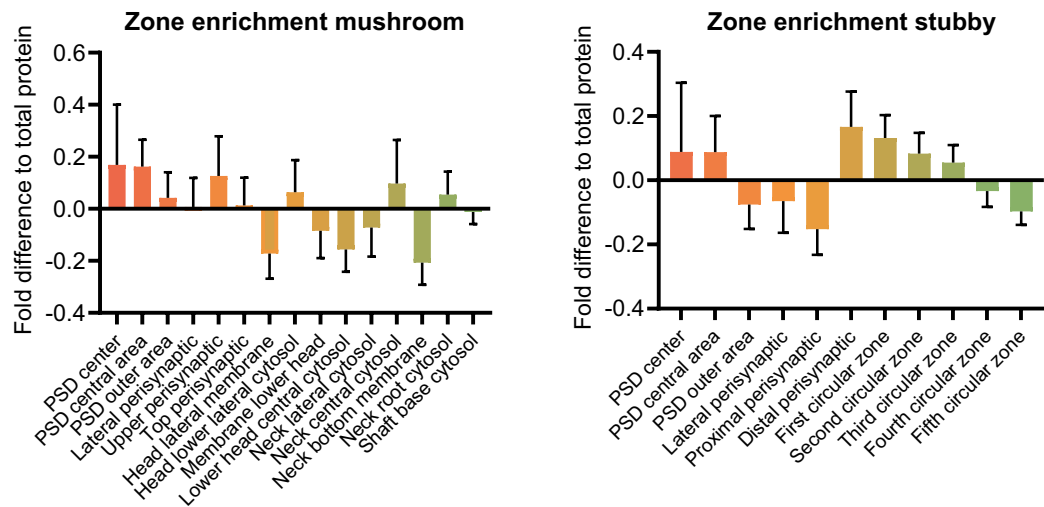
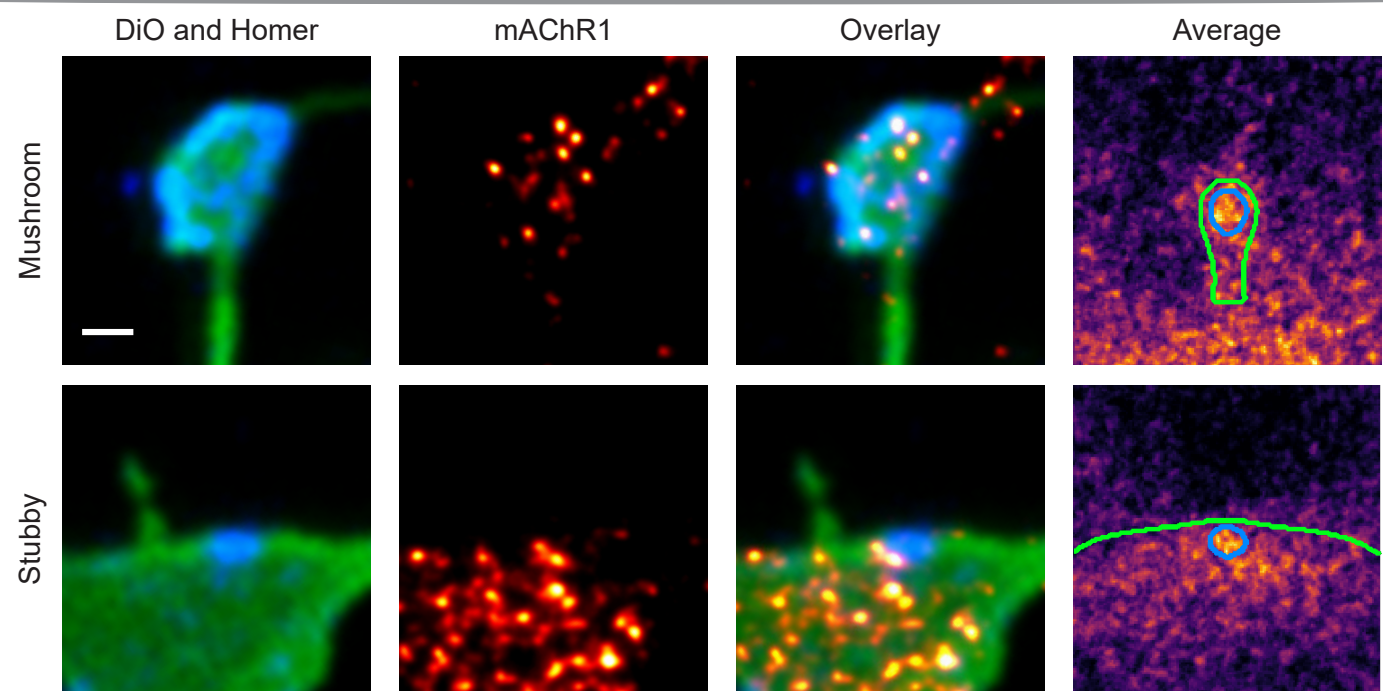
Yang et al., 2014, Cell Rep.

mAChR1 (HM1, Gene: Chrm1, Uniprot ID: P08482)

Known function: Activates PLC, Regulates intracellular calcium release, Reduces potassium conductance

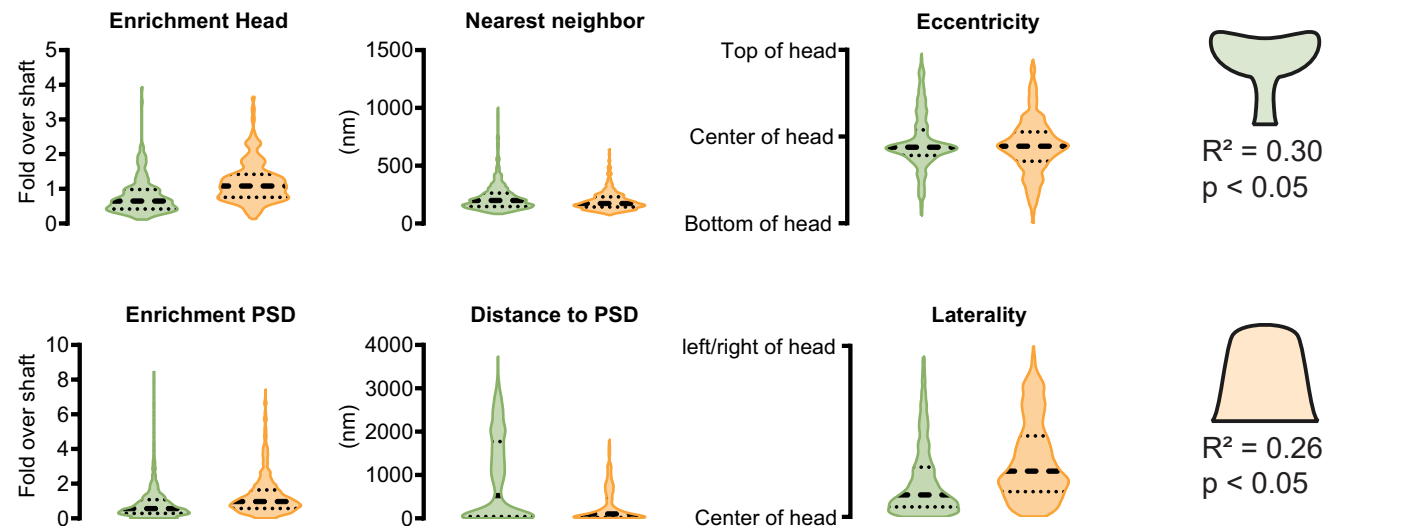
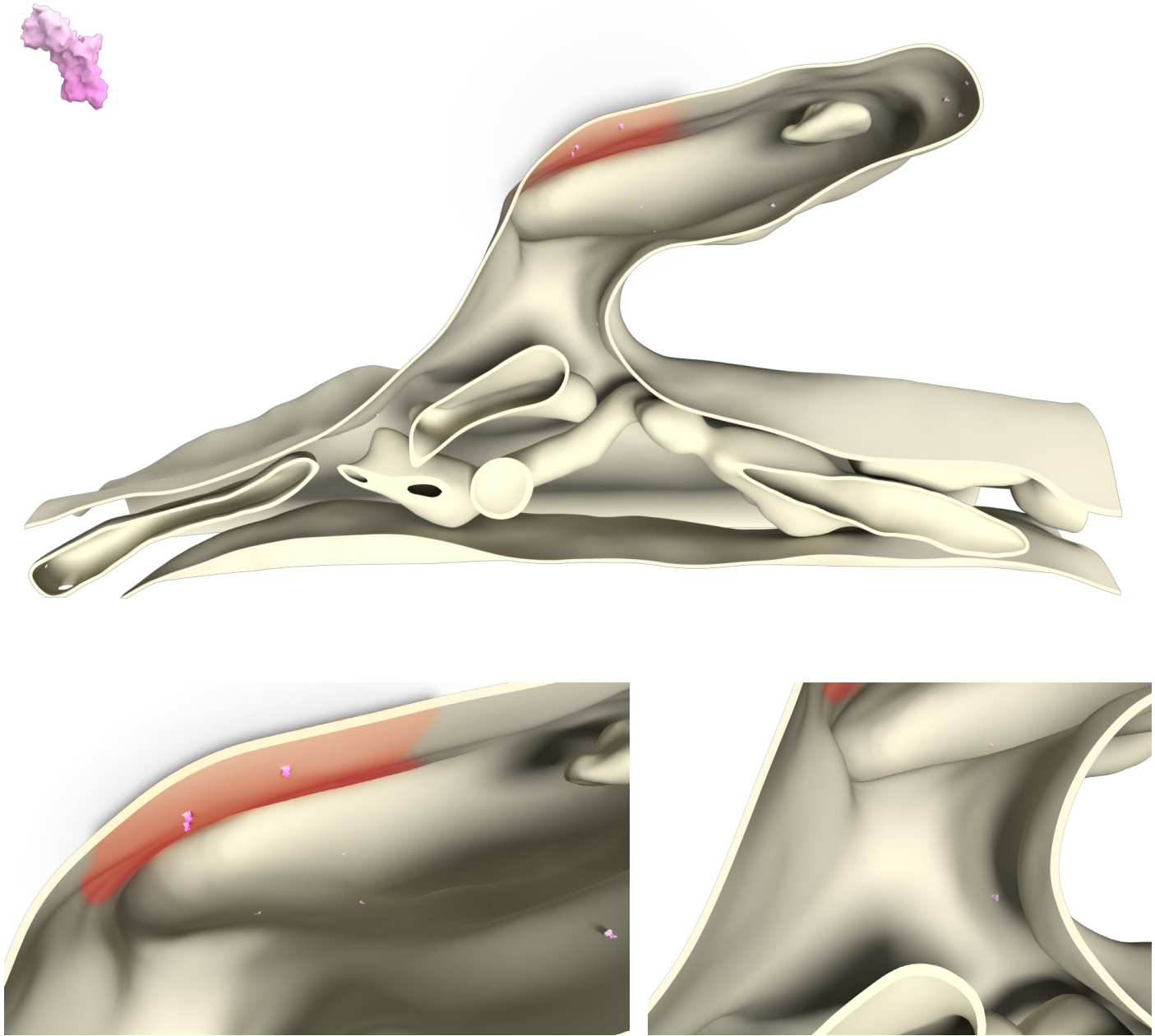
Known organization: Transmembrane protein, Enriched at dendrites and PSDs

Known Interactions: G_q coupled

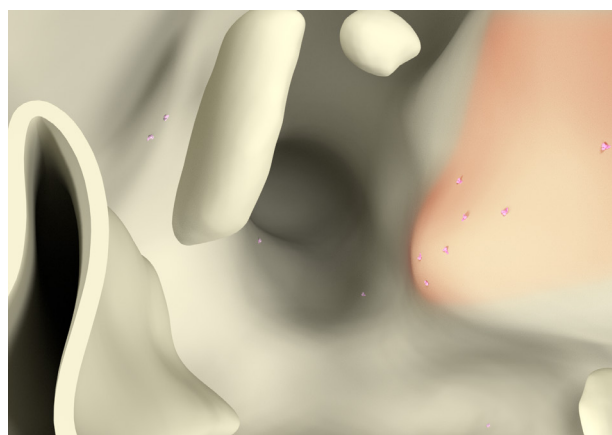
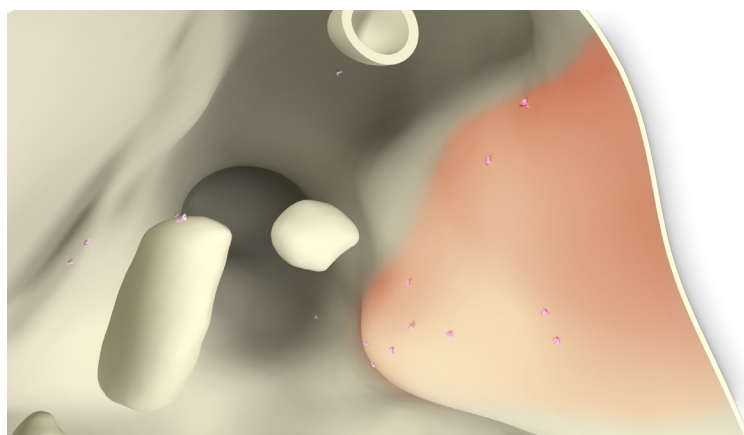
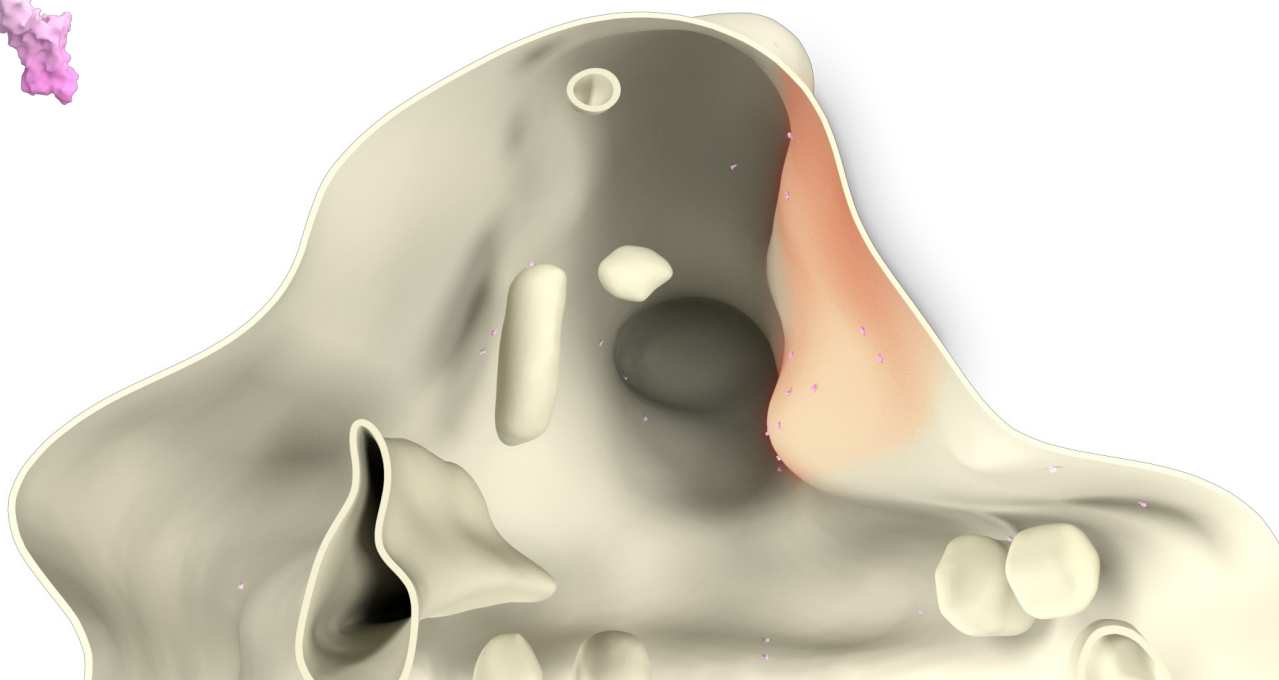


Whole cell copy number	167243.2 ± 38253.7	
Spine copy number	33.9 ± 8.7	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	25.9 ± 6.6	42.7 ± 10.9
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.3 ± 0.1	0.4 ± 0.1
PSD copy number	6 ± 1.5	7 ± 1.8
% in PSD	23.2 ± 5.9%	16.4 ± 4.2%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	25.9 ± 6.6	$0.0 \pm 0.0\%$	0.3 ± 0.1	6 ± 1.5
Stubby	42.7 ± 10.9	$0.0 \pm 0.0\%$	0.4 ± 0.1	7 ± 1.8



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	25.9 ± 6.6	$0.0 \pm 0.0\%$	0.3 ± 0.1	6 ± 1.5
Stubby	42.7 ± 10.9	$0.0 \pm 0.0\%$	0.4 ± 0.1	7 ± 1.8



References

Antibody: Novus Biologicals NBP1-87466

PDB Identifier: 5cxv

Literature:

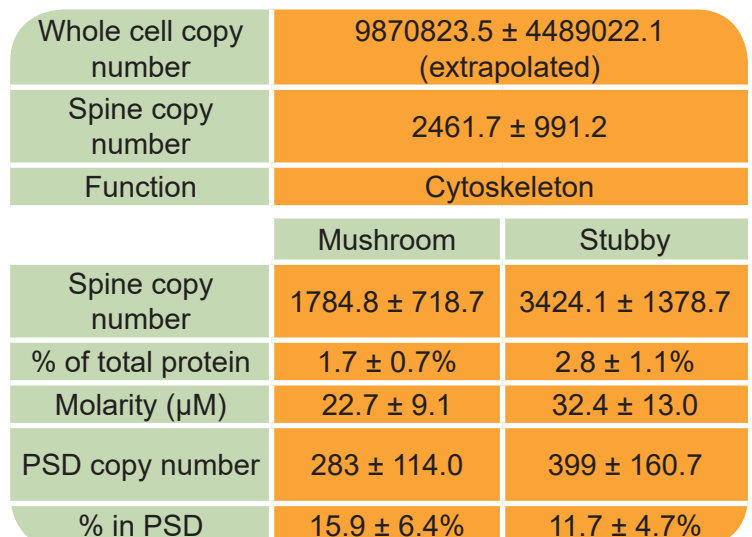
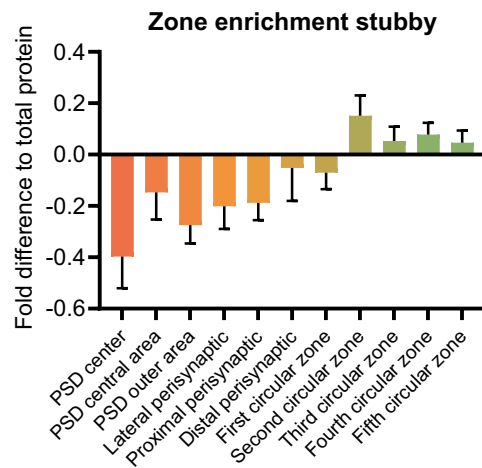
Egorov et al., 2002, Nature

Hersch et al., 1994, J. Neurosci.

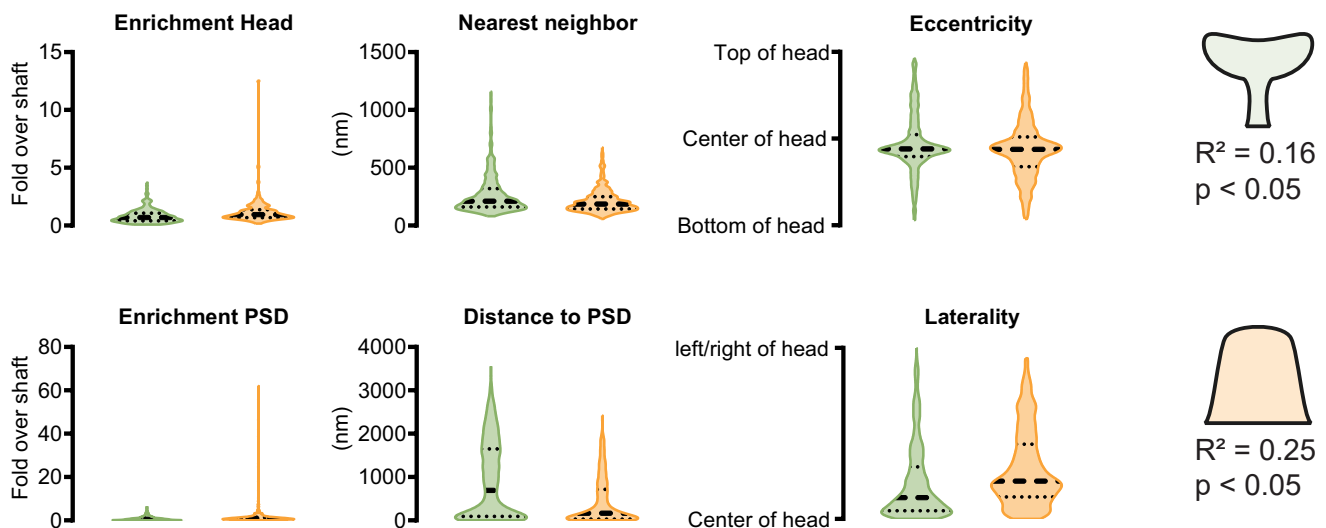
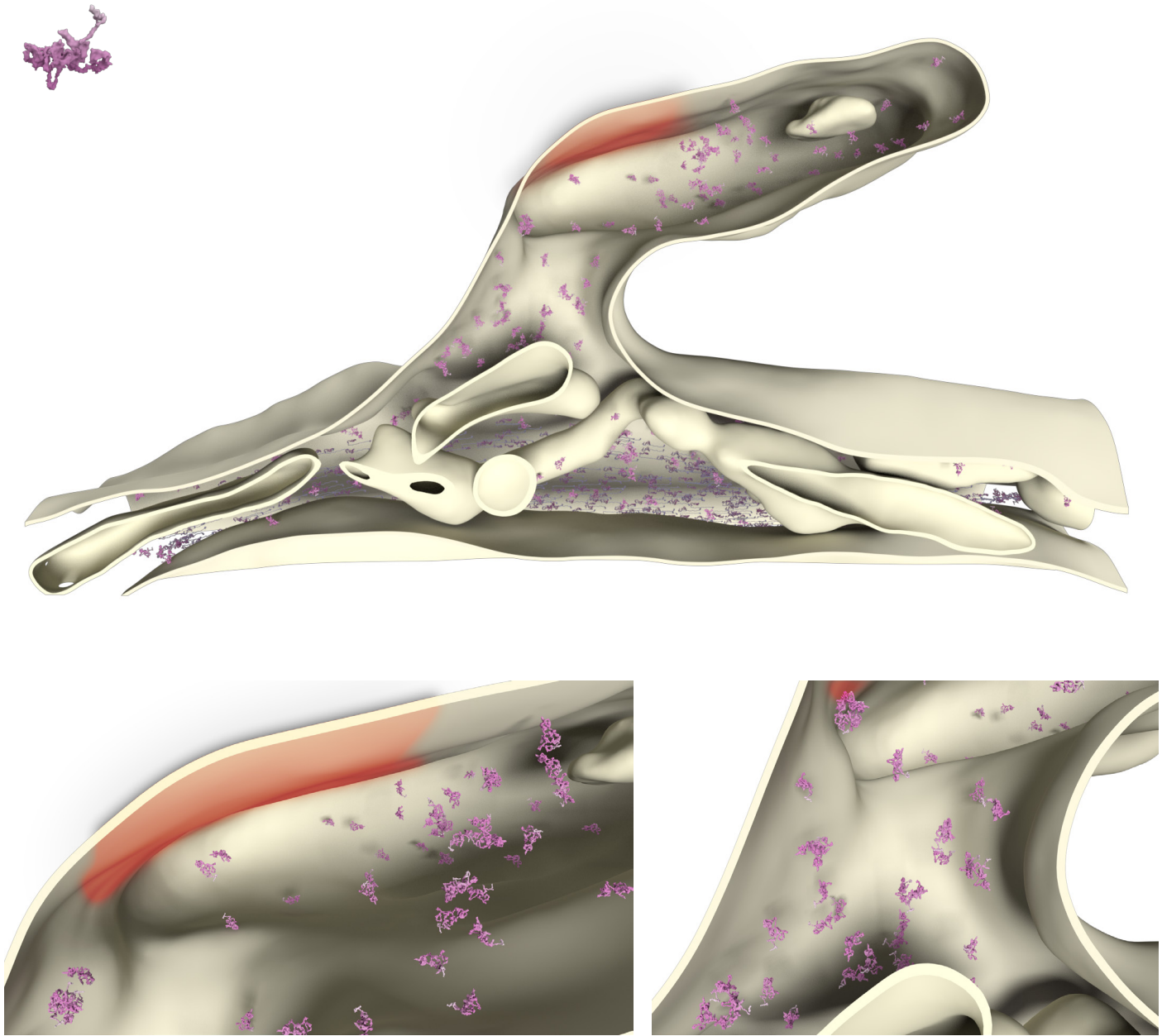
Smith and Araneda, 2010, J. Neurophysiol.

Uchimura and North, 1990, J. Physiol.

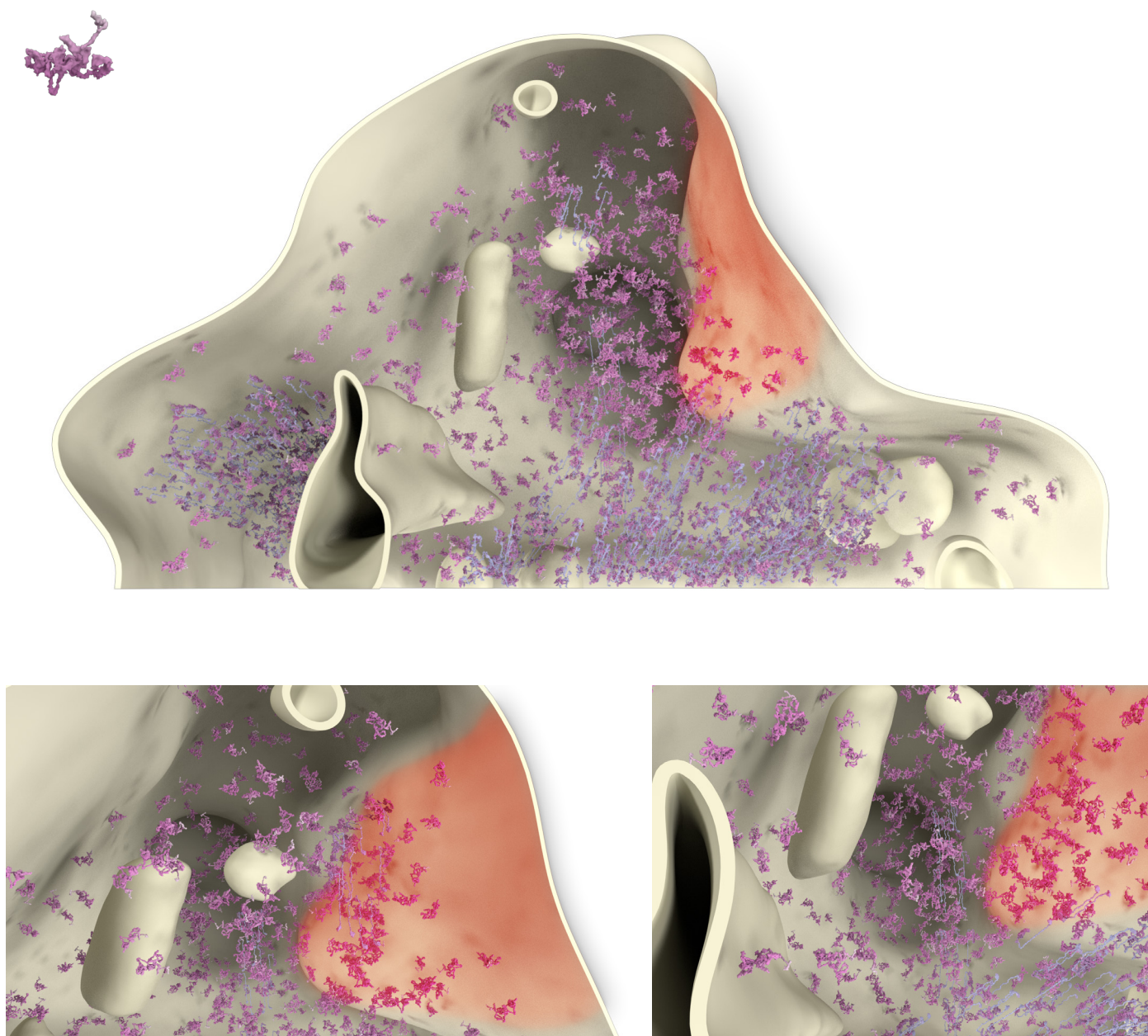
Known Interactions: Microtubules, Neurofilaments



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1784.8 ± 718.7	$1.7 \pm 0.7\%$	22.7 ± 9.1	283 ± 114.0
Stubby	3424.1 ± 1378.7	$2.8 \pm 1.1\%$	32.4 ± 13.0	399 ± 160.7



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1784.8 ± 718.7	$1.7 \pm 0.7\%$	22.7 ± 9.1	283 ± 114.0
Stubby	3424.1 ± 1378.7	$2.8 \pm 1.1\%$	32.4 ± 13.0	399 ± 160.7



References

Antibody: Synaptic Systems 188 002

PDB Identifier: 6cvn

Literature:

Farah and Leclerc, 2008, Cell Motil. Cytoskeleton.

Frappier et al., 1991, Biochem. J.

Hirokawa et al., 1996, J. Cell. Biol.

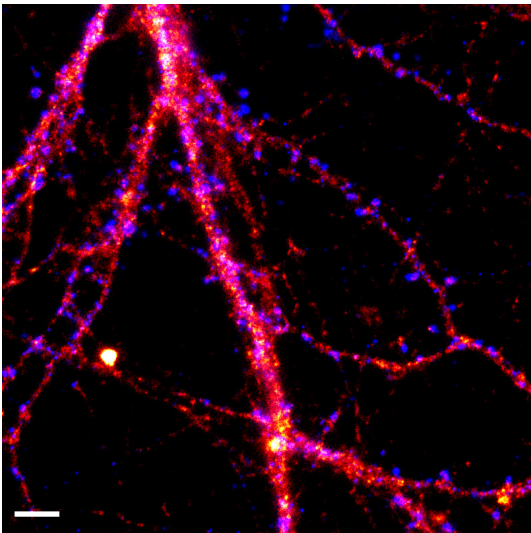
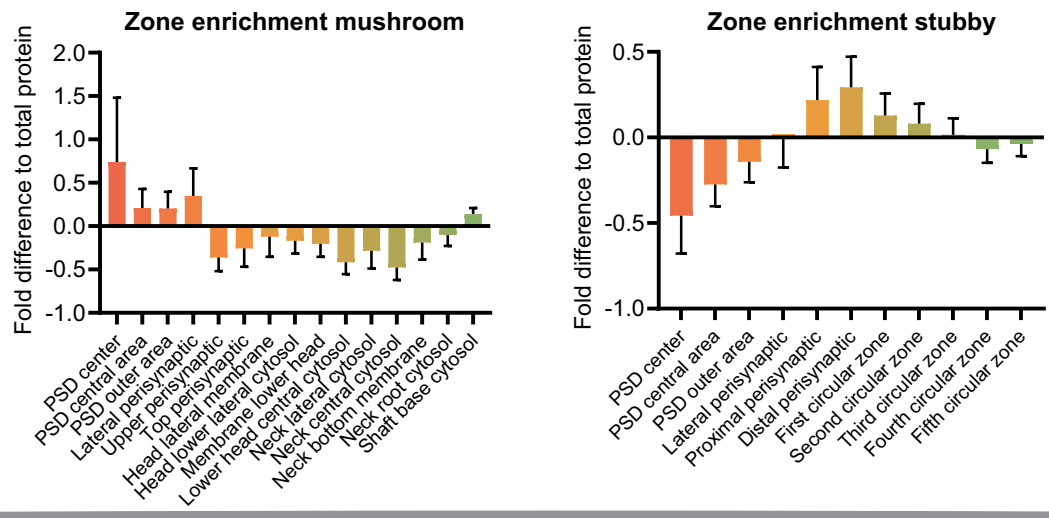
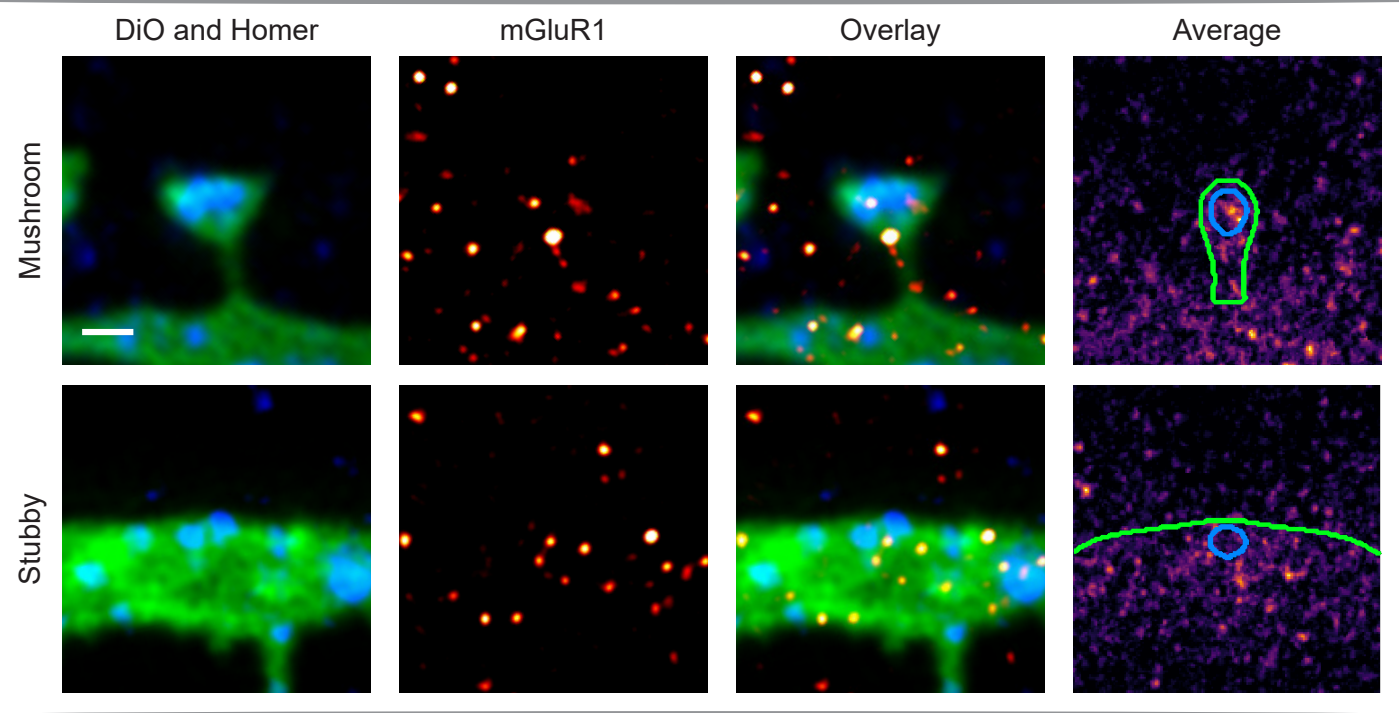
Jawdat Al-Bassam et al., 2002, J. Cell Biol.

mGluR1 (Gene: Grm1, Uniprot ID: P23385)

Known function: Activates PKC and PLC, Regulates intracellular calcium release, Involved in LTP and homeostatic plasticity, Activates cannabinoid synthesis

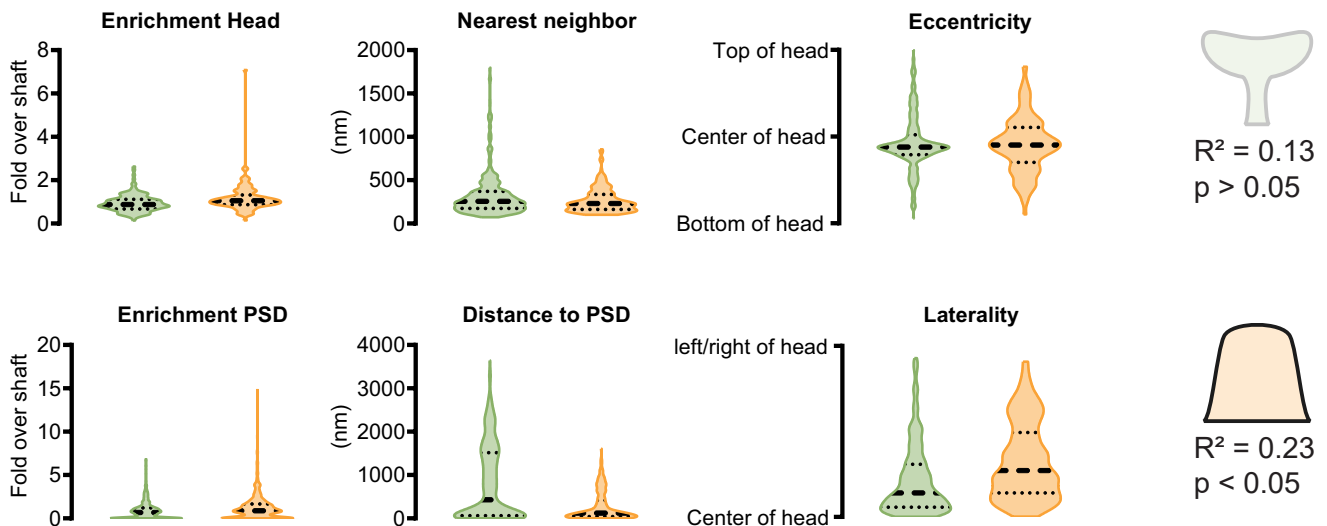
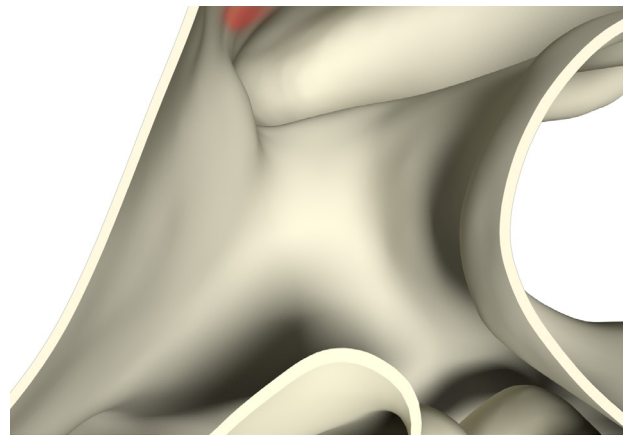
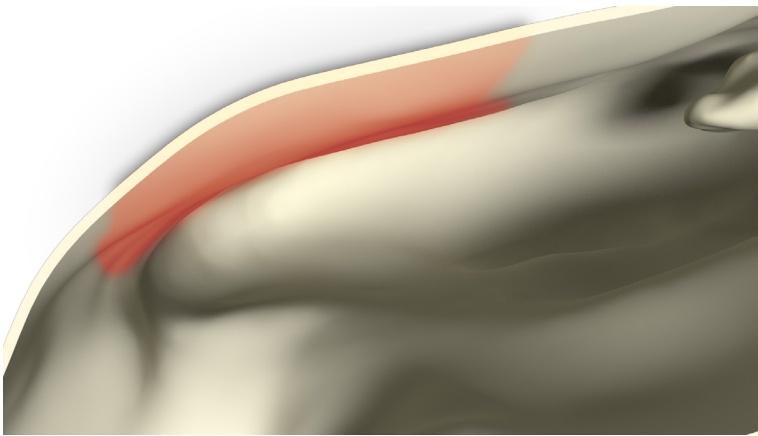
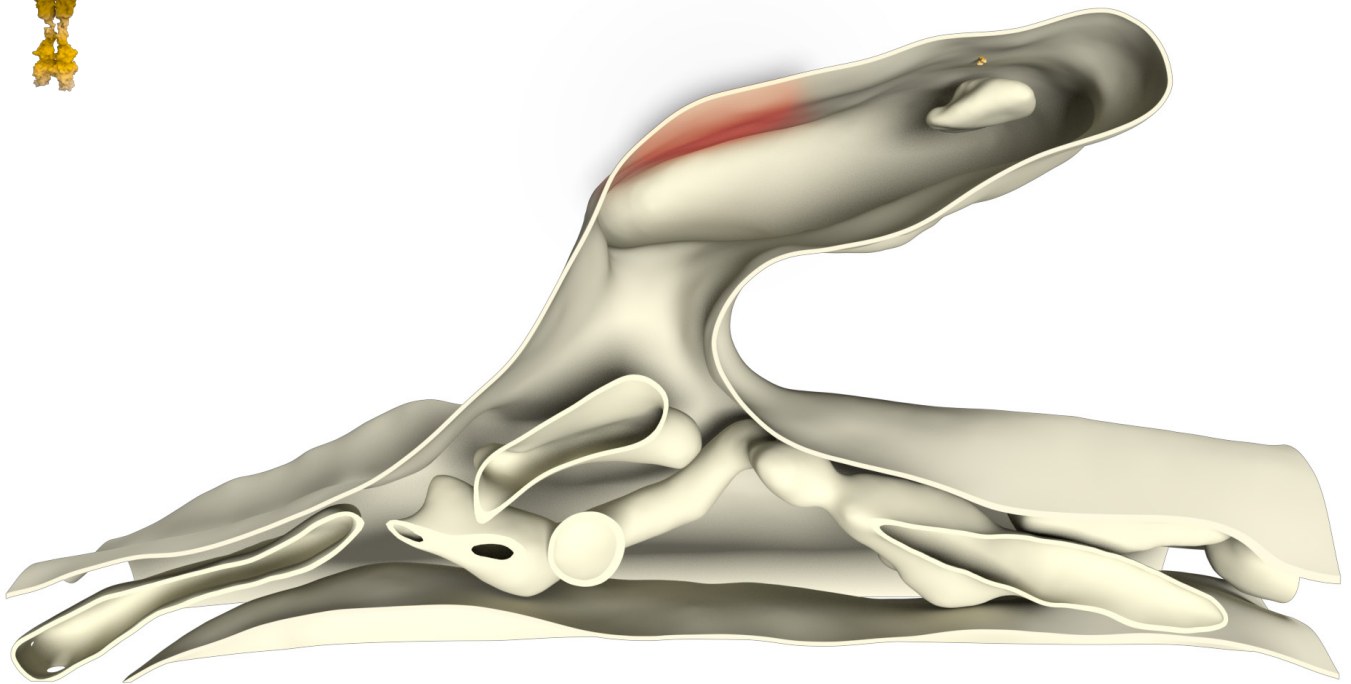
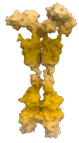
Known organization: Transmembrane protein, Perisynaptic

Known Interactions: G_q coupled, mGluR5, Homer proteins

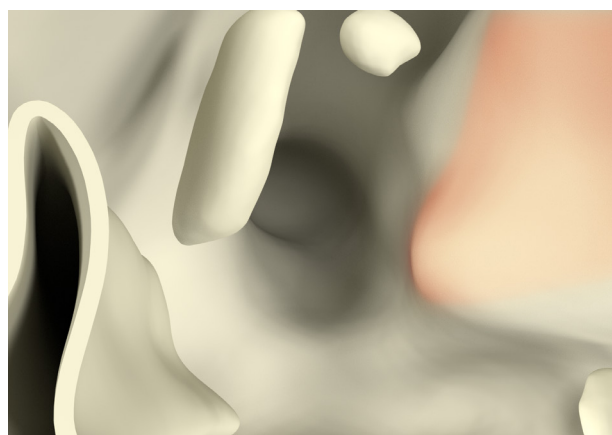
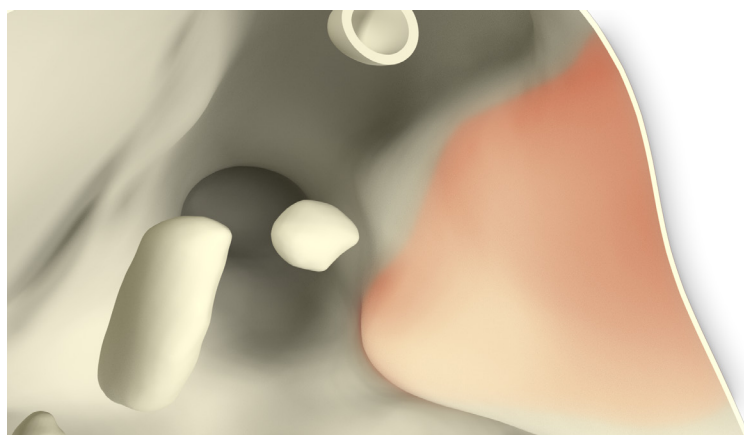
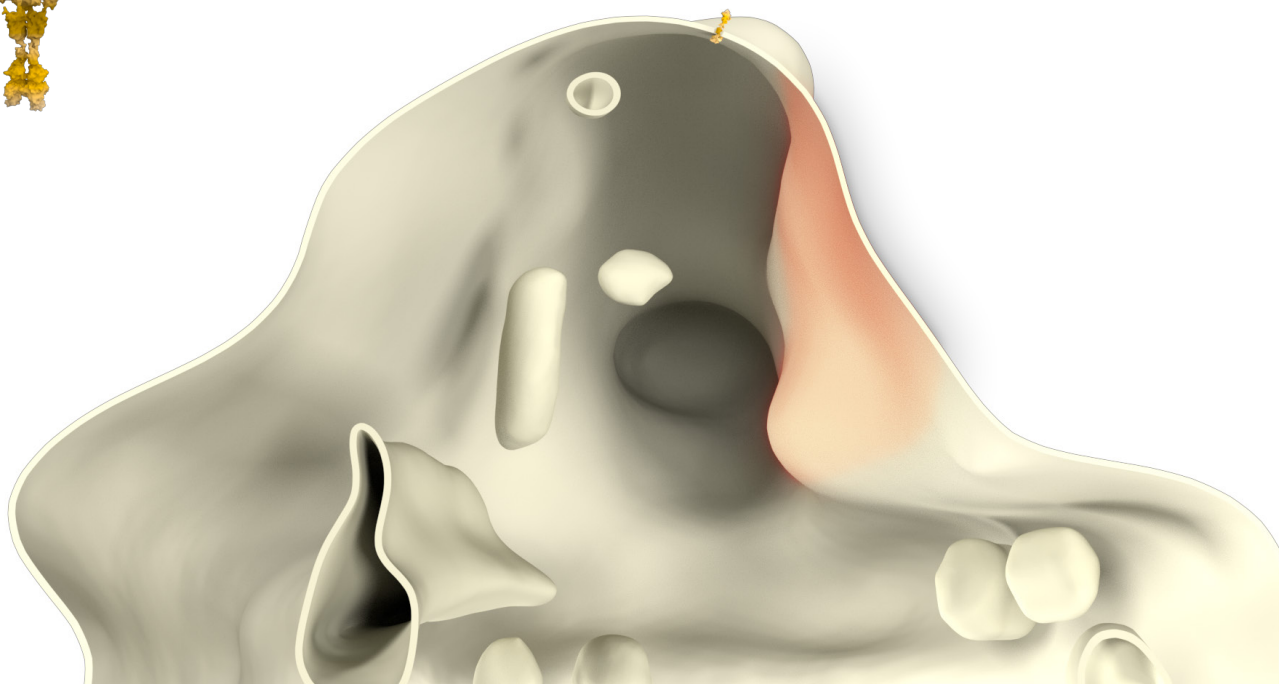


Whole cell copy number	8050.9 ± 4005.3	
Spine copy number	0.4 ± 0.3	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	0.4 ± 0.2	0.5 ± 0.3
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.0 ± 0.0	0.0 ± 0.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	0.4 ± 0.2	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	0.5 ± 0.3	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	0.4 ± 0.2	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	0.5 ± 0.3	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



References

Antibody: Abcam ab51314

PDB Identifier: 1ewk, 1ewt, 2e4u, 4or2, 3ks9

Literature:

Feng et al., 2002, J. Biol. Chem.

Hu et al., 2010, Neuron

Kato et al., 2008, Neuron

Kitano et al., 2003, J. Biol. Chem.

Maejima et al., 2001, Neuron

Mansouri et al., 2015, Eur. J. Neurosci.

Pandya et al., 2016, Proteomics

Park et al., 2008, Neuron

Roche et al., 1999, J. Biol. Chem.

Skeberdis et al., 2001, Neuropharmacology

Techlovská et al., 2014, Neuropharmacology

Tu et al., 1998, Neuron

Xiao et al., 1998, Neuron

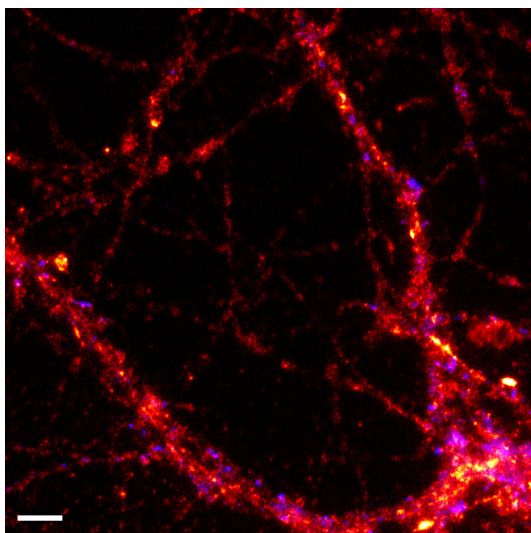
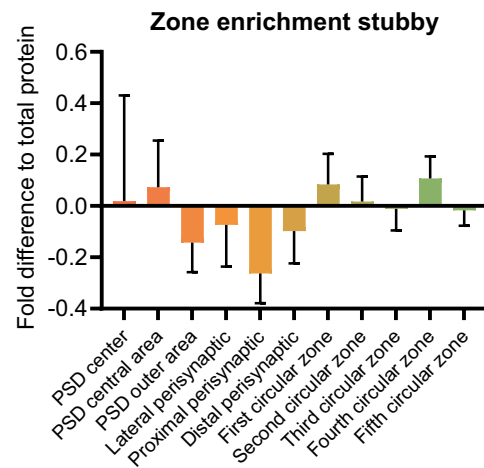
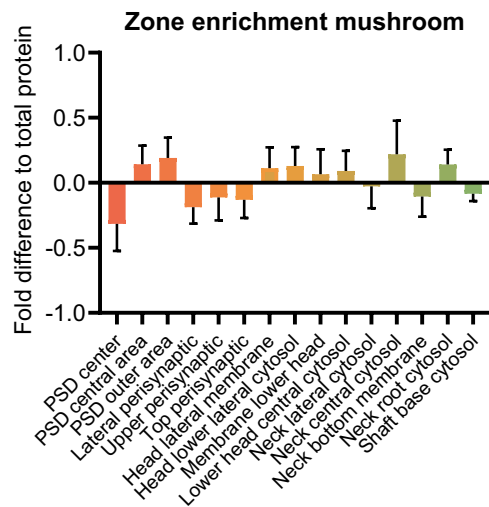
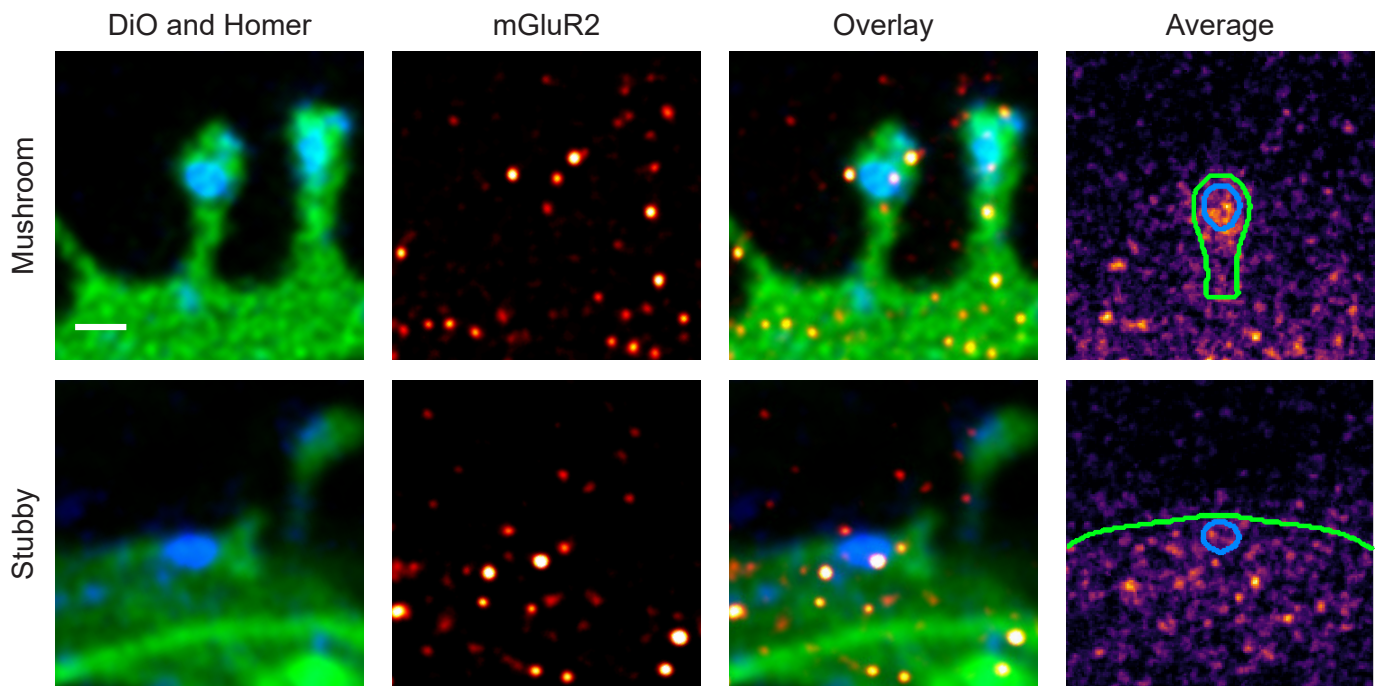
Yuan et al., 2003, Cell

mGluR2 (Gene: Grm2, Uniprot ID: P31421)

Known function: Inhibits PLC, Regulates intracellular calcium release

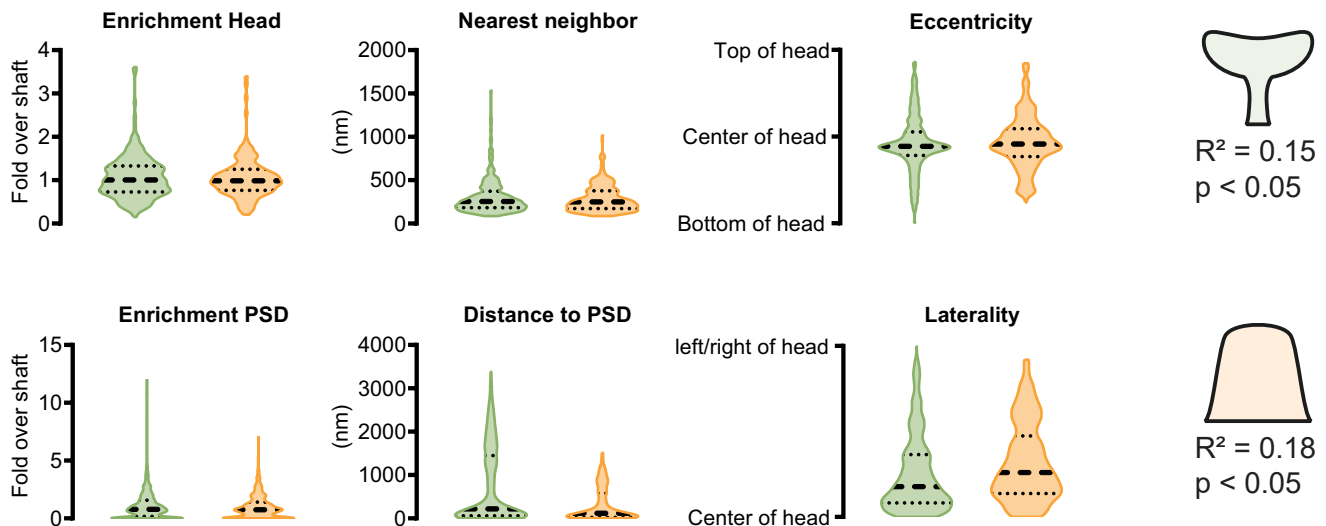
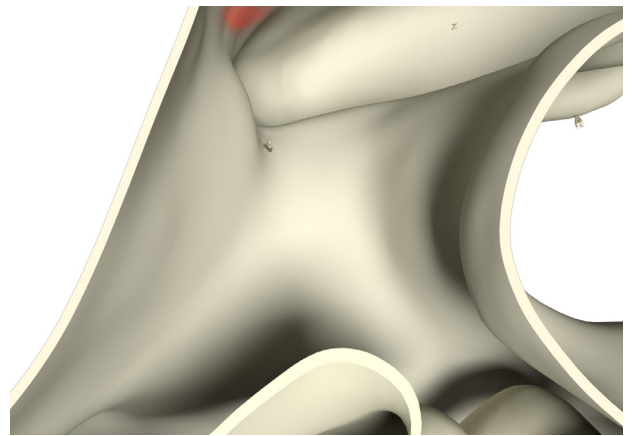
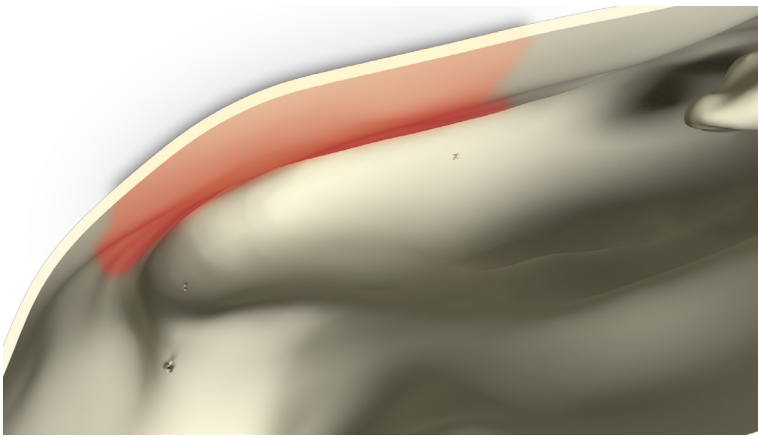
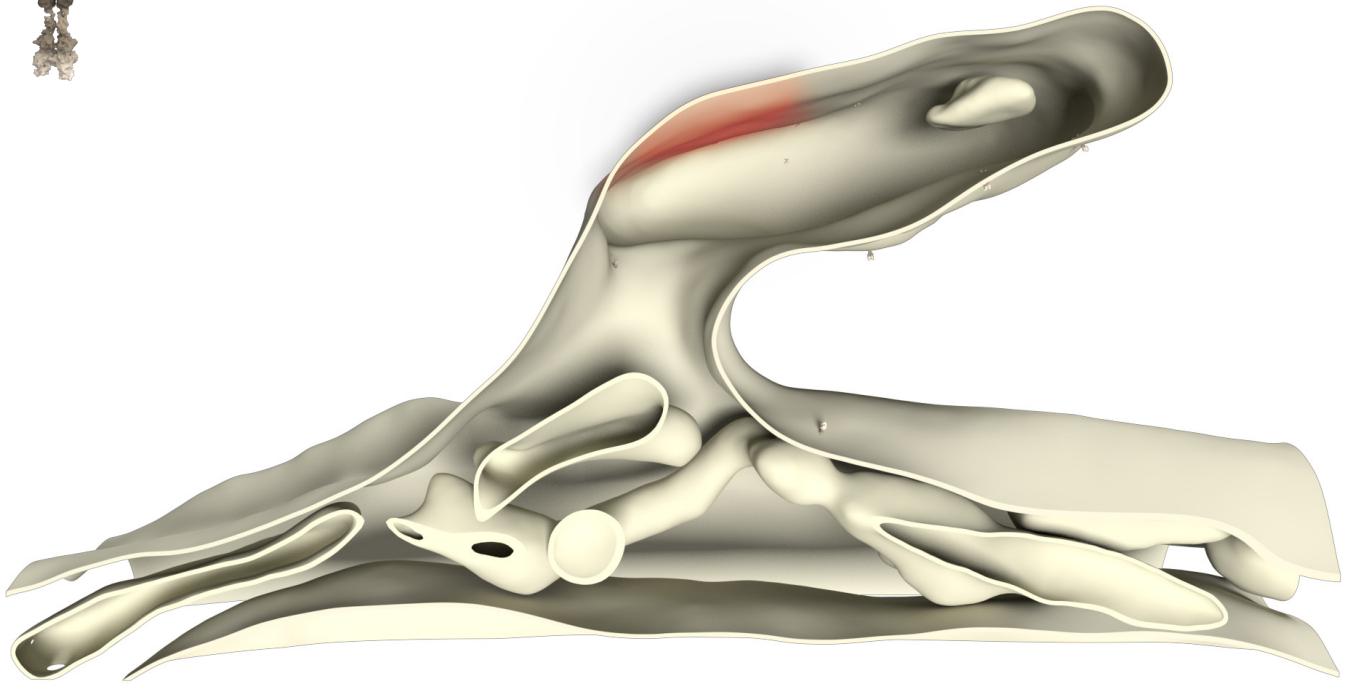
Known organization: Poorly understood

Known Interactions: G_i coupled, GRIP

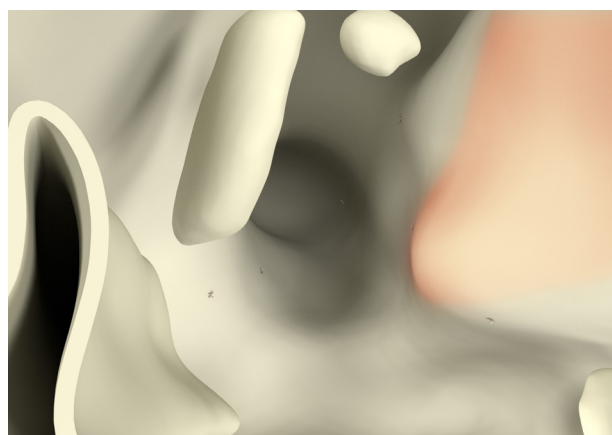
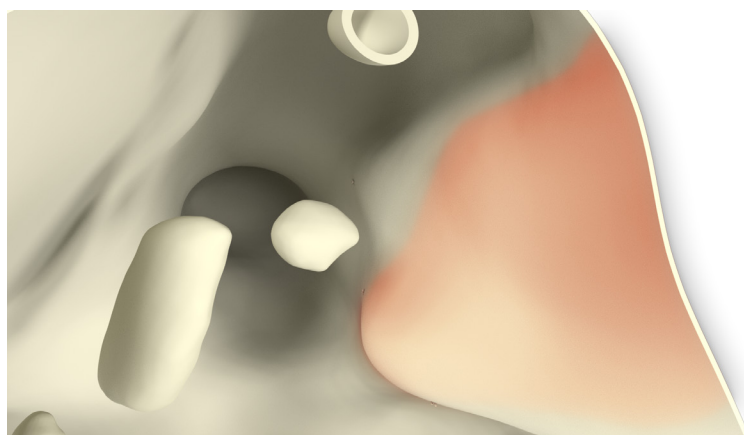
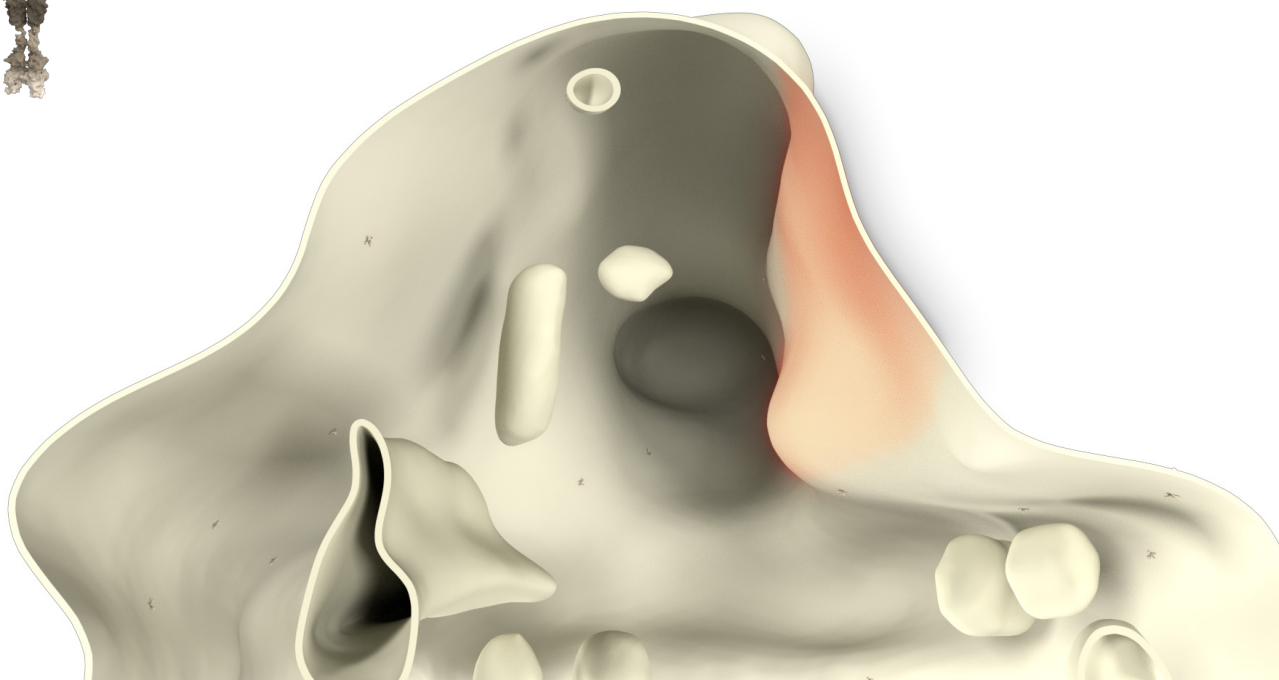


Whole cell copy number	741301.6 ± 379907.8 (extrapolated)	
Spine copy number	53.2 ± 16.6	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	41.9 ± 13.1	67.0 ± 20.9
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.5 ± 0.2	0.6 ± 0.2
PSD copy number	8 ± 2.5	6 ± 1.9
% in PSD	19.1 ± 5.9%	9.0 ± 2.8%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	41.9 ± 13.1	$0.0 \pm 0.0\%$	0.5 ± 0.2	8 ± 2.5
Stubby	67.0 ± 20.9	$0.0 \pm 0.0\%$	0.6 ± 0.2	6 ± 1.9



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	41.9 ± 13.1	$0.0 \pm 0.0\%$	0.5 ± 0.2	8 ± 2.5
Stubby	67.0 ± 20.9	$0.0 \pm 0.0\%$	0.6 ± 0.2	6 ± 1.9



References

Antibody: Abcam ab150387

PDB Identifier: modified mGluR1

Literature:

Ambrosini et al., 1995, Mol. Pharmacol.

Cai et al., 2001, J Neurochem.

Hirbec et al., 2002, J. Biol. Chem.

Jin et al., 2017, Mol. Psychiatry.

Kato et al., 2008, Neuron

Roche et al., 1999, J. Biol. Chem.

Schaffhauser et al., 2000, J. Neurosci.

Tu et al., 1998, Neuron

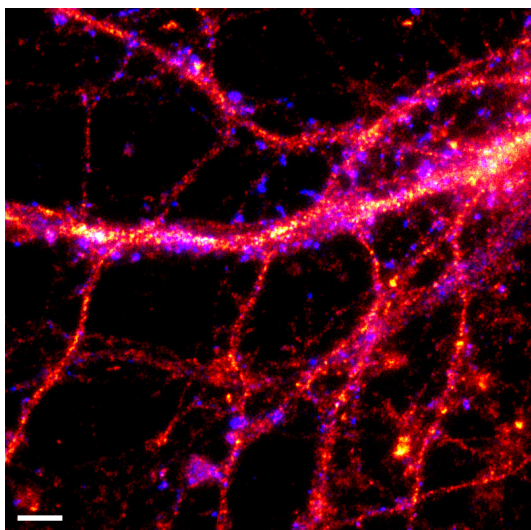
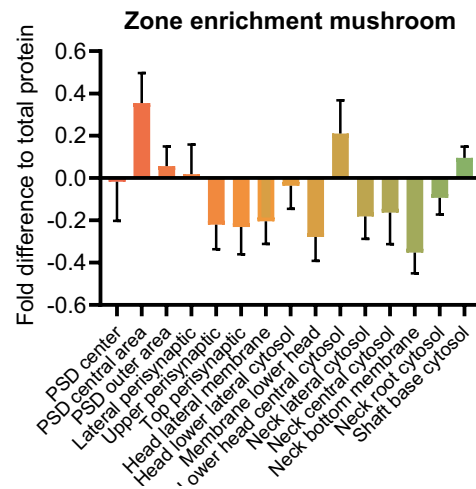
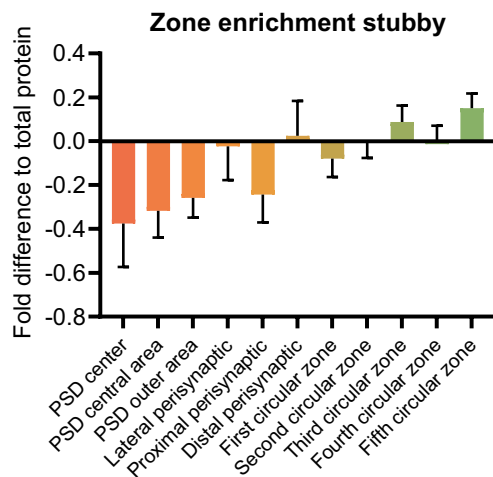
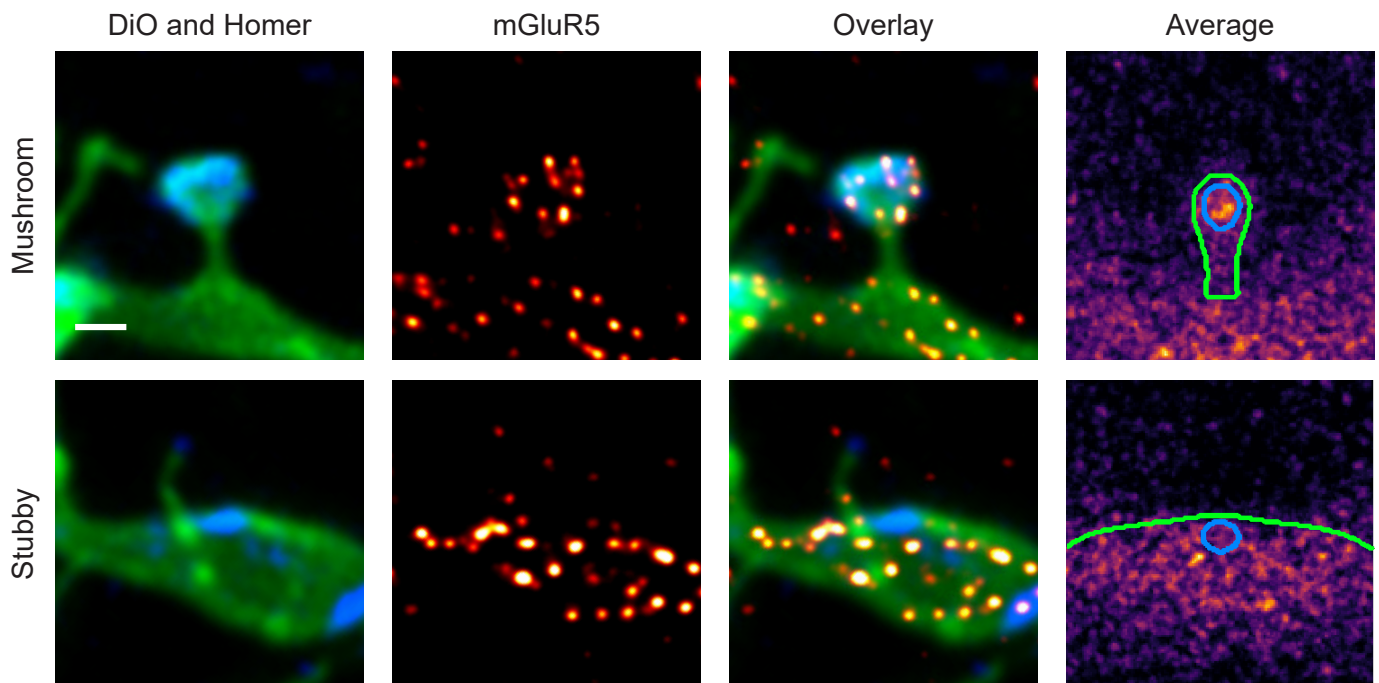
Xiao et al., 1998, Neuron

mGluR5 (Gene: Grm5, Uniprot ID: P31424)

Known function: Activates PKC and PLC, Regulates intracellular calcium release, Involved in LTP and homeostatic plasticity, Activates cannabinoid synthesis

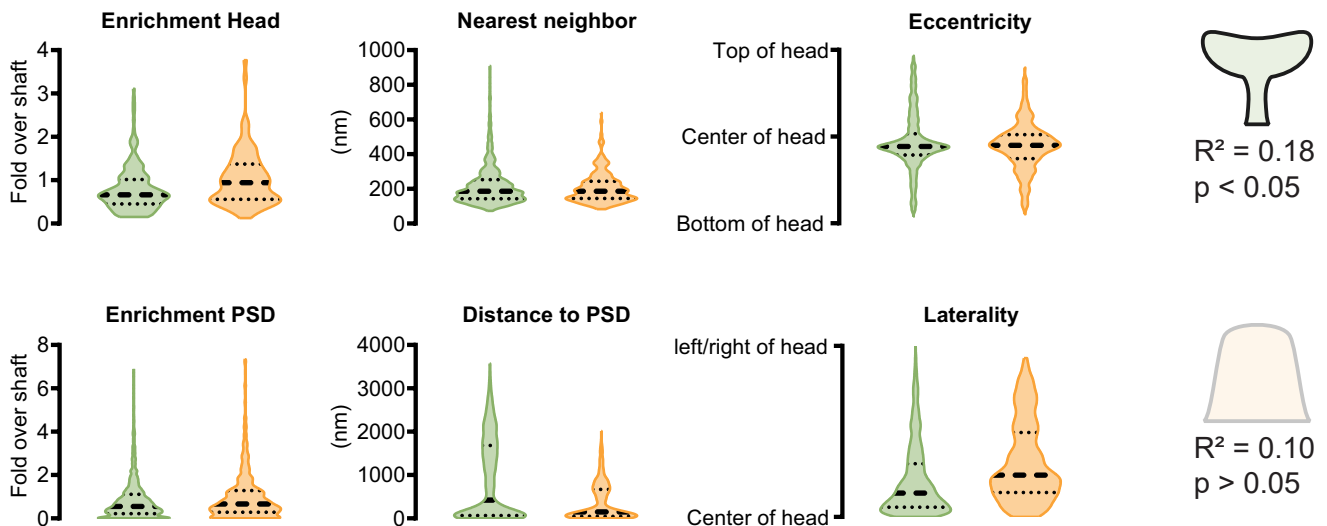
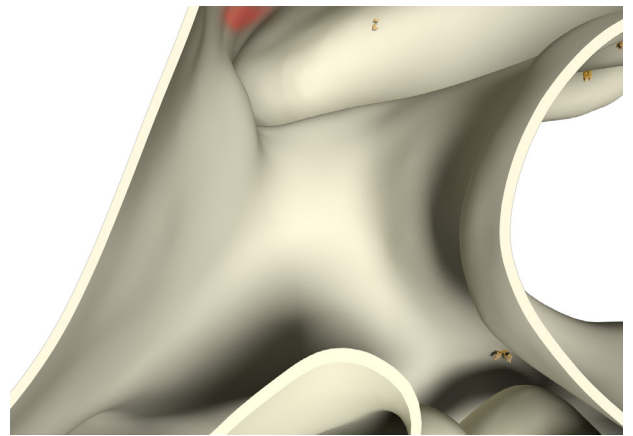
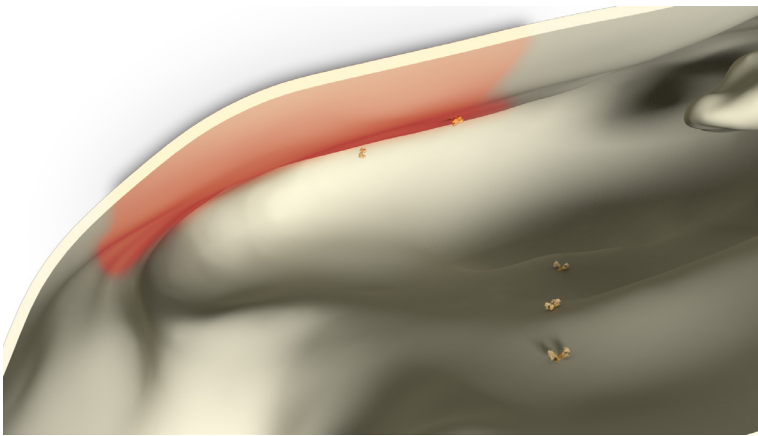
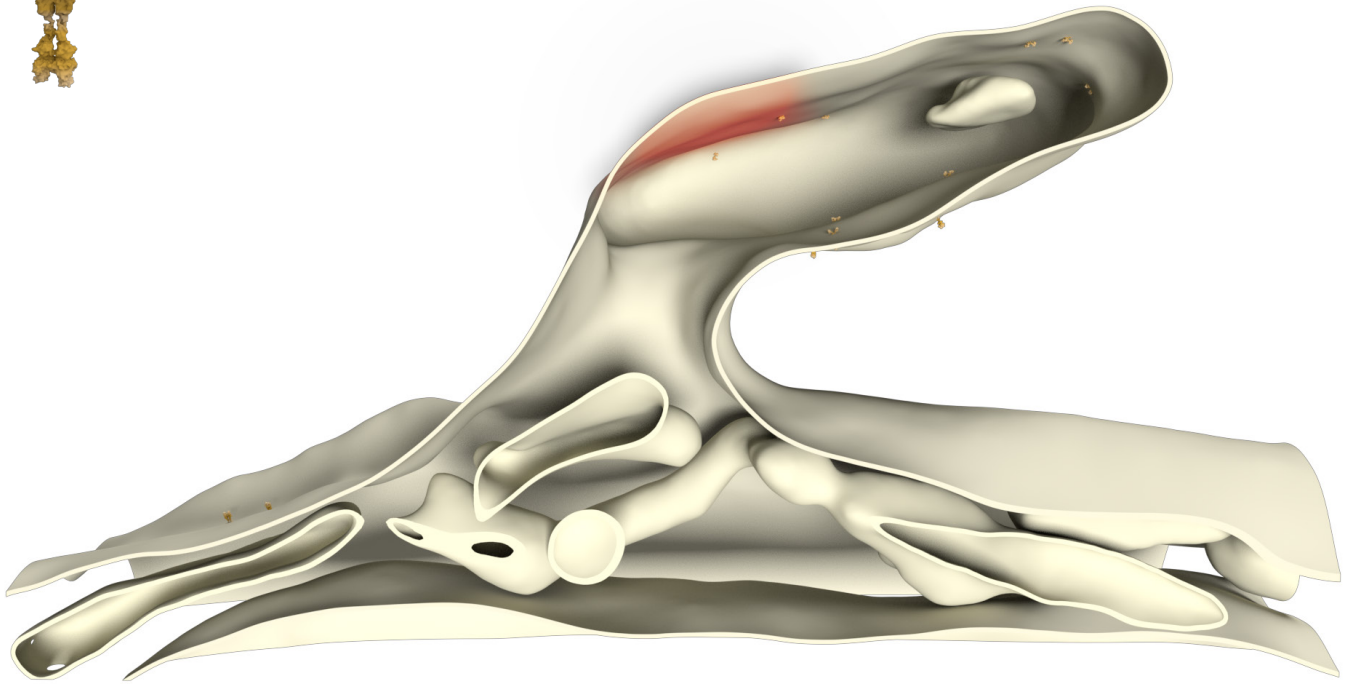
Known organization: Transmembrane protein, Perisynaptic

Known Interactions: G_q coupled, mGluR1, Homer proteins

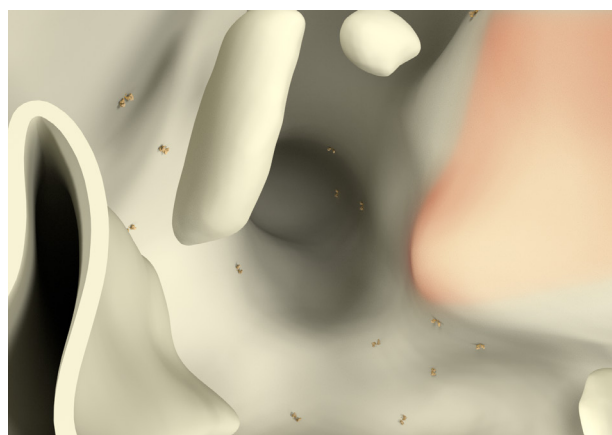
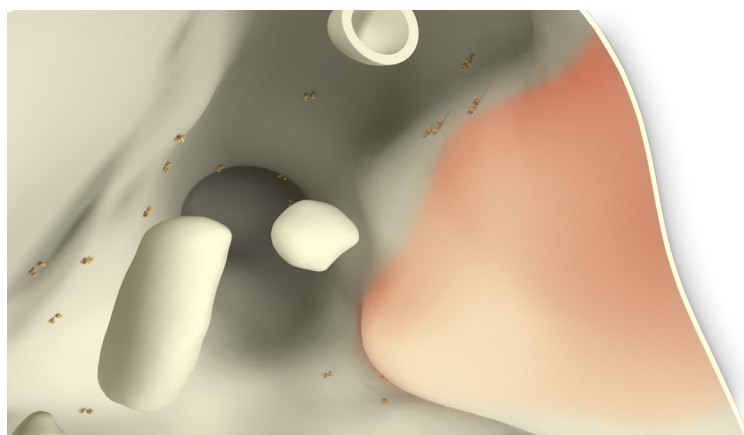


Whole cell copy number	390630.7 ± 122503 (extrapolated)	
Spine copy number	108.3 ± 26.7	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	80.3 ± 19.8	152.7 ± 37.7
% of total protein	0.1 ± 0.0%	0.1 ± 0.0%
Molarity (μM)	1.0 ± 0.3	1.4 ± 0.4
PSD copy number	26 ± 6.4	10 ± 2.5
% in PSD	32.4 ± 8.0%	6.6 ± 1.6%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	80.3 ± 19.8	$0.1 \pm 0.0\%$	1.0 ± 0.3	26 ± 6.4
Stubby	152.7 ± 37.7	$0.1 \pm 0.0\%$	1.4 ± 0.4	10 ± 2.5



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	80.3 ± 19.8	$0.1 \pm 0.0\%$	1.0 ± 0.3	26 ± 6.4
Stubby	152.7 ± 37.7	$0.1 \pm 0.0\%$	1.4 ± 0.4	10 ± 2.5



References

Antibody: Abcam ab76316

PDB Identifier: 3lmk, 5cgd

Literature:

Feng et al., 2002, J. Biol. Chem.

Hu et al., 2010, Neuron

Kitano et al., 2003, J. Biol. Chem.

Maejima et al., 2001, Neuron

Mansouri et al., 2015, Eur. J. Neurosci.

Pandya et al., 2016, Proteomics

Park et al., 2008, Neuron

Skeberdis et al., 2001, Neuropharmacology

Techlovská et al., 2014, Neuropharmacology

Roche et al., 1999, J. Biol. Chem.

Tu et al., 1998, Neuron

Pandya et al., 2016, Proteomics

Kato et al., 1998, J. Biol. Chem.

Xiao et al., 1998, Neuron

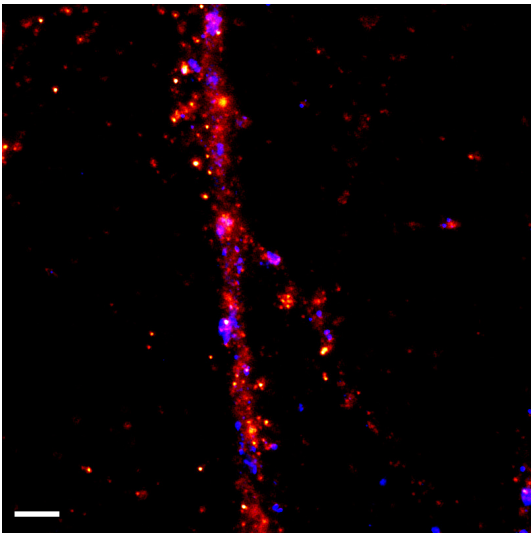
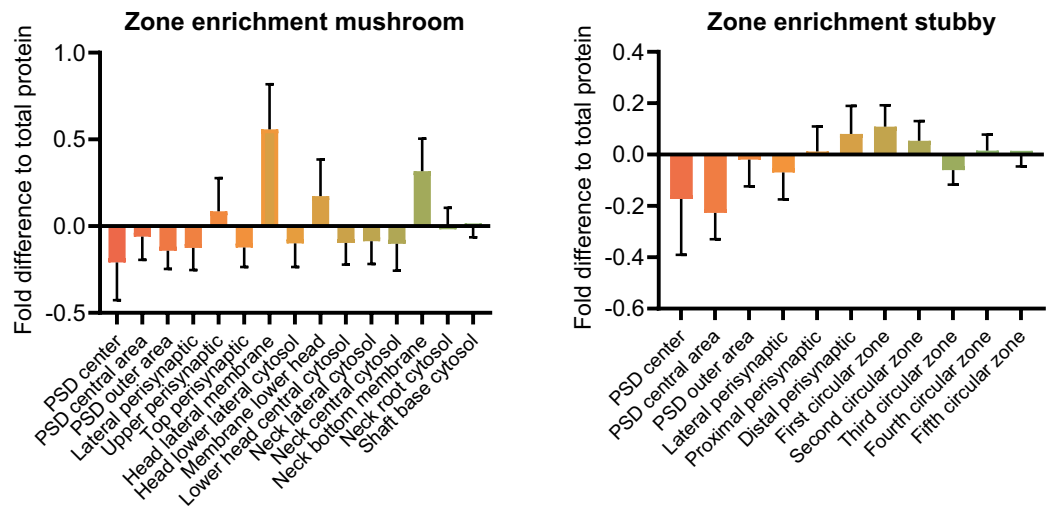
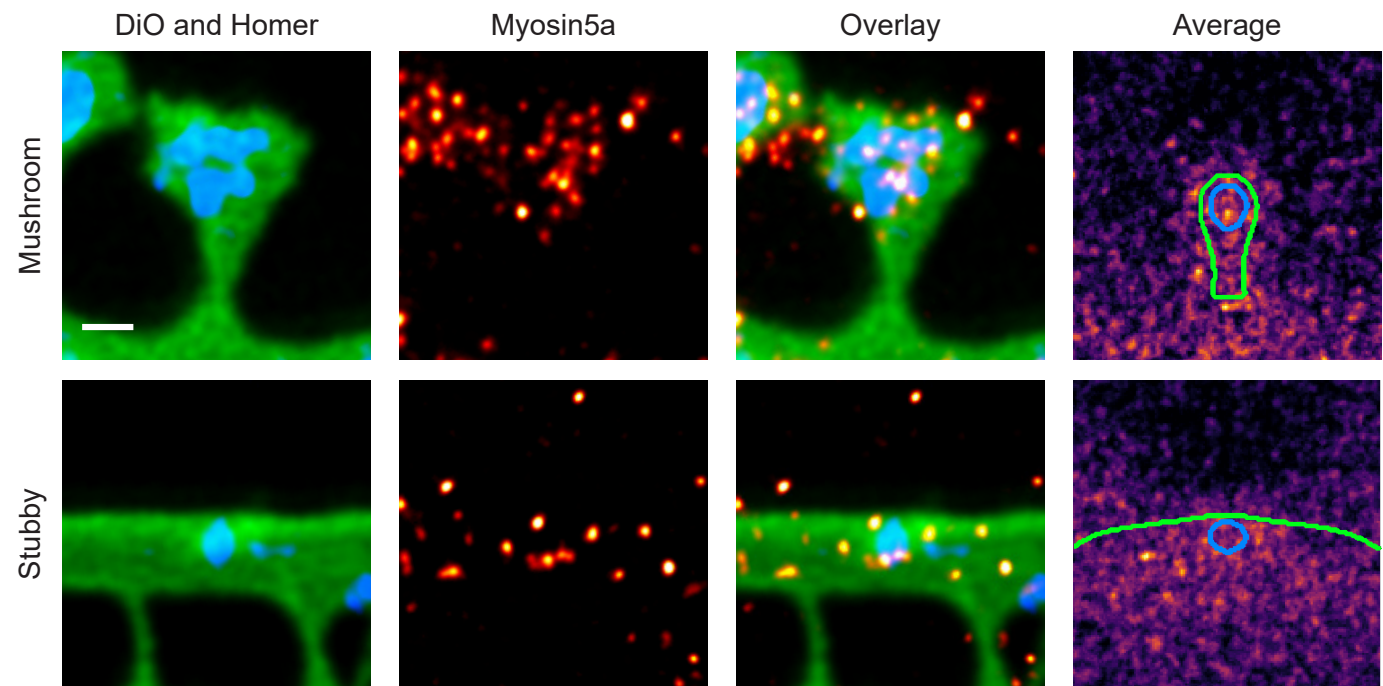
Yuan et al., 2003, Cell

Myosin5a (Gene: Myo5a, Uniprot ID: Q9QYF3)

Known function: Transport of GluR1 and GluR2 during LTP, Regulates ER localization, Transport of various other cargos

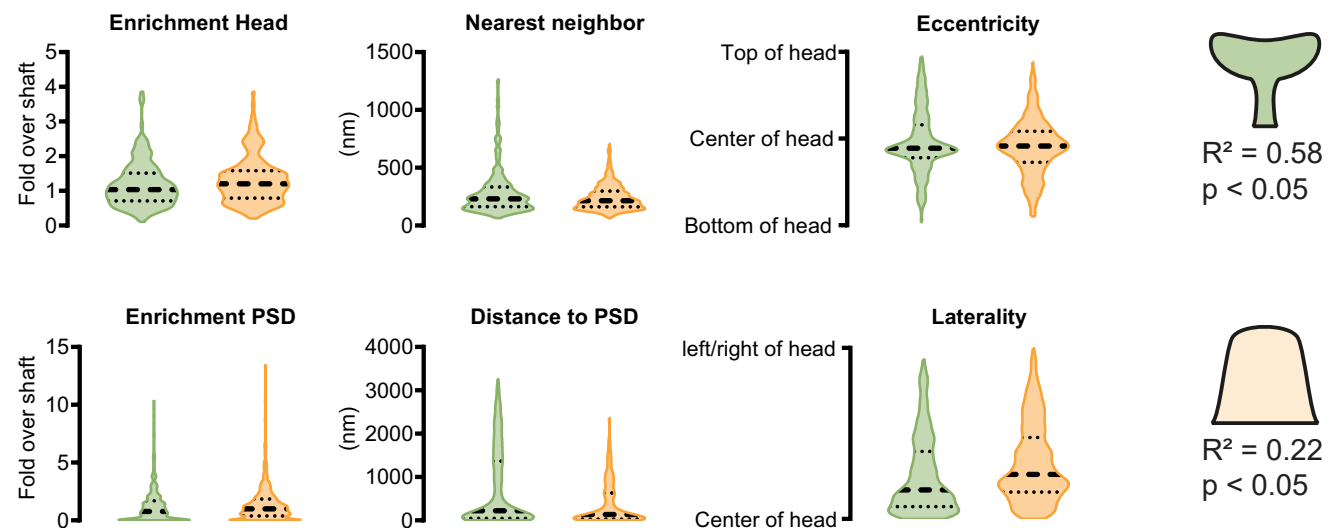
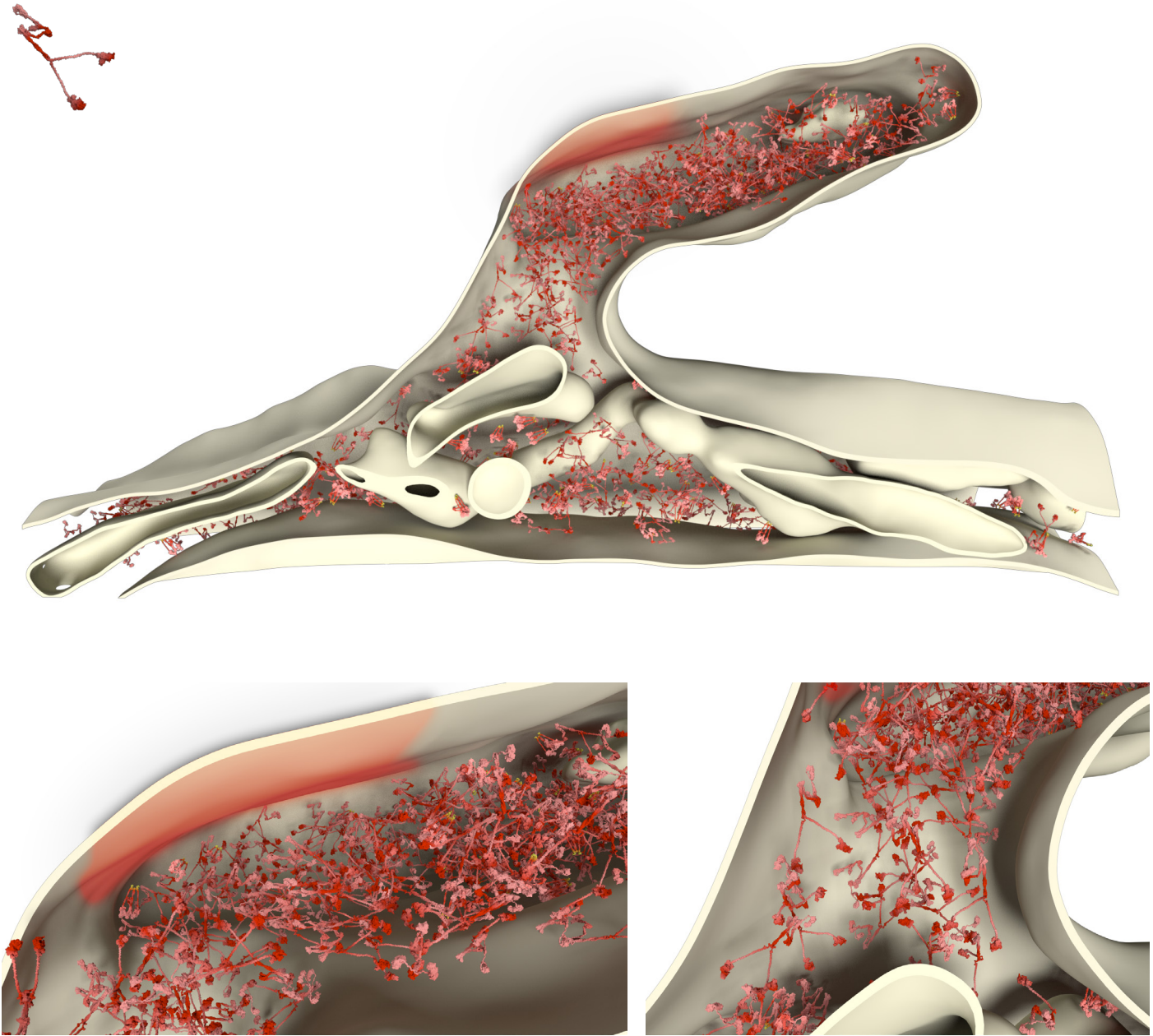
Known organization: Cytosolic

Known Interactions: Actin

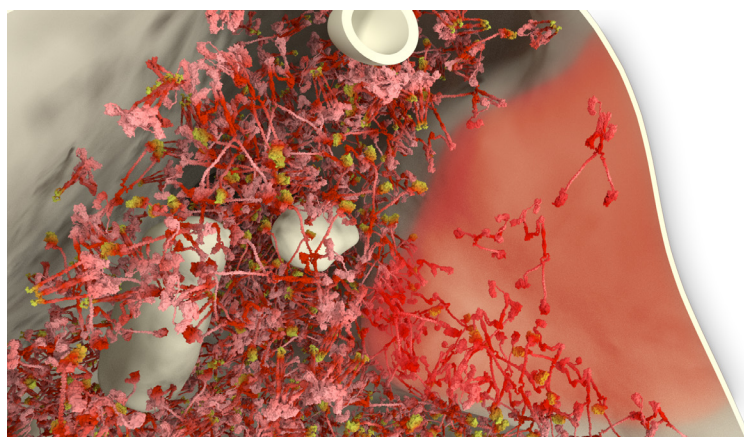
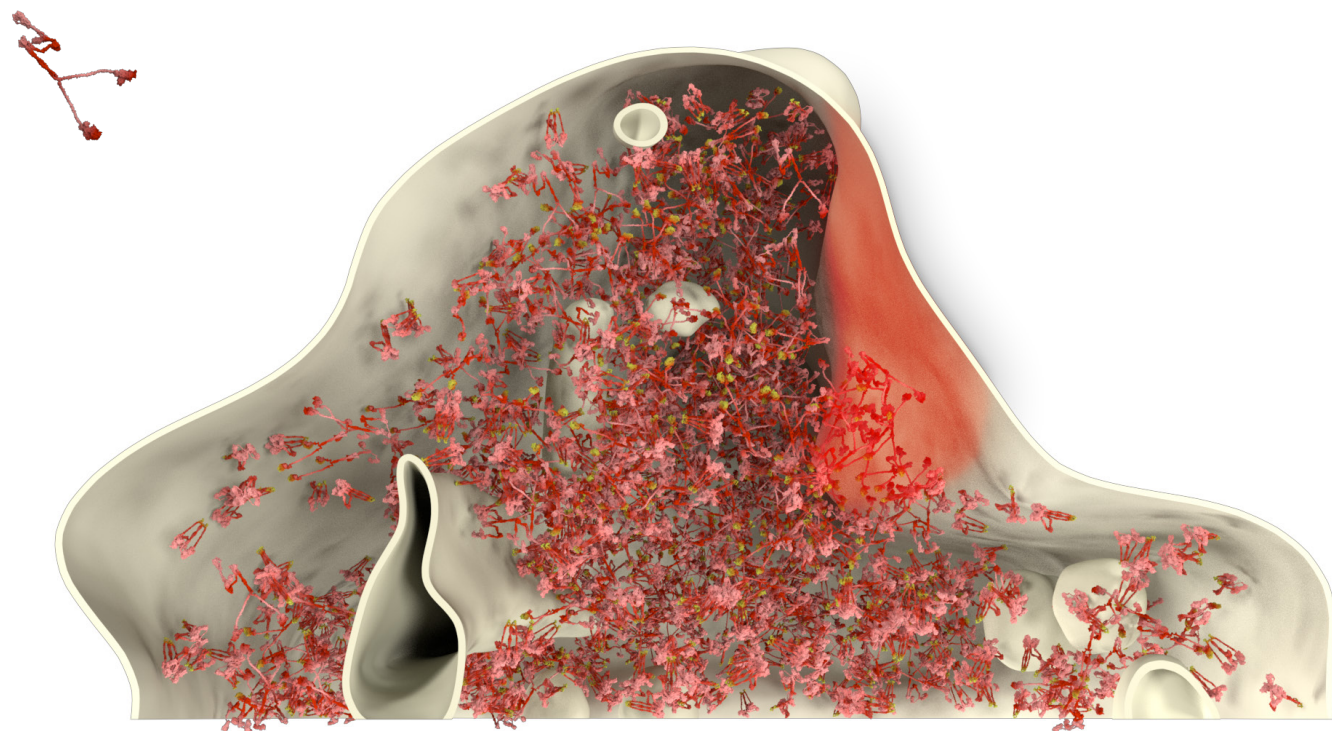


Whole cell copy number	150424230.8 ± 235143509.7 (extrapolated)	
Spine copy number	3802.9 ± 3100.7	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	2986.8 ± 2435.3	4938.1 ± 4026.3
% of total protein	3.1 ± 2.5%	4.4 ± 3.6%
Molarity (µM)	37.9 ± 30.9	46.7 ± 38.1
PSD copy number	382 ± 311.5	576 ± 469.6
% in PSD	12.8 ± 10.4%	11.7 ± 9.5%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	2986.8 ± 2435.3	$3.1 \pm 2.5\%$	37.9 ± 30.9	382 ± 311.5
Stubby	4938.1 ± 4026.3	$4.4 \pm 3.6\%$	46.7 ± 38.1	576 ± 469.6



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	2986.8 ± 2435.3	$3.1 \pm 2.5\%$	37.9 ± 30.9	382 ± 311.5
Stubby	4938.1 ± 4026.3	$4.4 \pm 3.6\%$	46.7 ± 38.1	576 ± 469.6



References

Antibody: Sigma-Aldrich M5062

PDB Identifier: 2dfs

Literature:

Correia et al., 2008, Nat. Neurosci.

Lisé et al., 2006, J. Biol. Chem.

Miyata et al., 2000, Neuron

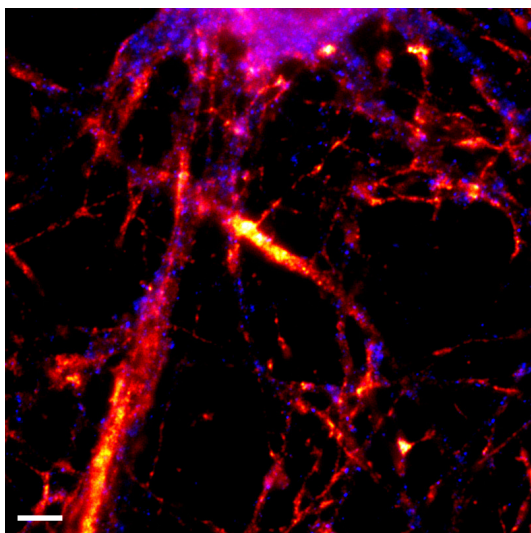
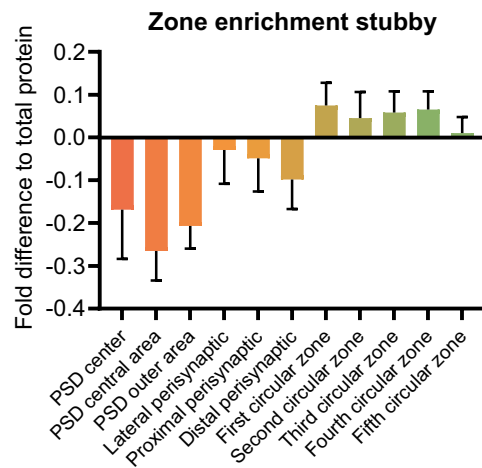
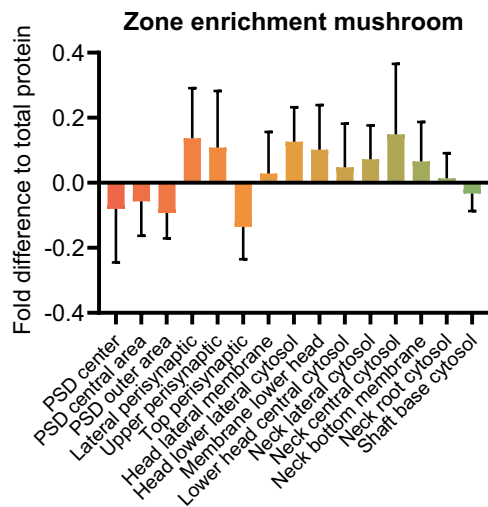
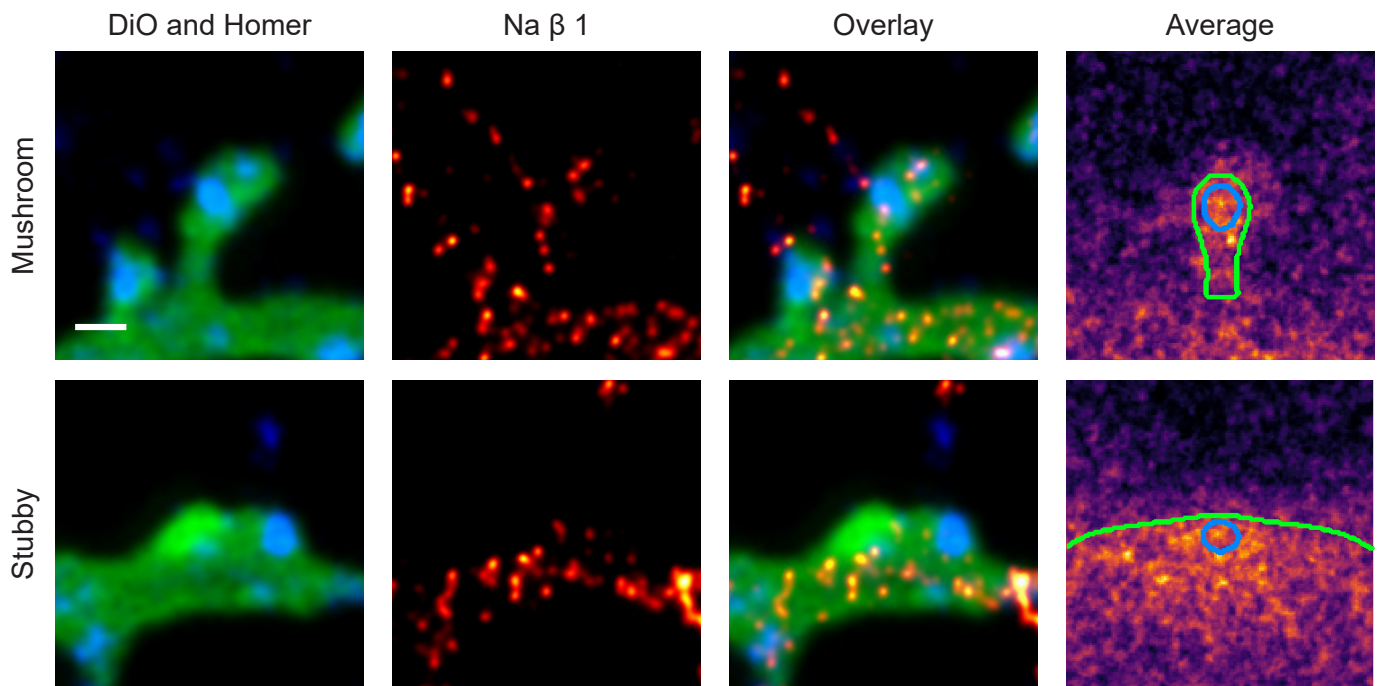
Rudolf et al., 2011, J. Neurochem.

Na β 1 (Gene: Scnb1, Uniprot ID: Q00954)

Known function: Modulates sodium channel properties, Acts as adhesion molecule

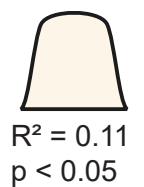
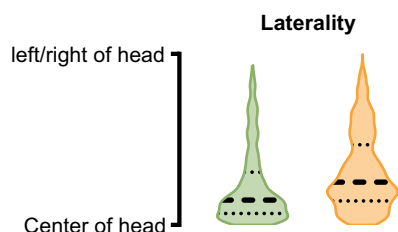
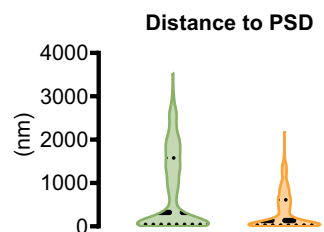
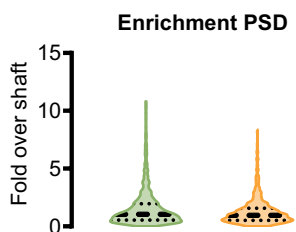
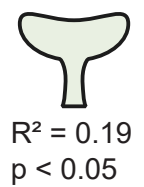
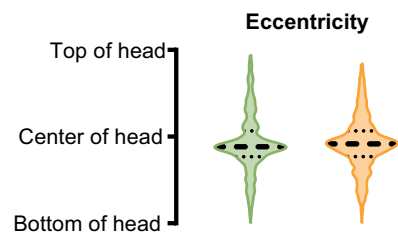
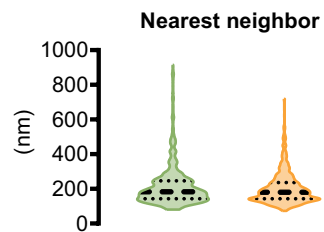
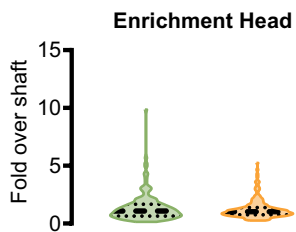
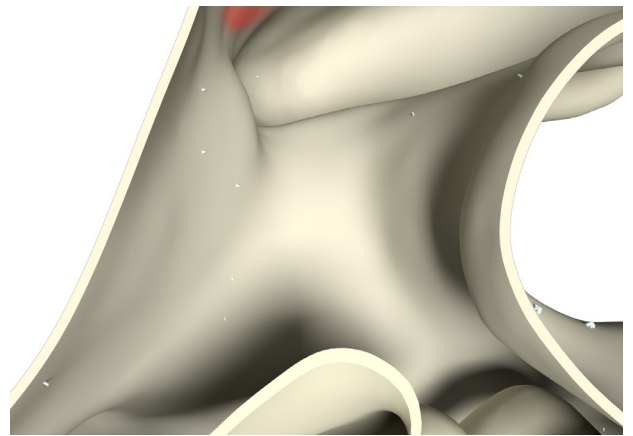
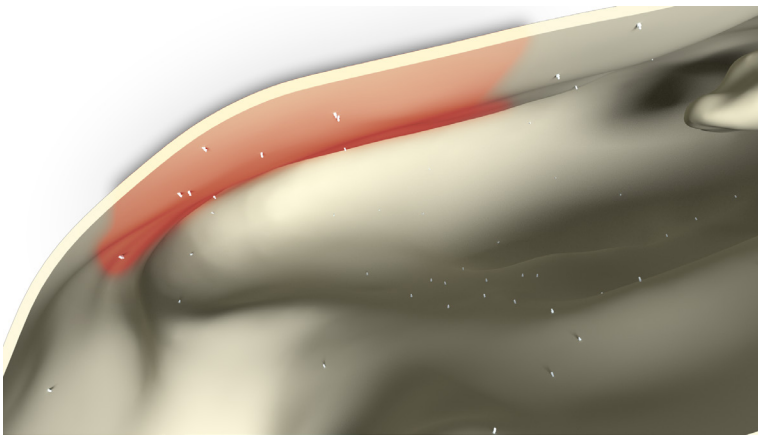
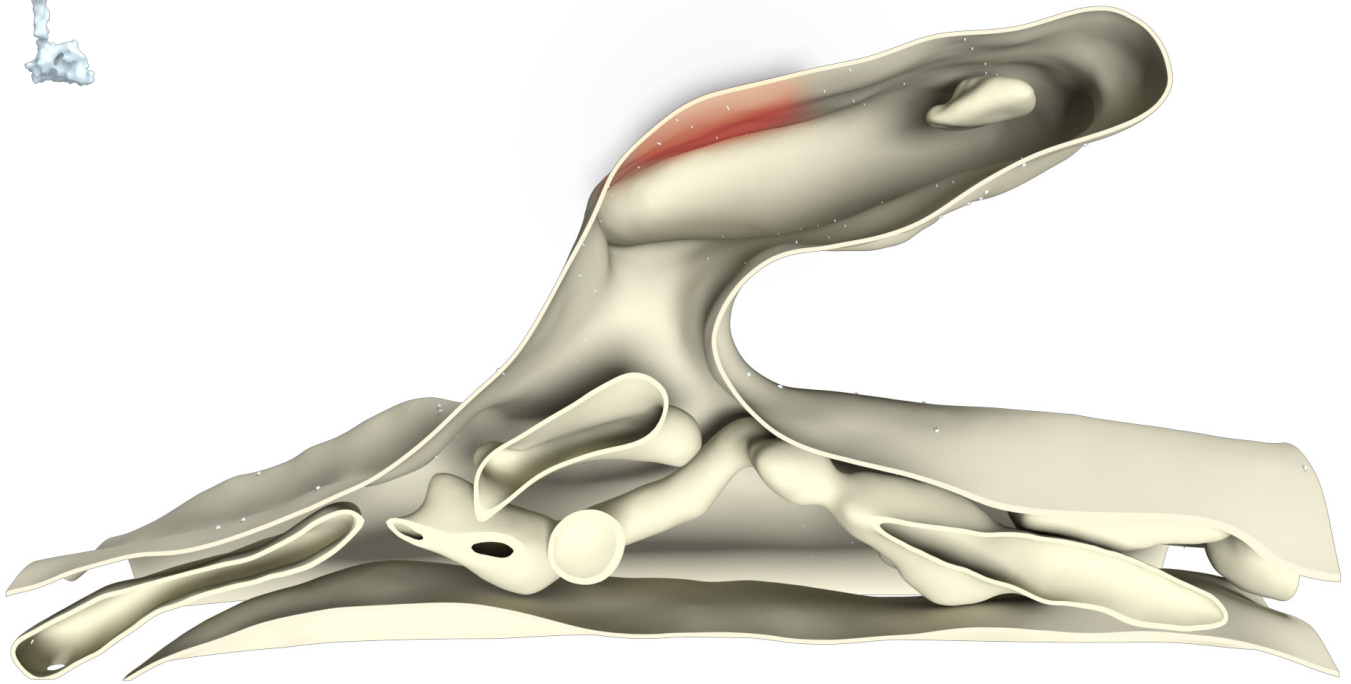
Known organization: Transmembrane protein

Known Interactions: Na_v1.1, Na_v1.3

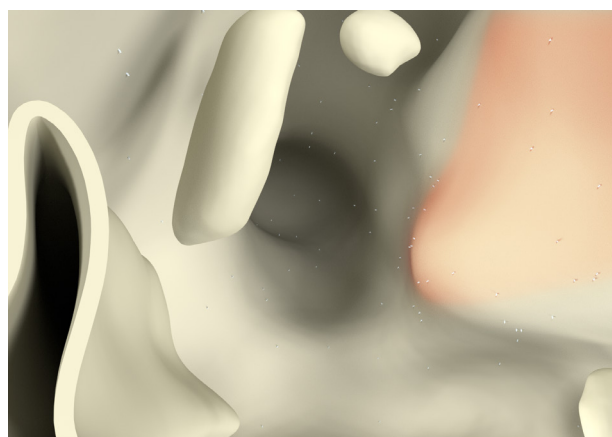
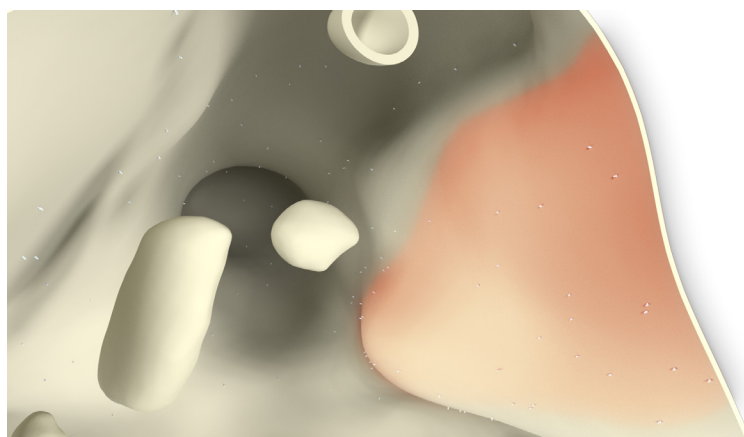
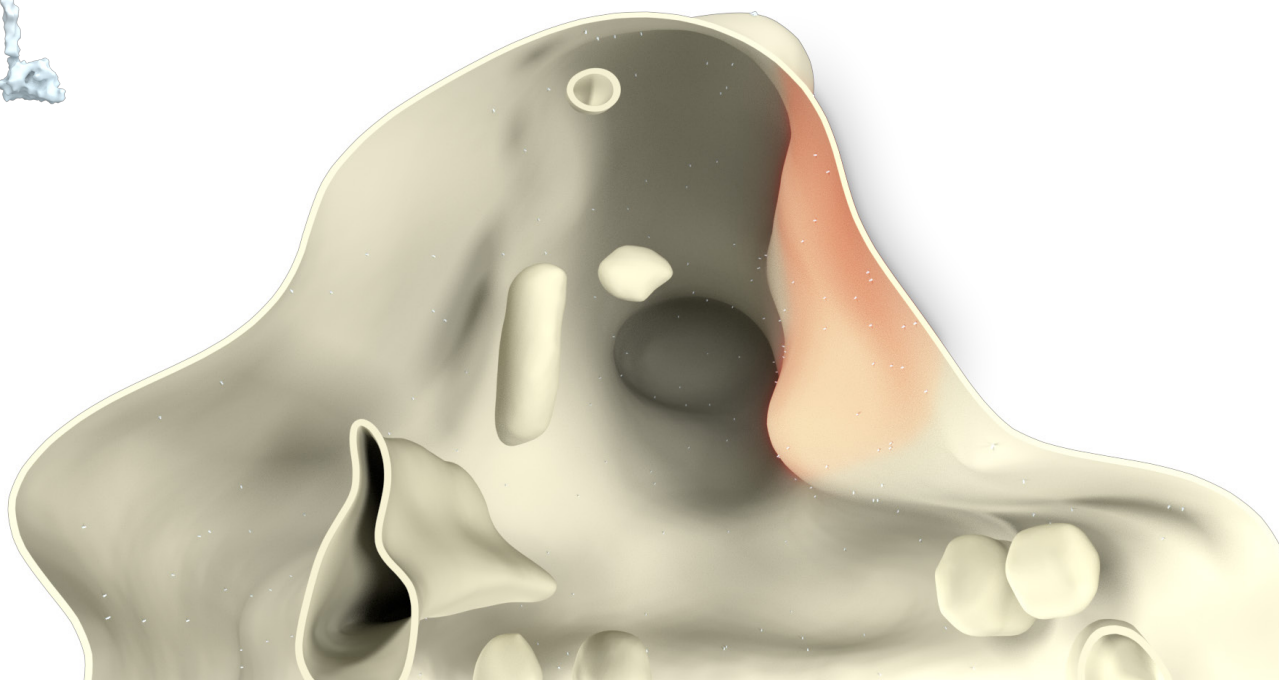


Whole cell copy number	714636.5 ± 139941.4	
Spine copy number	285.4 ± 71.5	
Function	Ion channel	
	Mushroom	Stubby
Spine copy number	243.6 ± 61.0	342.1 ± 85.7
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	3.1 ± 0.8	3.2 ± 0.8
PSD copy number	41 ± 10.3	33 ± 8.3
% in PSD	16.8 ± 4.2%	9.6 ± 2.4%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	243.6 ± 61.0	$0.0 \pm 0.0\%$	3.1 ± 0.8	41 ± 10.3
Stubby	342.1 ± 85.7	$0.0 \pm 0.0\%$	3.2 ± 0.8	33 ± 8.3



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	243.6 ± 61.0	$0.0 \pm 0.0\%$	3.1 ± 0.8	41 ± 10.3
Stubby	342.1 ± 85.7	$0.0 \pm 0.0\%$	3.2 ± 0.8	33 ± 8.3



References

Antibody: Alomone labs ASC-041

PDB Identifier: 6agf

Literature:

Kazarinova-Noyes et al., 2001, J. Neurosci.

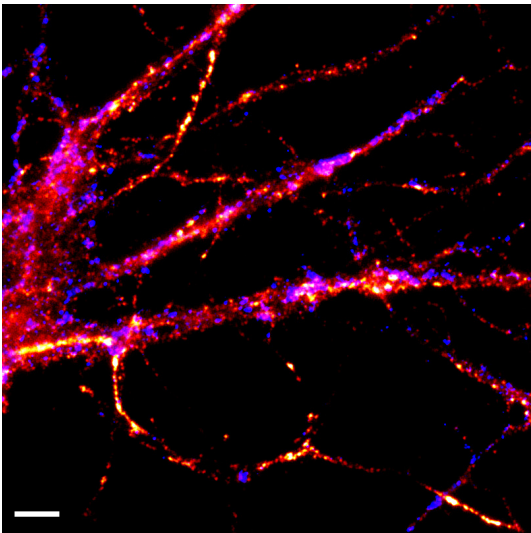
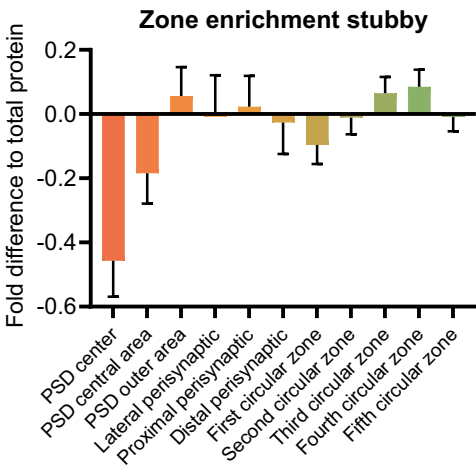
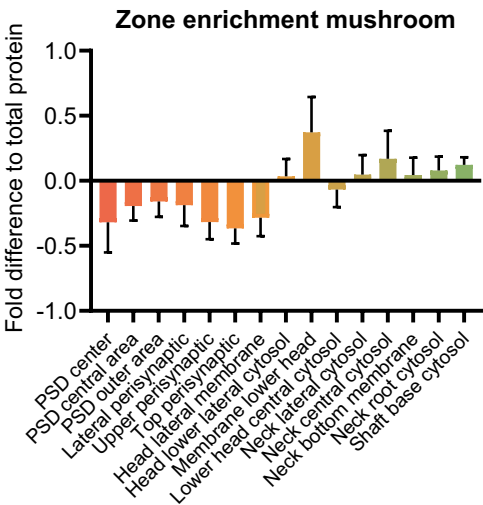
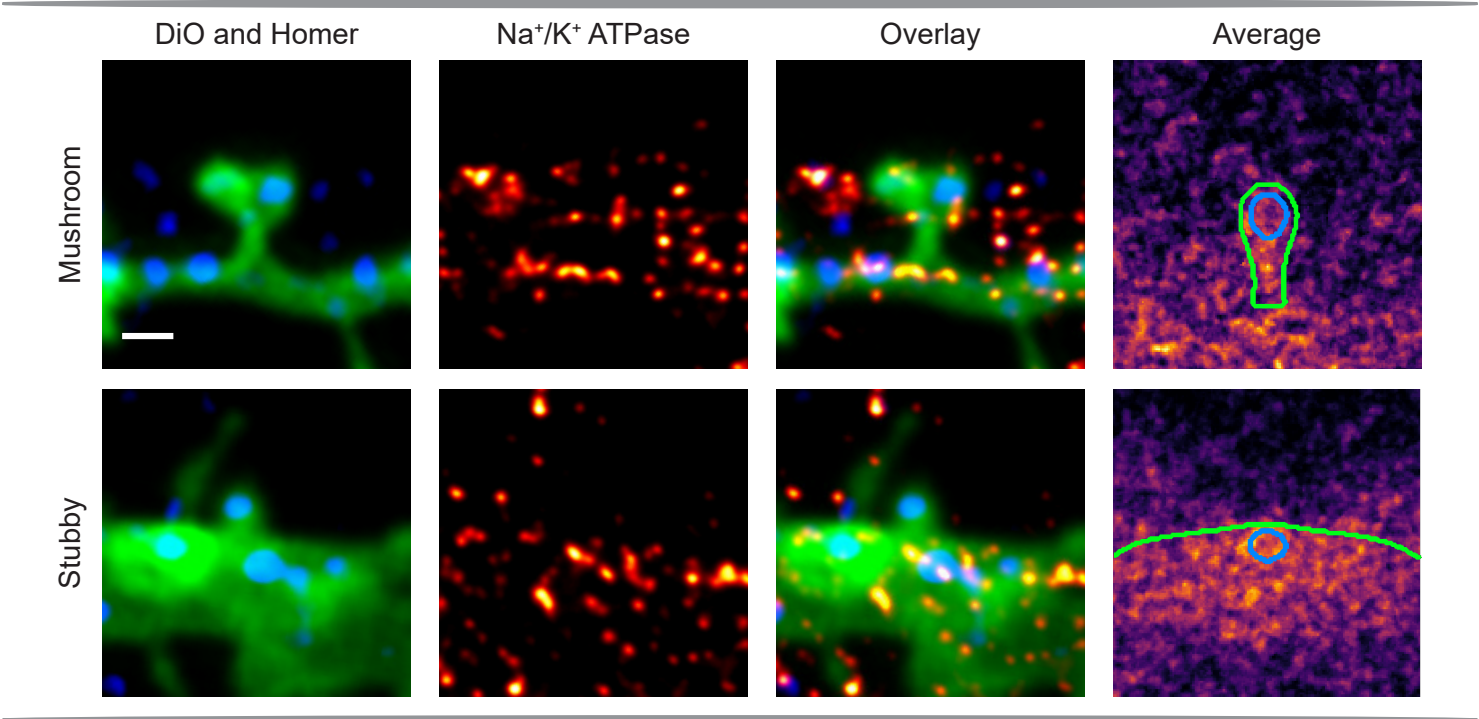
Malhotra et al., 2000, J. Biol. Chem.

Na⁺/K⁺ ATPase (Gene: Atp1a3, Uniprot ID: P06687)

Known function: Maintains resting potential

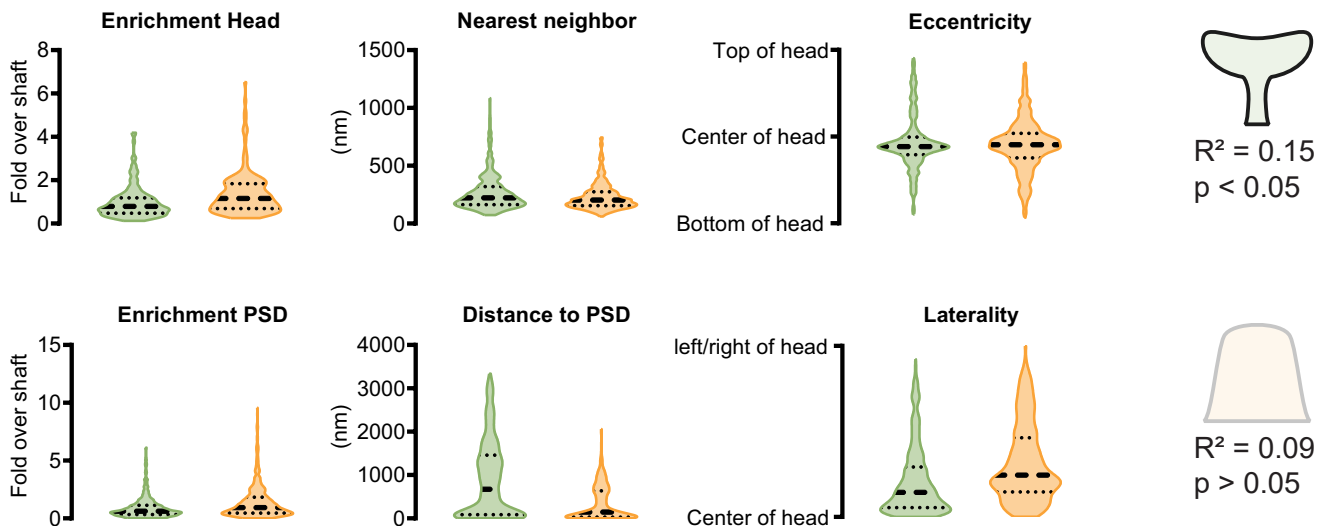
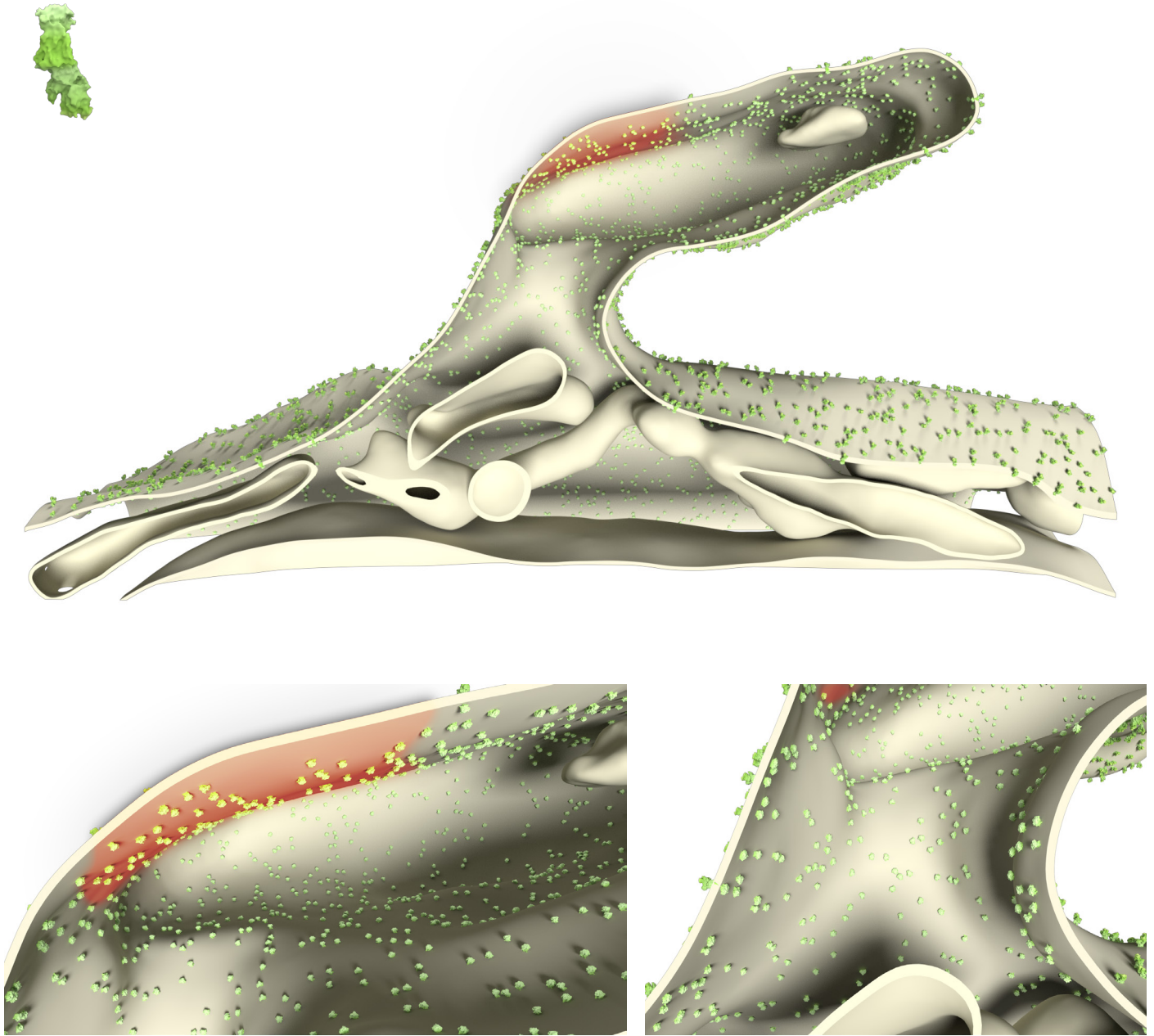
Known organization: Transmembrane protein, Forms clusters

Known Interactions: None

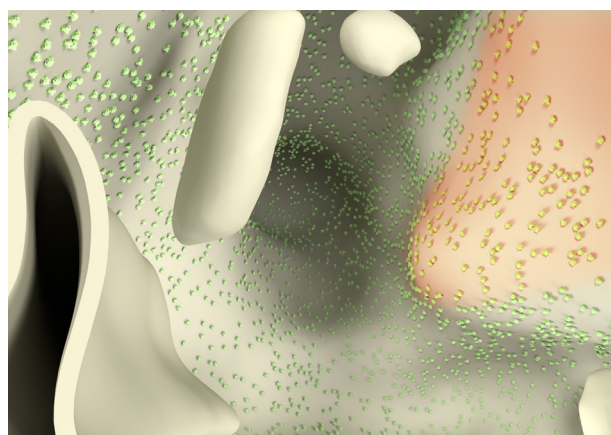
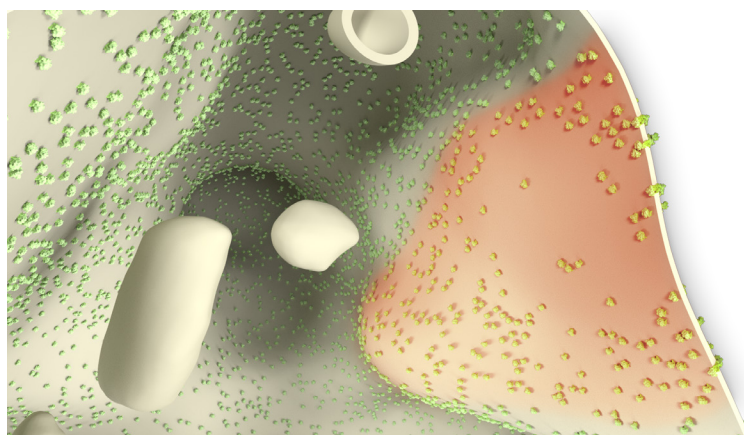
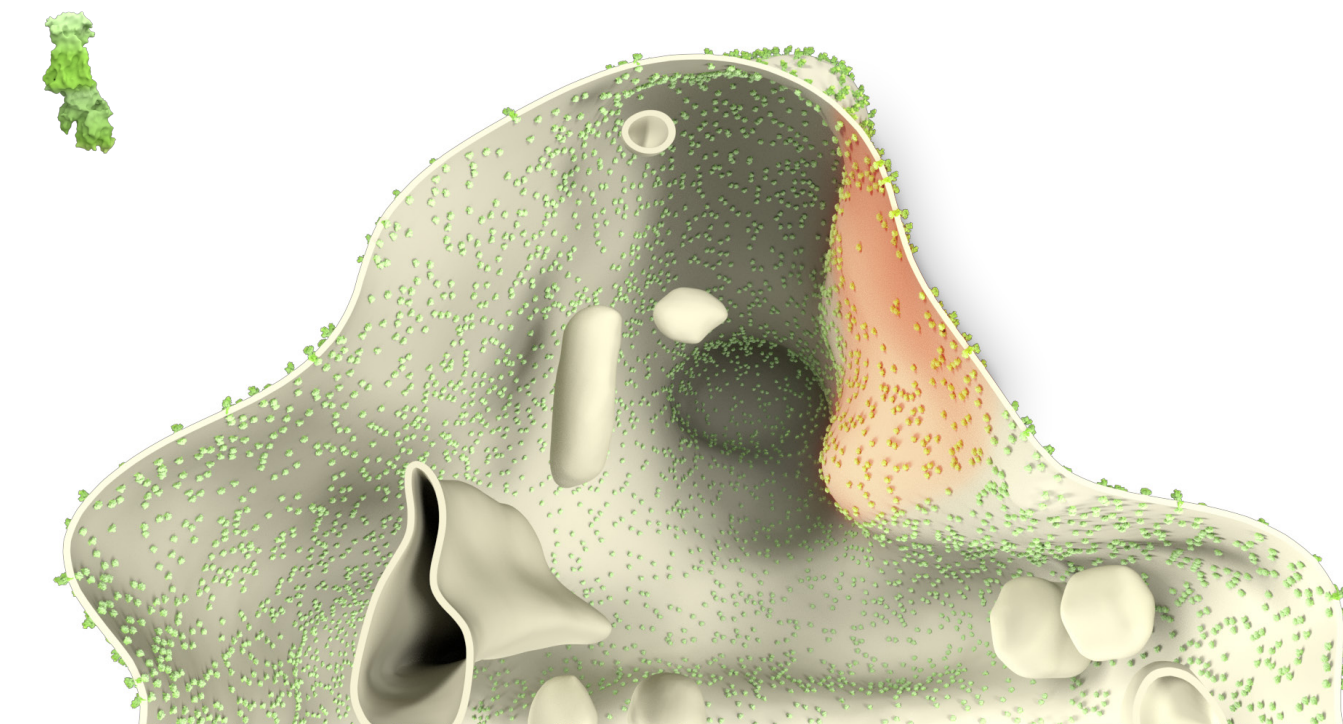


Whole cell copy number	29929991.7 ± 1624205.1	
Spine copy number	6166.8 ± 1477.8	
Function	Ion channel	
	Mushroom	Stubby
Spine copy number	4473.8 ± 1072.1	8111.4 ± 1943.8
% of total protein	2.4 ± 0.6%	3.8 ± 0.9%
Molarity (μM)	56.8 ± 13.6	76.7 ± 18.4
PSD copy number	720 ± 172.5	1705 ± 408.6
% in PSD	16.1 ± 3.9%	21.0 ± 5.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	4473.8 ± 1072.1	$2.4 \pm 0.6\%$	56.8 ± 13.6	720 ± 172.5
Stubby	8111.4 ± 1943.8	$3.8 \pm 0.9\%$	76.7 ± 18.4	1705 ± 408.6



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	4473.8 ± 1072.1	$2.4 \pm 0.6\%$	56.8 ± 13.6	720 ± 172.5
Stubby	8111.4 ± 1943.8	$3.8 \pm 0.9\%$	76.7 ± 18.4	1705 ± 408.6



References

Antibody: Thermo Scientific MA3-915

PDB Identifier: 4xe5

Literature:

Blom et al., 2011, BMC Neurosci.

Blom et al., 2012, Microsc. Res. Tech.

Blom et al., 2016, Neurophotonics

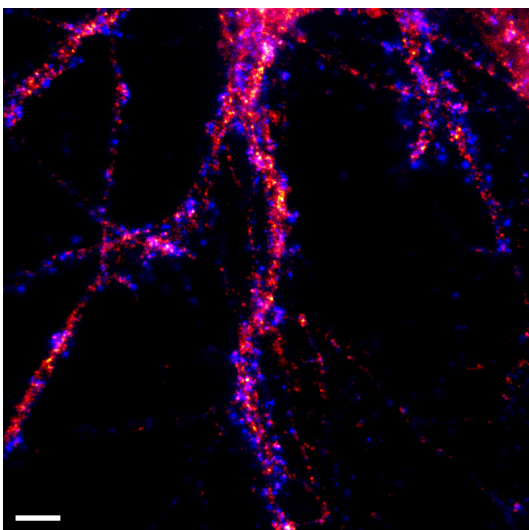
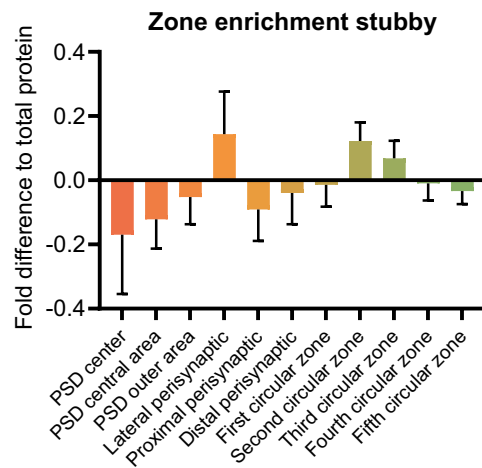
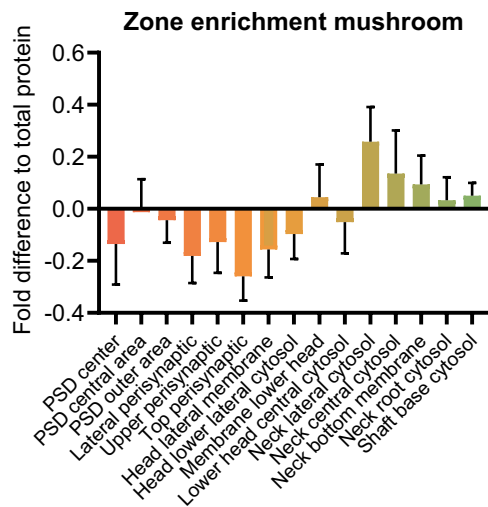
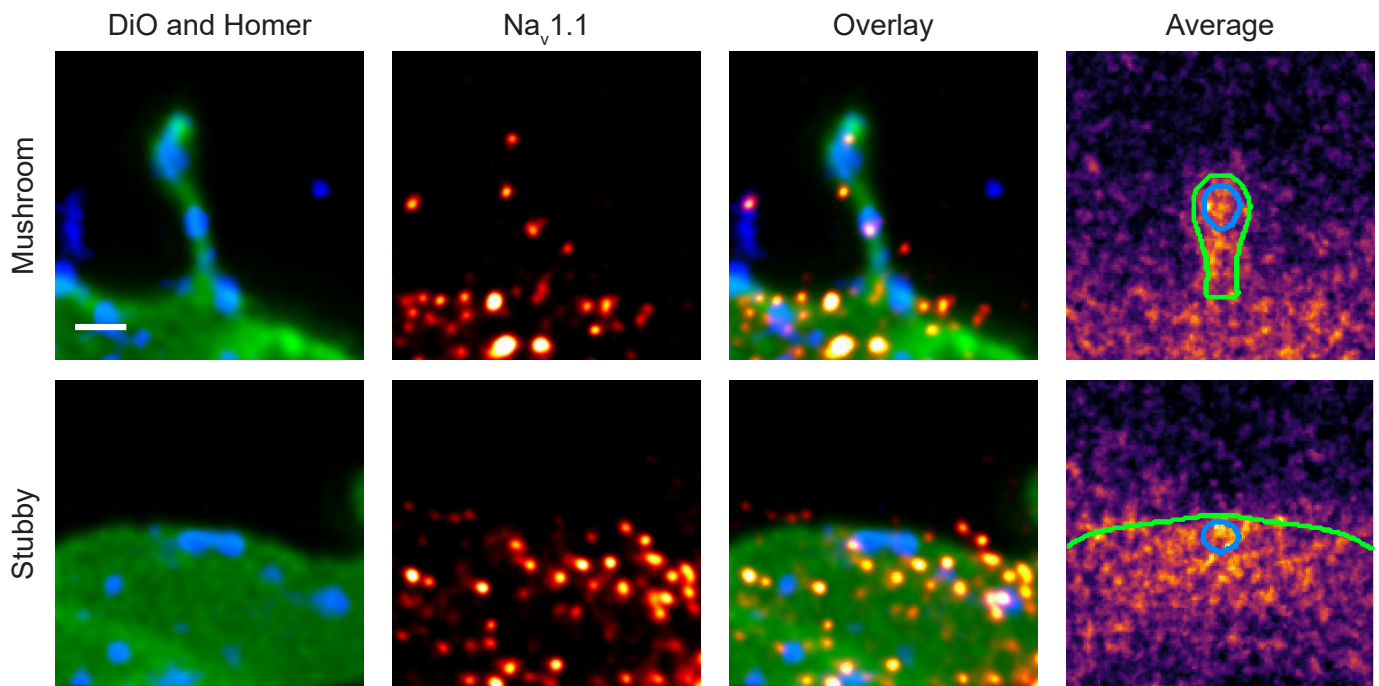
Skou, 1957, Biochim. Biophys. Acta.

Na_v1.1 (Gene: Scn1a, Uniprot ID: P04774)

Known function: Sodium channel

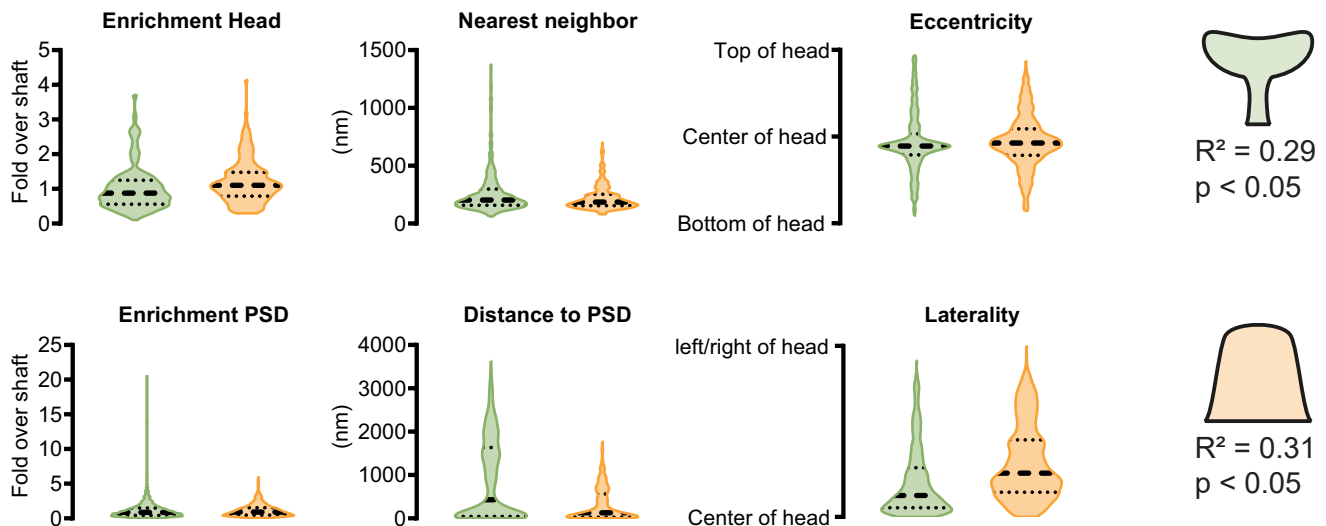
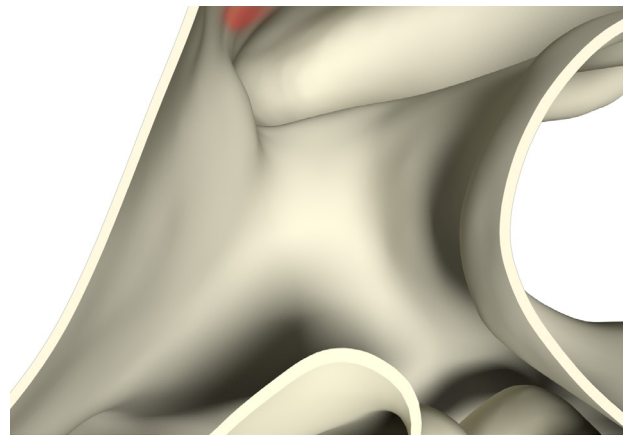
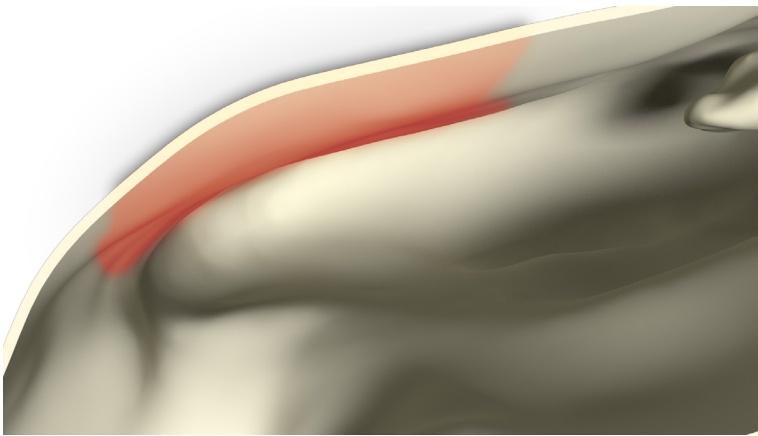
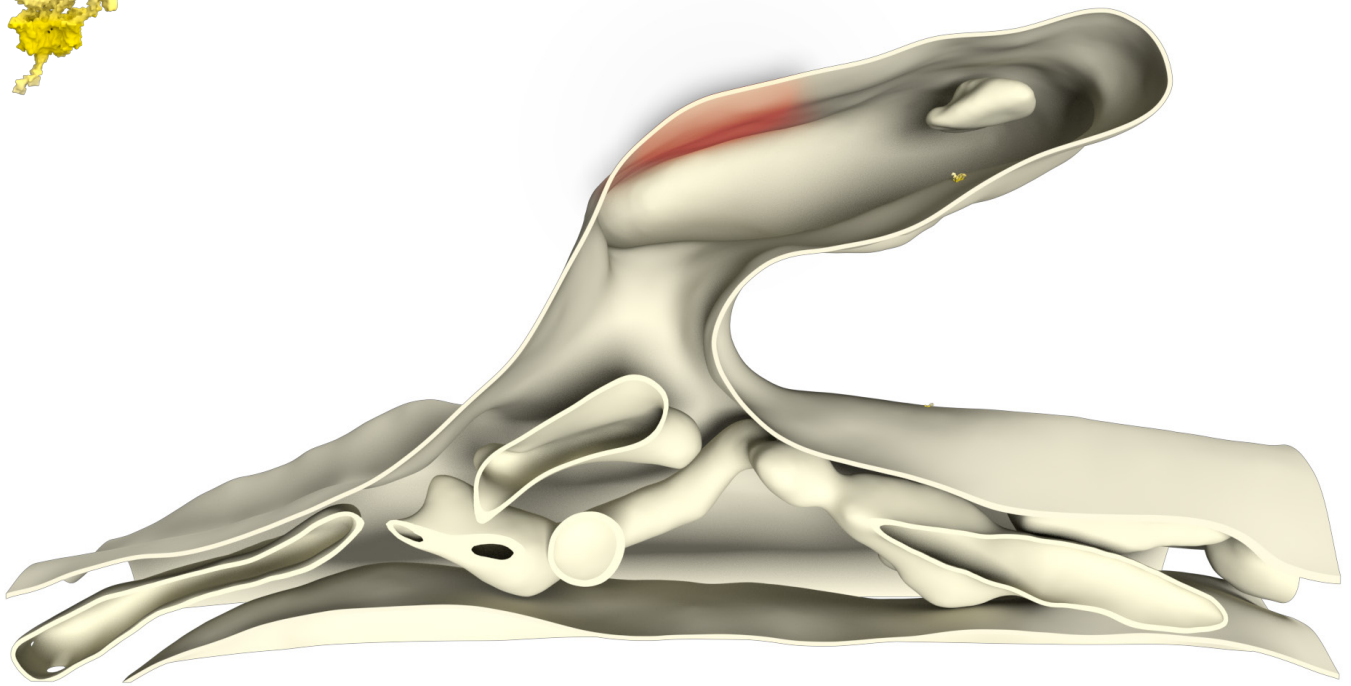
Known organization: Transmembrane protein

Known Interactions: Na β 1

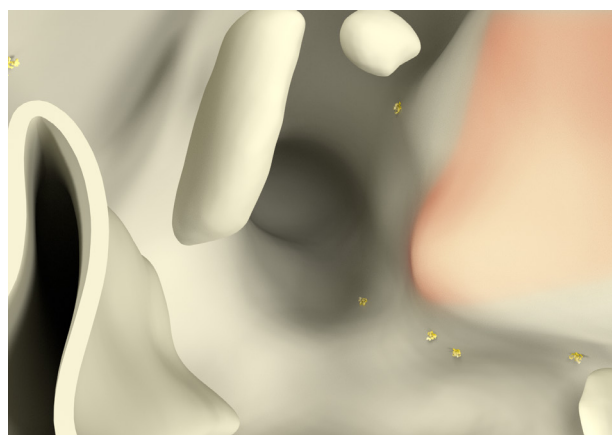
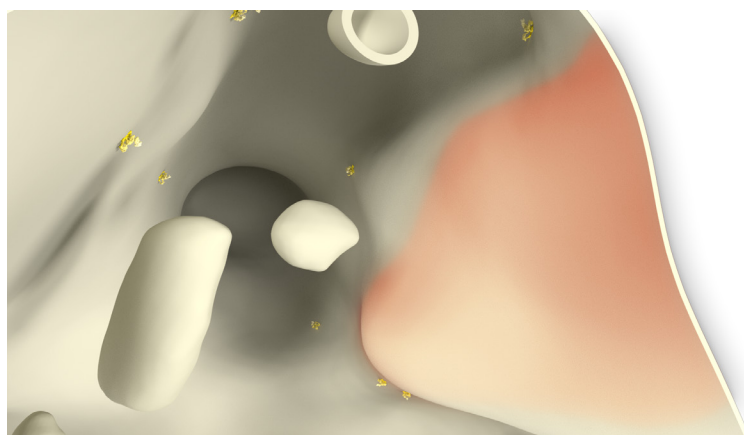
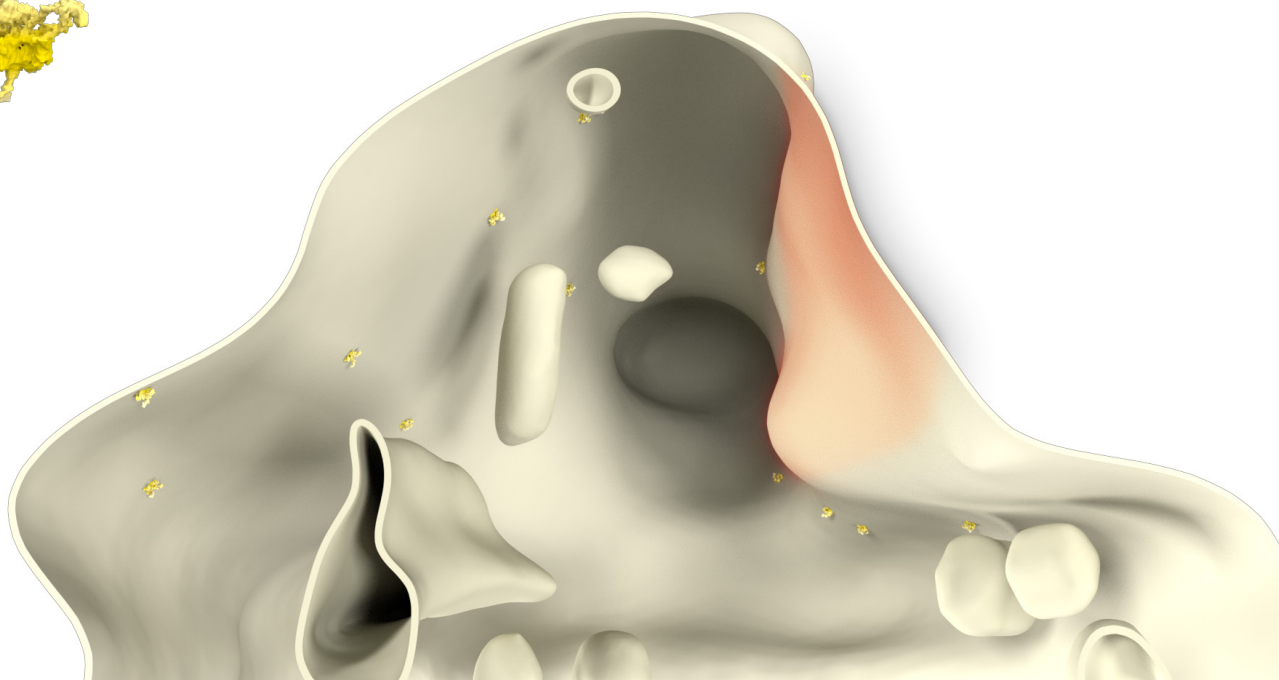


Whole cell copy number	81566.9 ± 6386.5	
Spine copy number	17.7 ± 3.1	
Function	Ion channel	
	Mushroom	Stubby
Spine copy number	14.4 ± 2.5	21.7 ± 3.8
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.2 ± 0.0	0.2 ± 0.0
PSD copy number	1 ± 0.2	2 ± 0.3
% in PSD	7.0 ± 1.2%	9.2 ± 1.6%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	14.4 ± 2.5	$0.0 \pm 0.0\%$	0.2 ± 0.0	1 ± 0.2
Stubby	21.7 ± 3.8	$0.0 \pm 0.0\%$	0.2 ± 0.0	2 ± 0.3



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	14.4 ± 2.5	$0.0 \pm 0.0\%$	0.2 ± 0.0	1 ± 0.2
Stubby	21.7 ± 3.8	$0.0 \pm 0.0\%$	0.2 ± 0.0	2 ± 0.3



References

Antibody: Merck Millipore 06-811

PDB Identifier: 6agf

Literature:

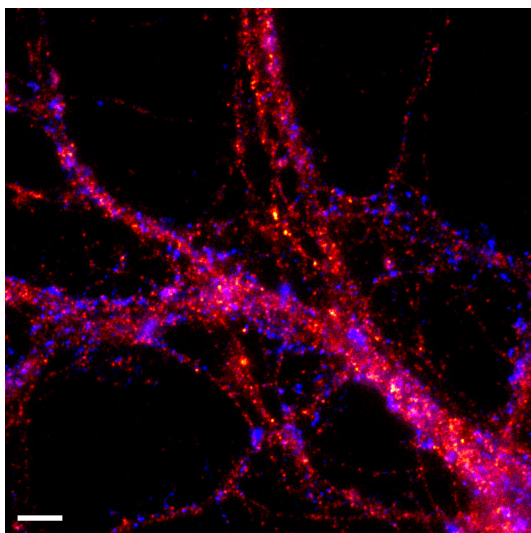
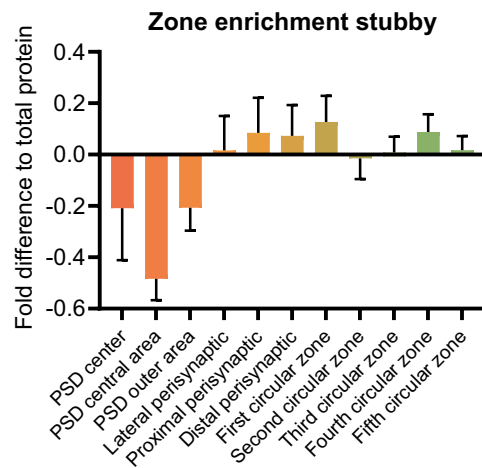
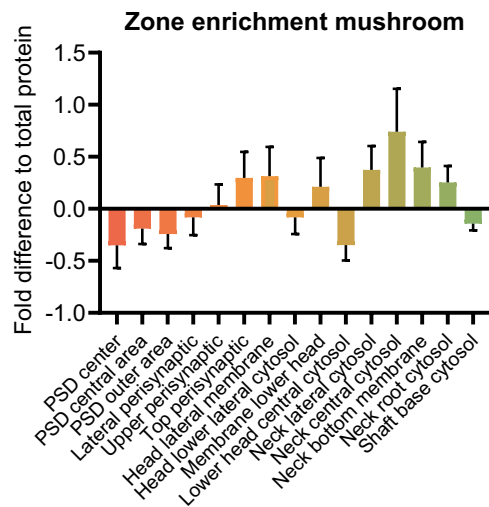
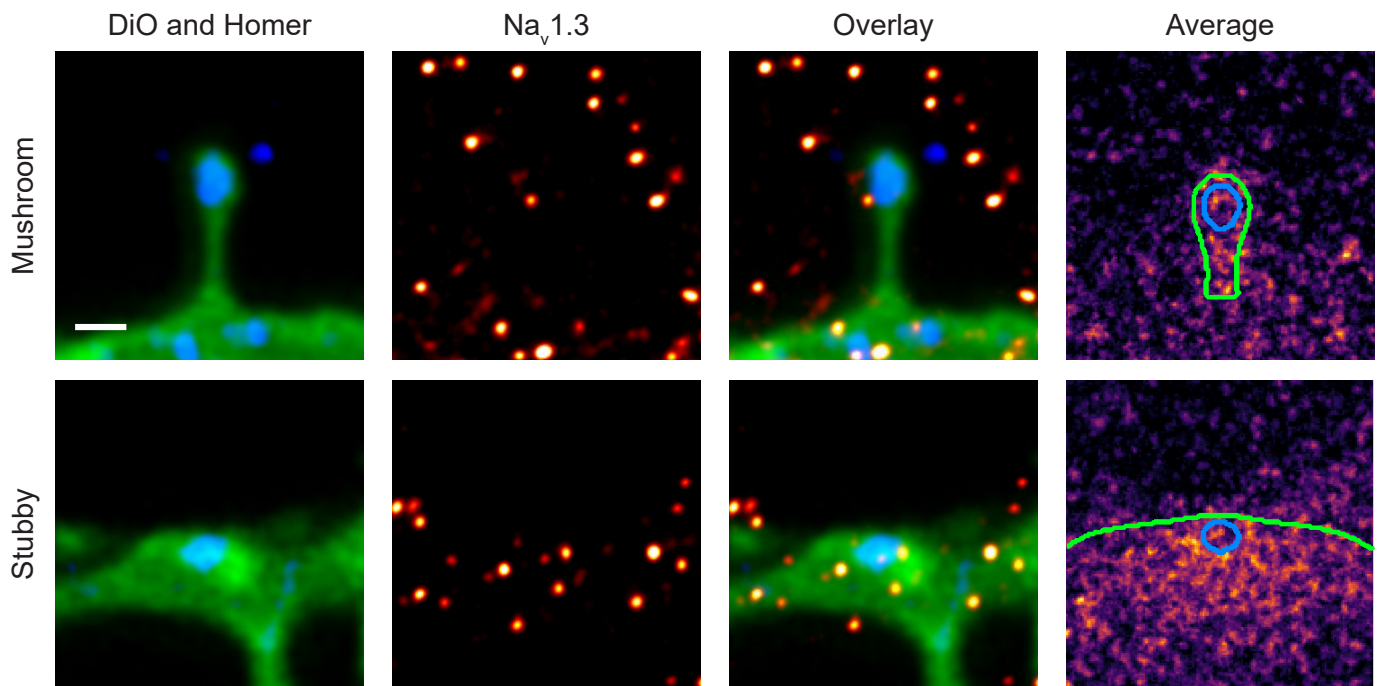
Westenbroek et al., 1989, Neuron

Na_v1.3 (Gene: Scn3a, Uniprot ID: P08104)

Known function: Sodium channel

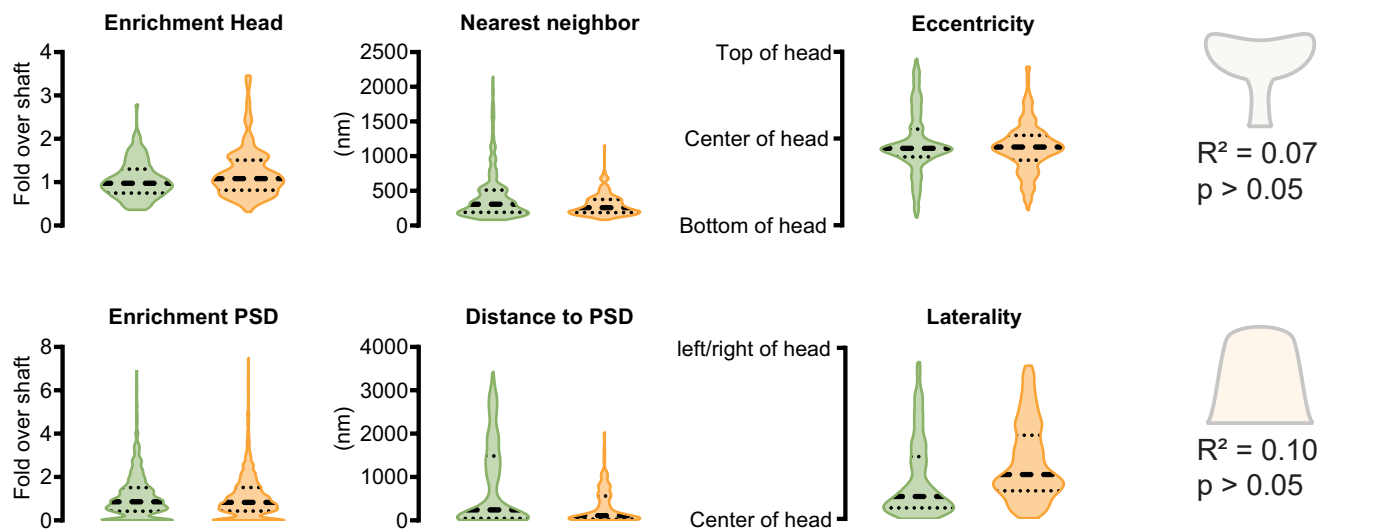
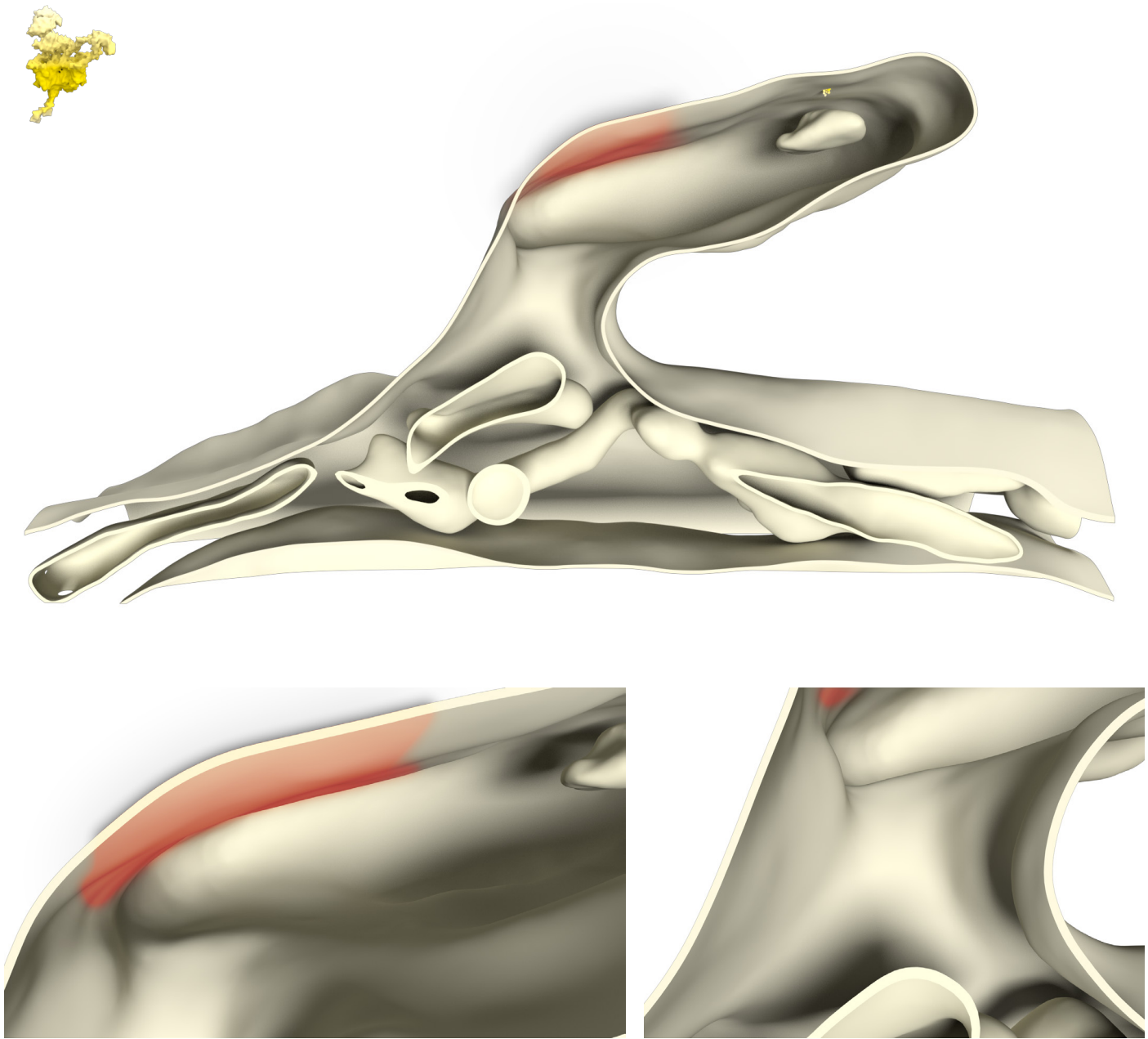
Known organization: Transmembrane protein

Known Interactions: Na β 1

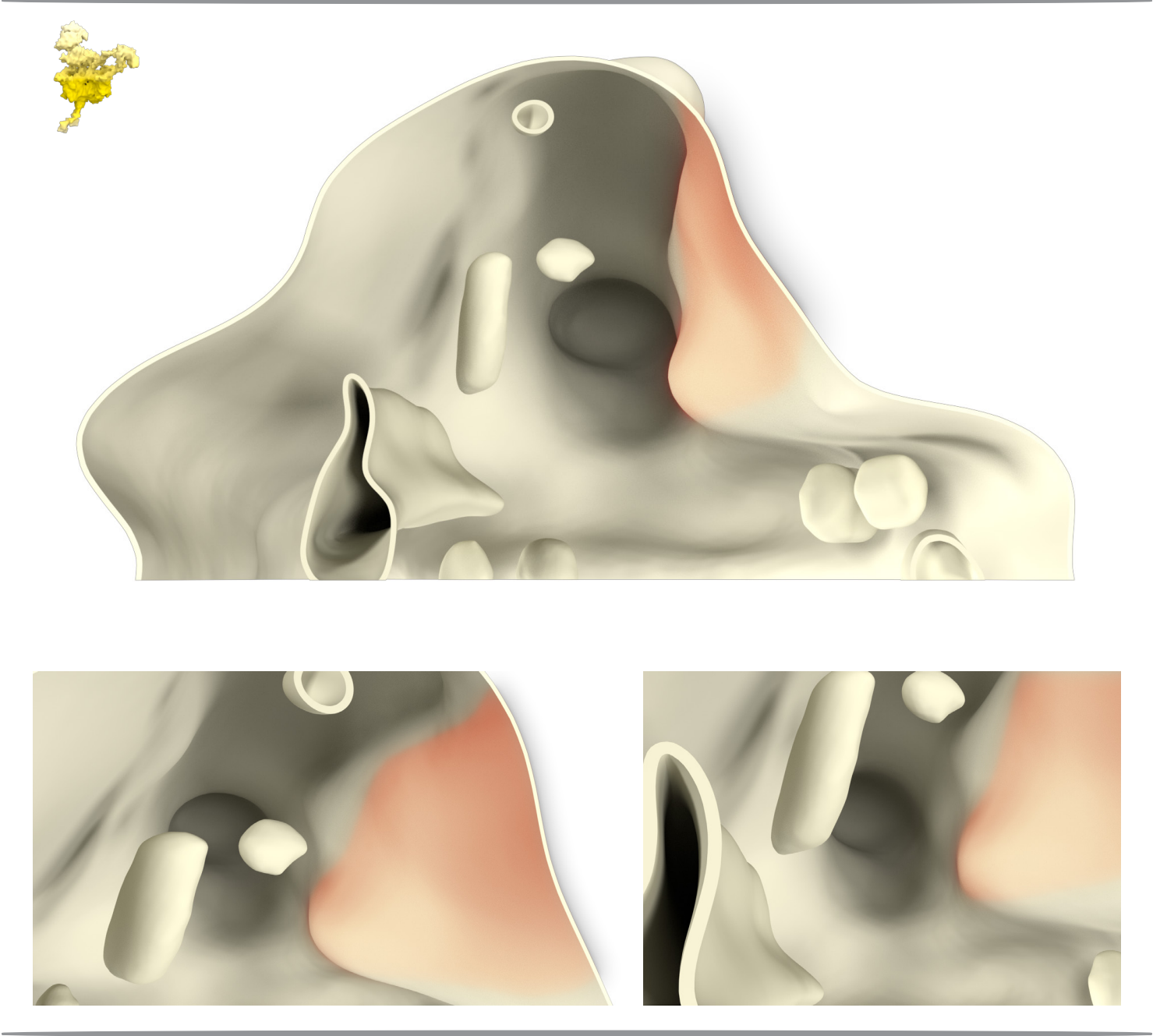


Whole cell copy number	2645.3 ± 454.1	
Spine copy number	0.1 ± 0.1	
Function	Ion channel	
	Mushroom	Stubby
Spine copy number	0.1 ± 0.1	0.1 ± 0.1
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.0 ± 0.0	0.0 ± 0.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	0.1 ± 0.1	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	0.1 ± 0.1	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	0.1 ± 0.1	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	0.1 ± 0.1	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



References

Antibody:
Literature:
 Westenbroek et al., 1989, Neuron
 Whitaker et al., 2001, Brain Res. Mol. Brain Res.

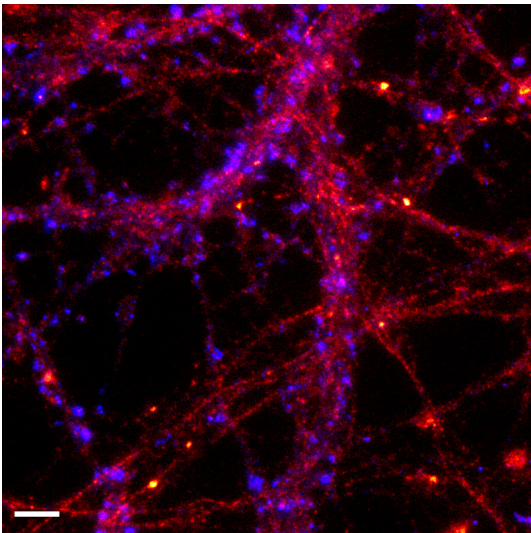
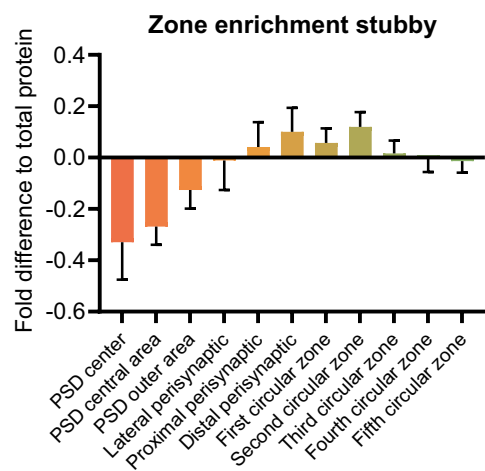
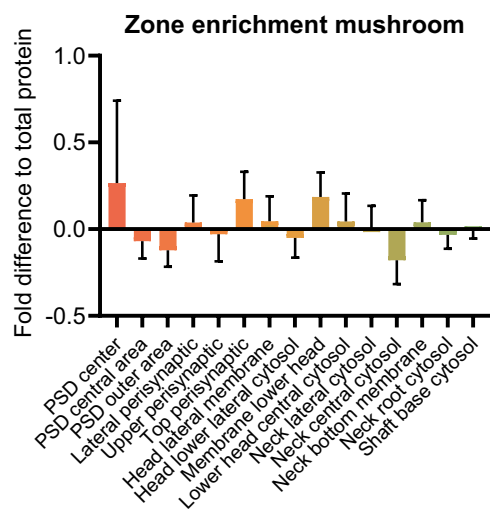
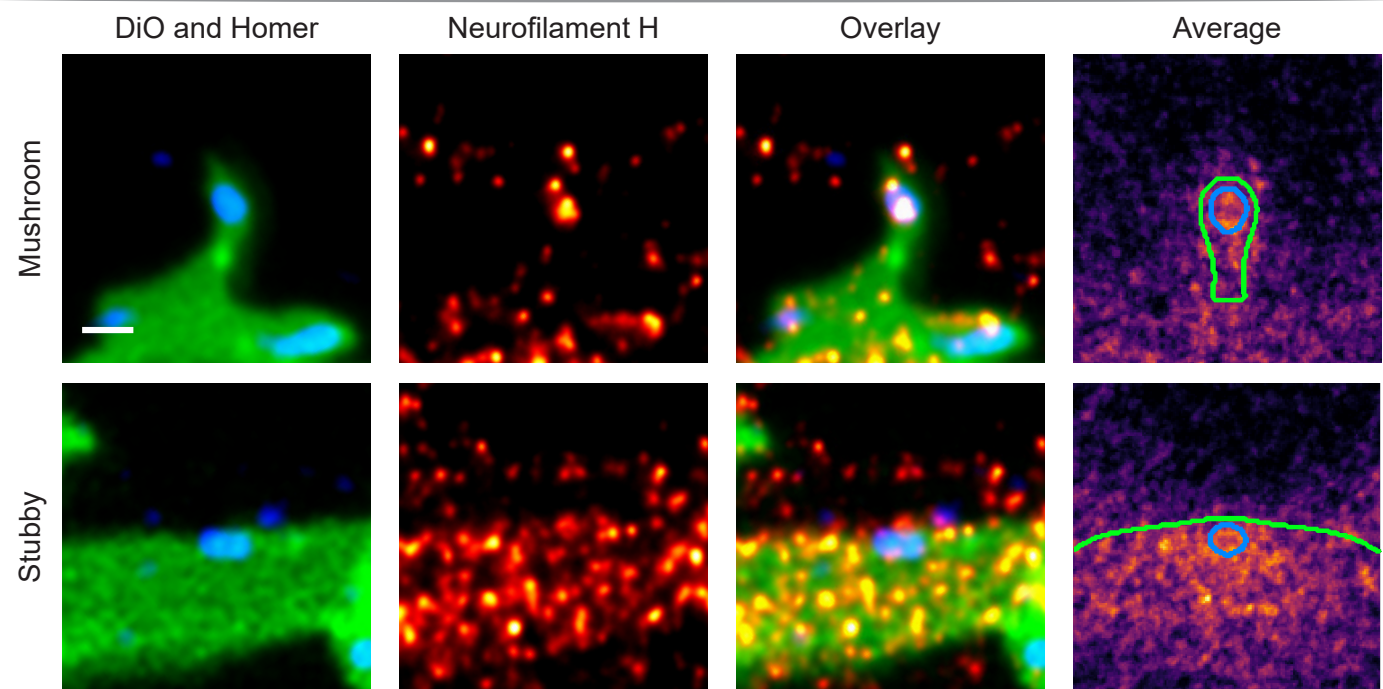
PDB Identifier: 6agf

Neurofilament H (Gene: Nefh, Uniprot ID: P16884)

Known function: Forms neurofilaments, Regulates ER and Endosome location

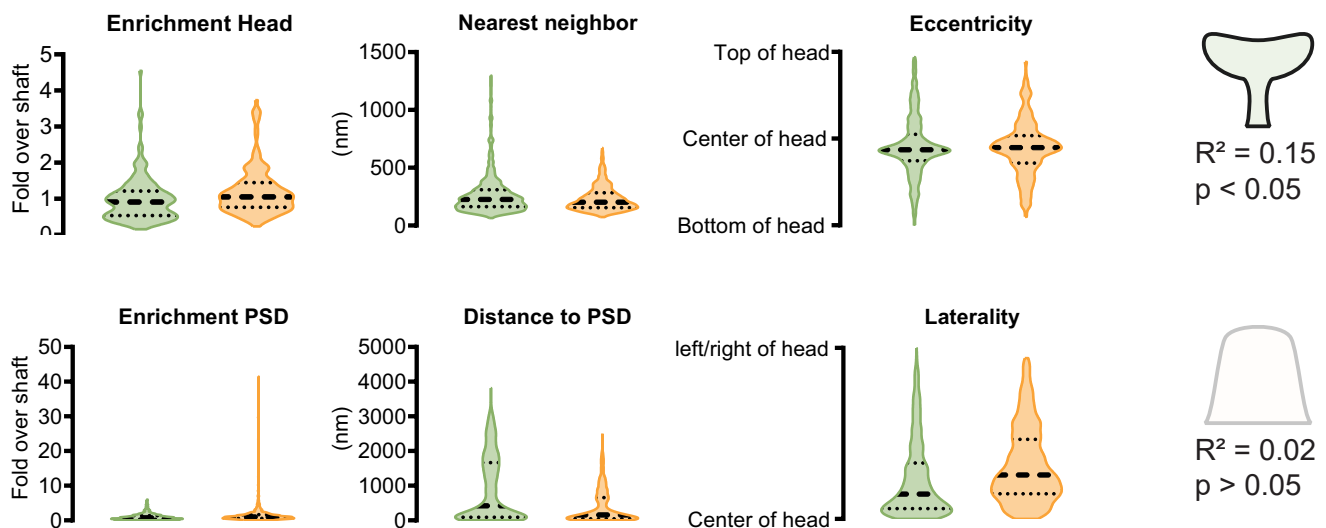
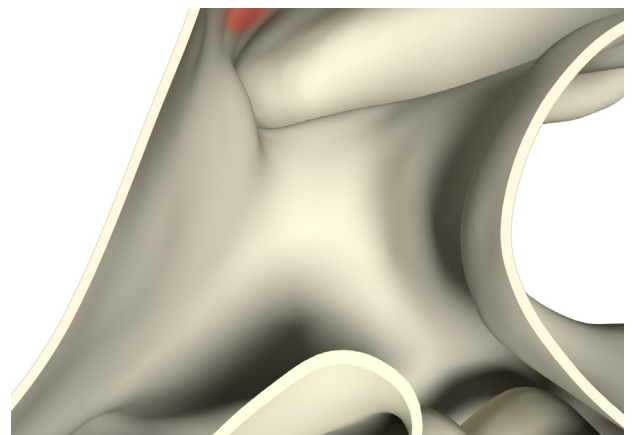
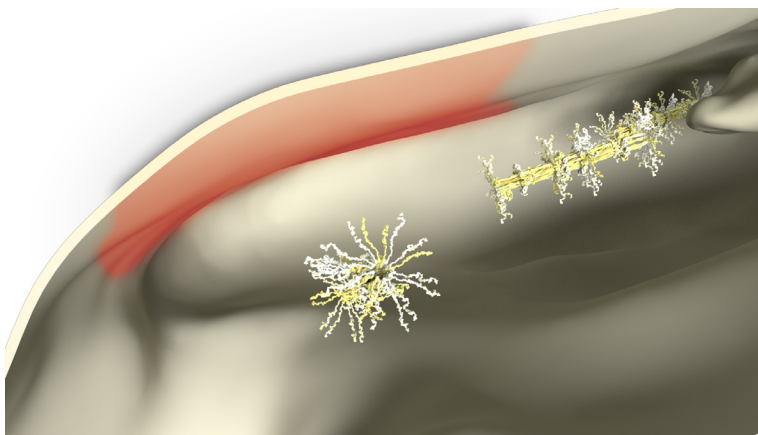
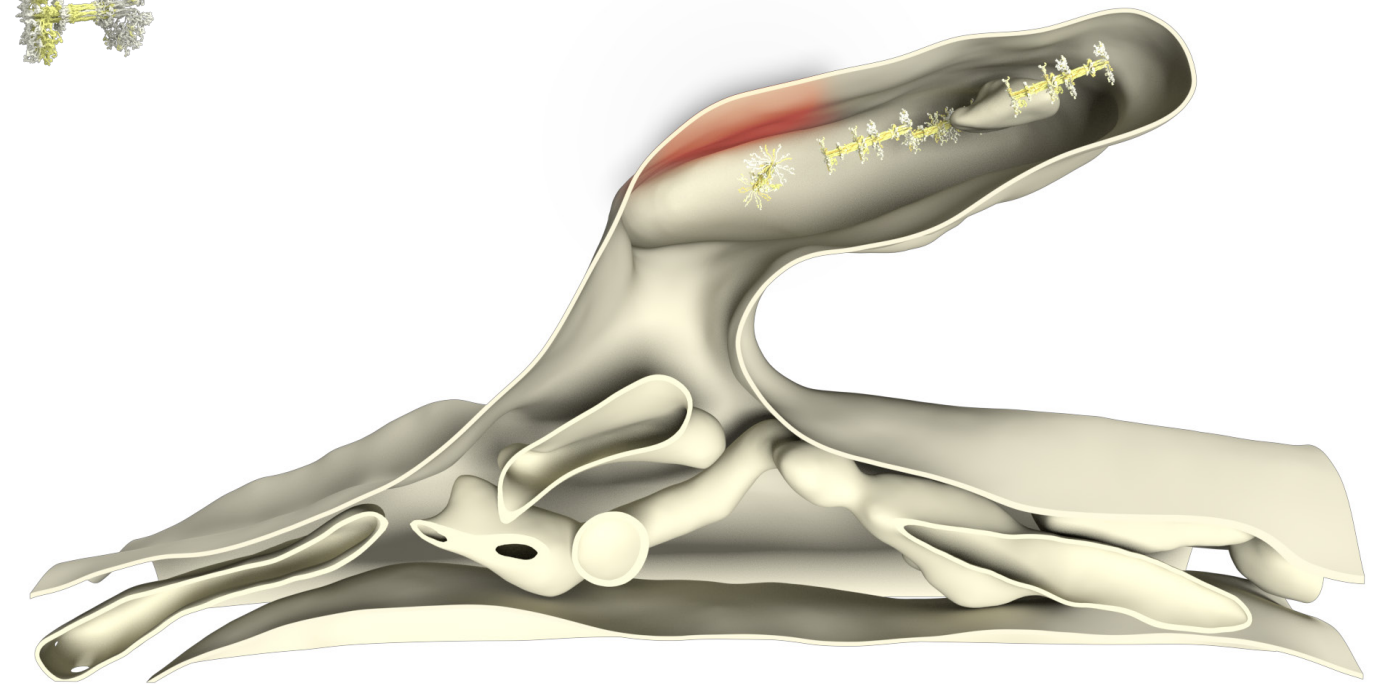
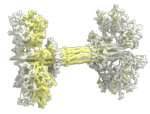
Known organization: Cytosolic, Forms triplet with Neurofilament L and M

Known Interactions: Neurofilament L and M, α -internexin, DLGAP1, Myosin5a, Dopamine D1 receptor

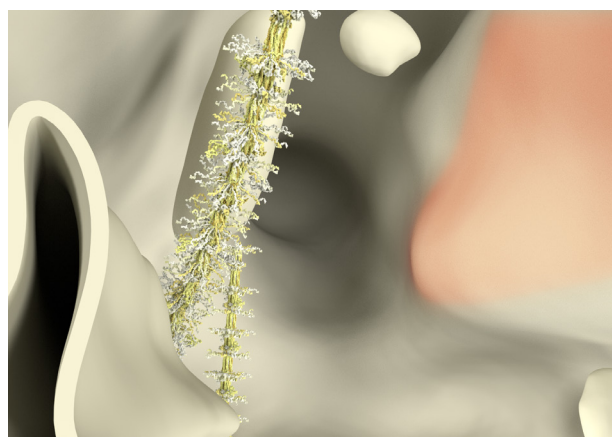
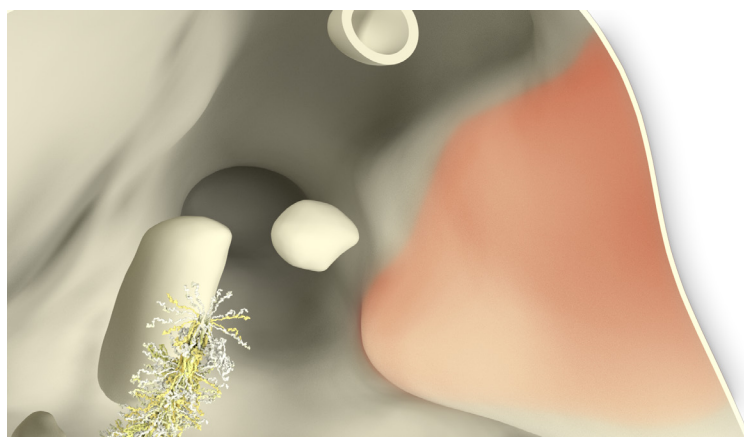
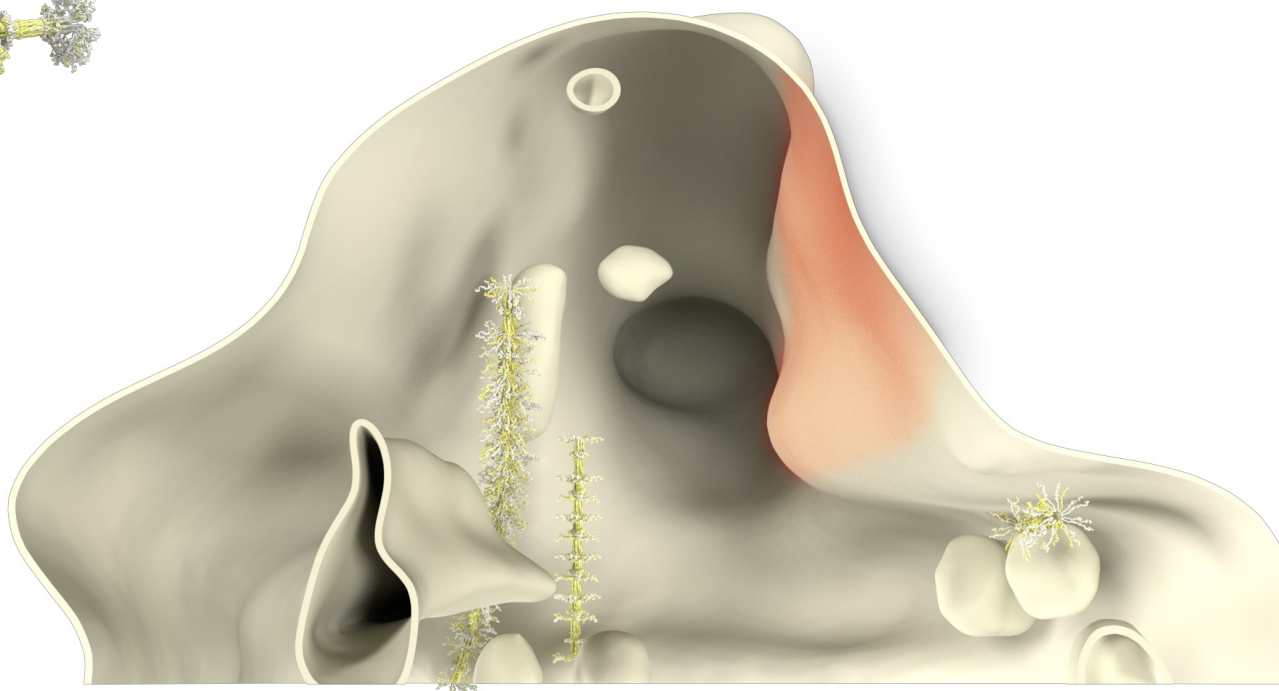
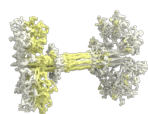


Whole cell copy number	428846.5 ± 342726.1	
Spine copy number	48.0 ± 42.5	
Function	Cytoskeleton	
	Mushroom	Stubby
Spine copy number	37.3 ± 33.1	65.9 ± 58.4
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.5 ± 0.4	0.6 ± 0.6
PSD copy number	4 ± 3.5	7 ± 6.2
% in PSD	10.7 ± 9.5%	10.6 ± 9.4%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	37.3 ± 33.1	$0.0 \pm 0.0\%$	0.5 ± 0.4	4 ± 3.5
Stubby	65.9 ± 58.4	$0.0 \pm 0.0\%$	0.6 ± 0.6	7 ± 6.2



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	37.3 ± 33.1	$0.0 \pm 0.0\%$	0.5 ± 0.4	4 ± 3.5
Stubby	65.9 ± 58.4	$0.0 \pm 0.0\%$	0.6 ± 0.6	7 ± 6.2



References

Antibody: LS Bio LS-C143052

PDB Identifier: 3s4r, 3swk, 3uf1, 1gk4, 3tnu

Literature:

Hirao et al., 2000, Genes Cells

Rao et al., 2011, PLoS One

Yuan et al., 2012, J. Cell. Sci.

Yuan et al., 2015a, Mol. Psychiatry

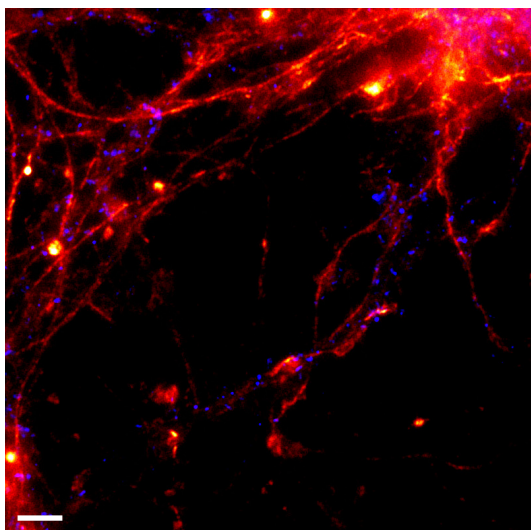
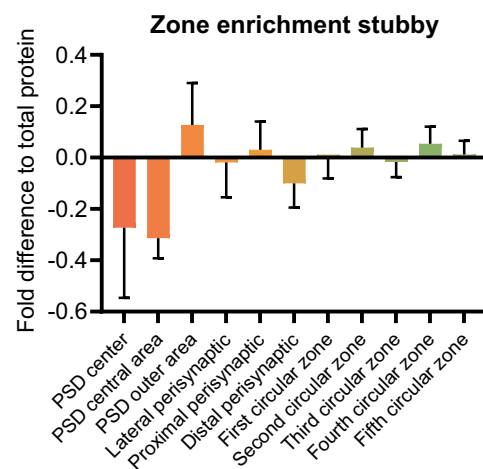
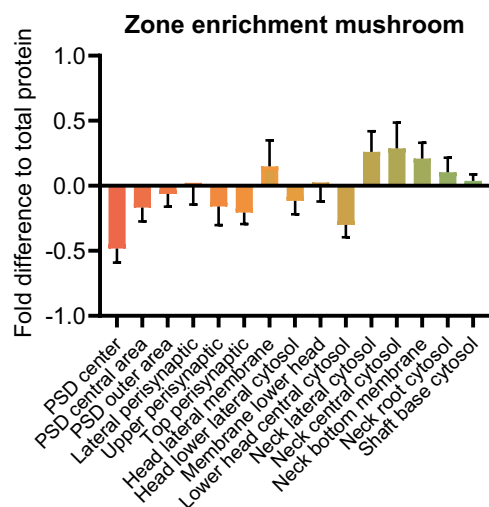
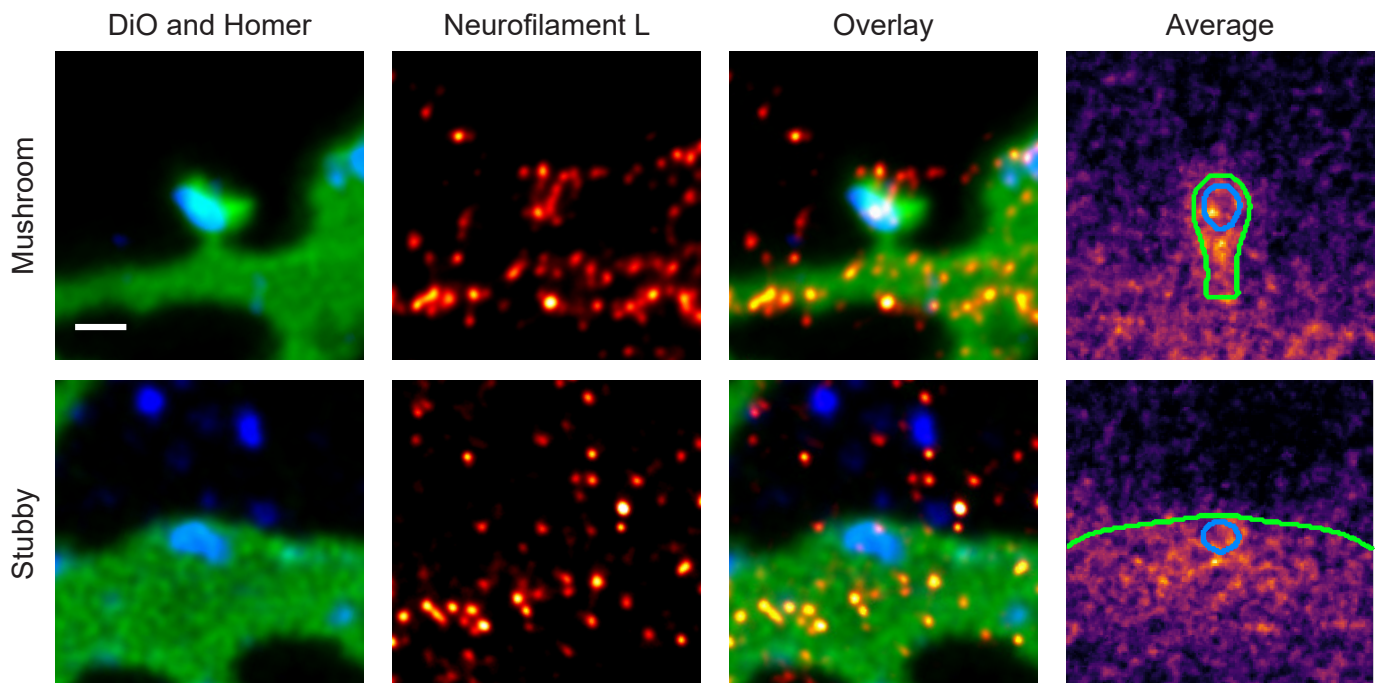
Yuan et al., 2015b, Mol. Psychiatry

Neurofilament L (Gene: Nefl, Uniprot ID: P19527)

Known function: Forms neurofilaments, Regulates ER and Endosome location

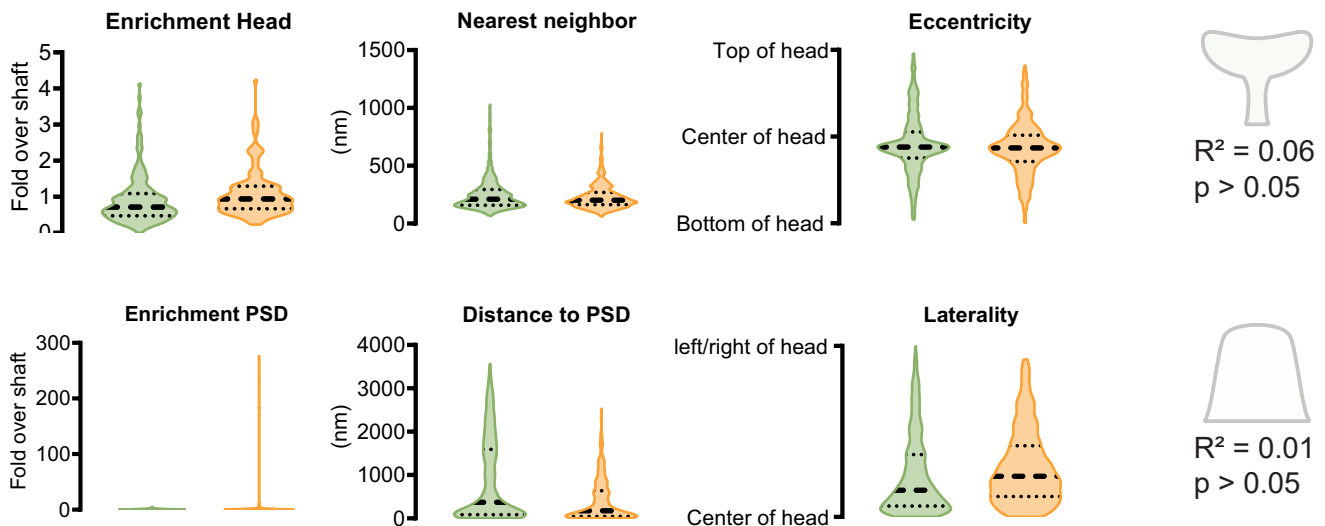
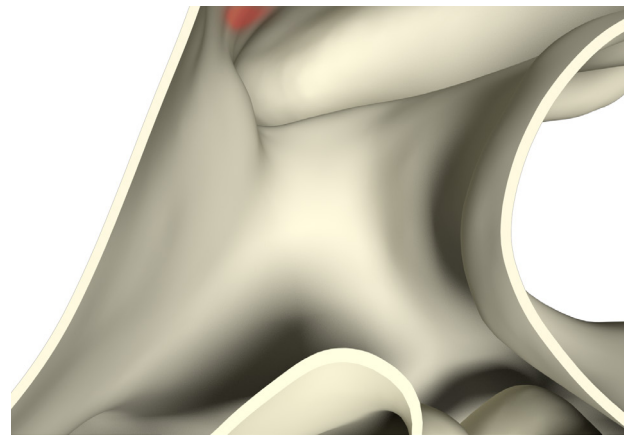
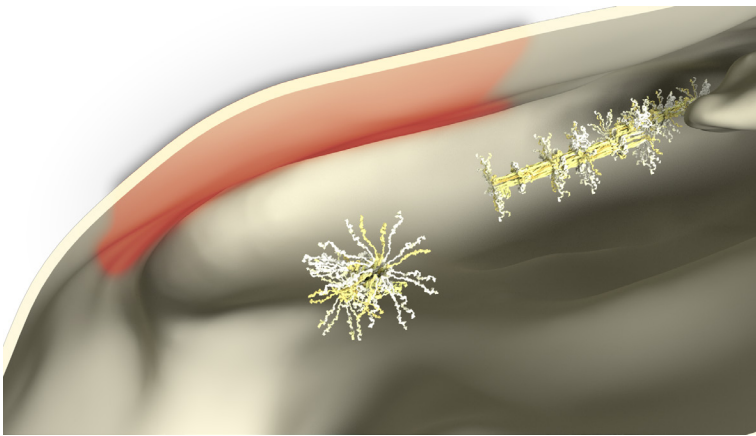
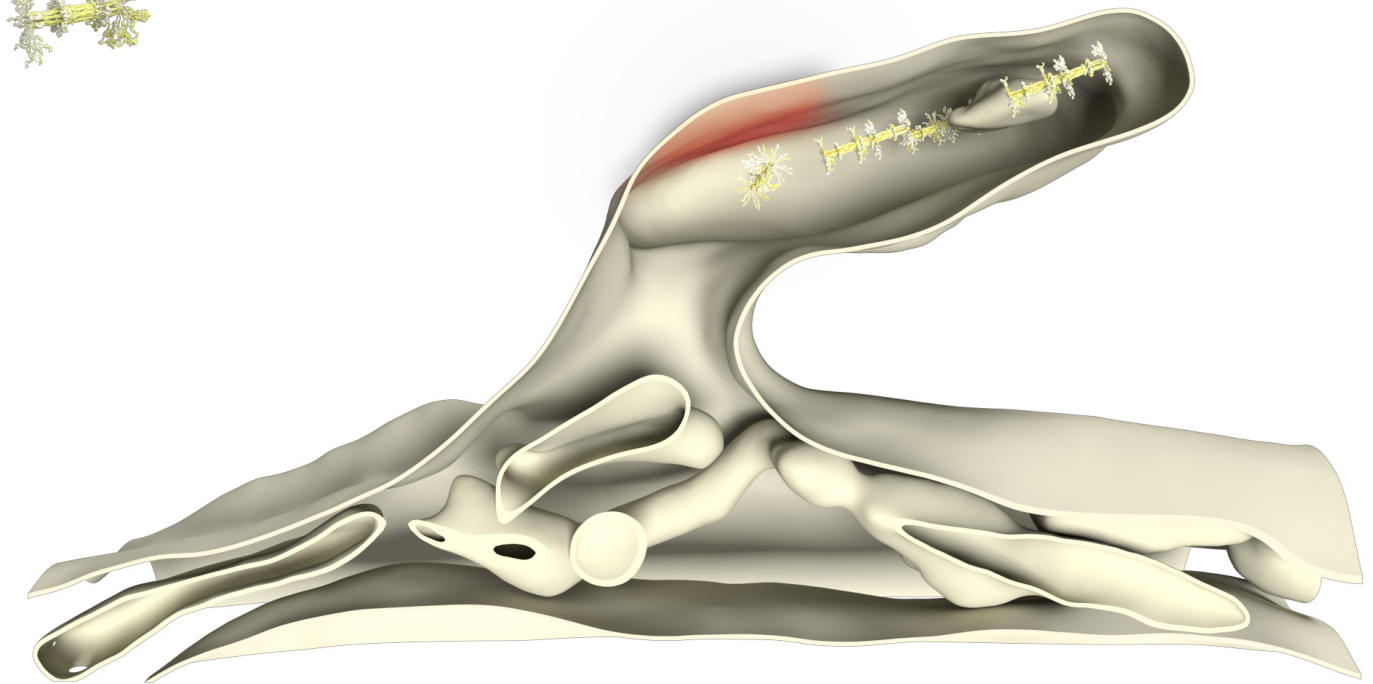
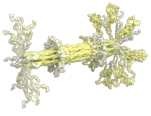
Known organization: Cytosolic, Forms triplet with Neurofilament L and M

Known Interactions: Neurofilament L and M, α -internexin, DLGAP1, Myosin5a, Dopamine D1 receptor

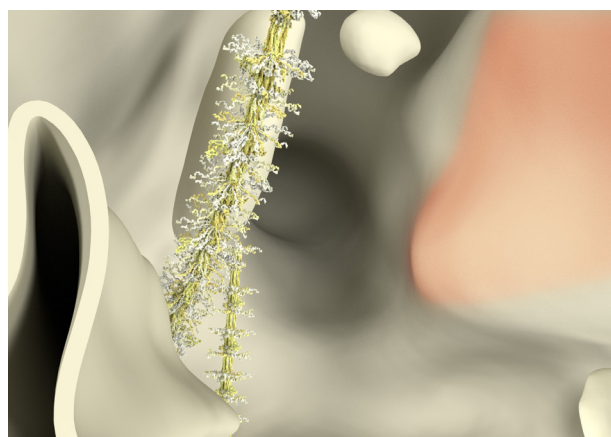
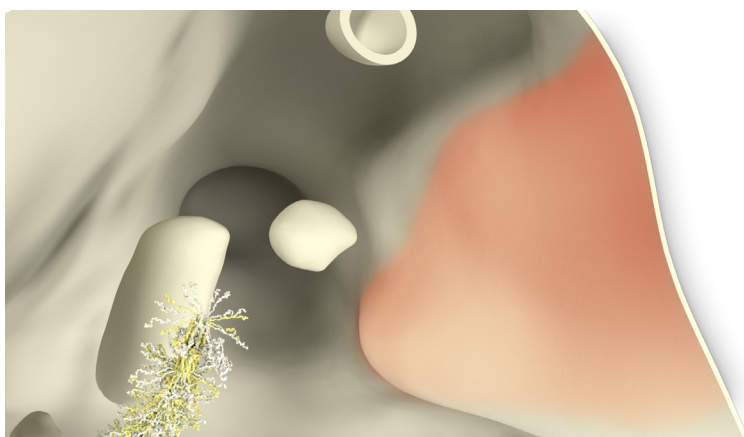
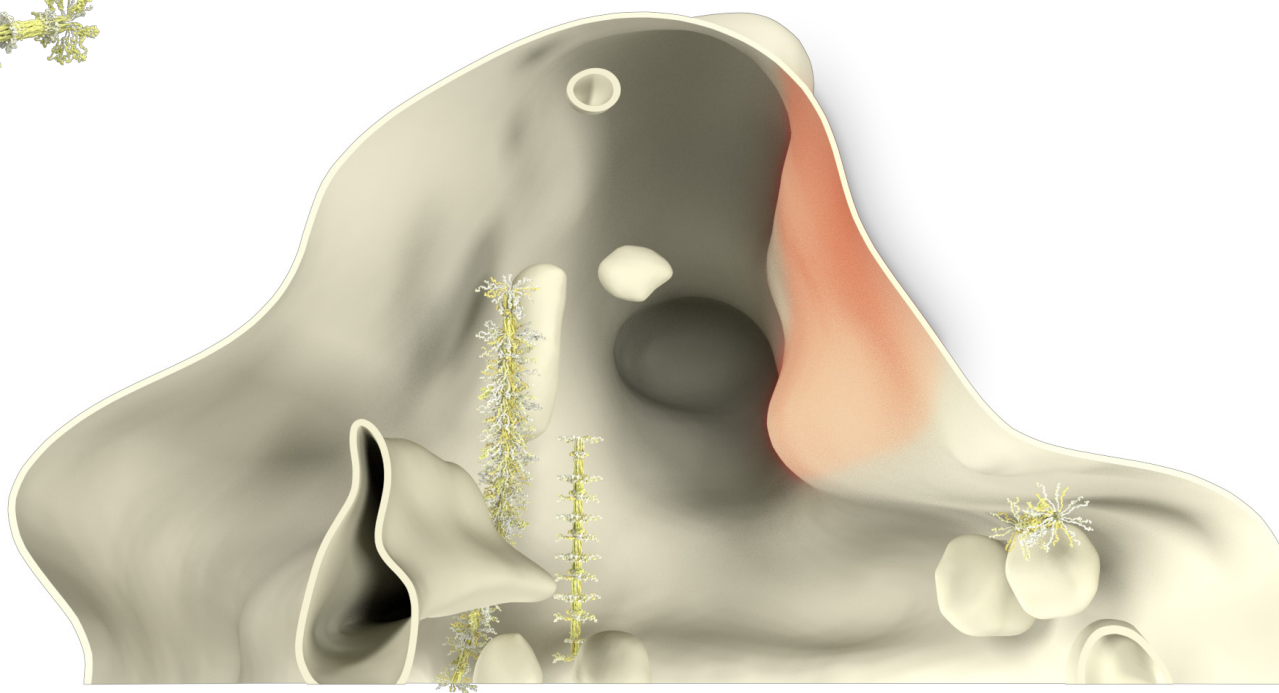
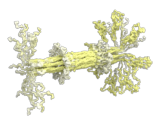


Whole cell copy number	5345200.7 ± 1726386.6	
Spine copy number	428.3 ± 248.4	
Function	Cytoskeleton	
	Mushroom	Stubby
Spine copy number	371.2 ± 215.3	486.4 ± 282.1
% of total protein	0.1 ± 0.1%	0.1 ± 0.1%
Molarity (μM)	4.7 ± 2.7	4.6 ± 2.7
PSD copy number	65 ± 37.7	68 ± 39.4
% in PSD	17.5 ± 10.2%	14.0 ± 8.1%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	371.2 ± 215.3	$0.1 \pm 0.1\%$	4.7 ± 2.7	65 ± 37.7
Stubby	486.4 ± 282.1	$0.1 \pm 0.1\%$	4.6 ± 2.7	68 ± 39.4



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	371.2 ± 215.3	$0.1 \pm 0.1\%$	4.7 ± 2.7	65 ± 37.7
Stubby	486.4 ± 282.1	$0.1 \pm 0.1\%$	4.6 ± 2.7	68 ± 39.4



References

Antibody: Synaptic Systems 171 002

PDB Identifier: modified NF-H

Literature:

Hirao et al., 2000, Genes Cells

Rao et al., 2011, PLoS One

Yuan et al., 2012, J. Cell. Sci.

Yuan et al., 2015a, Mol. Psychiatry

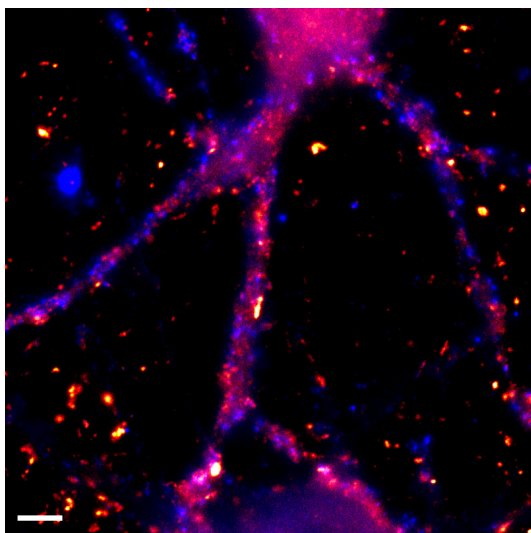
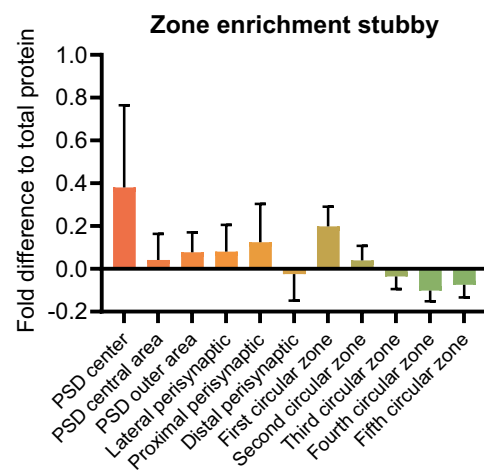
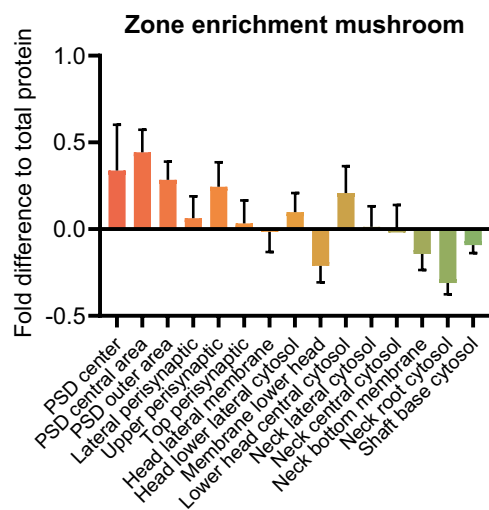
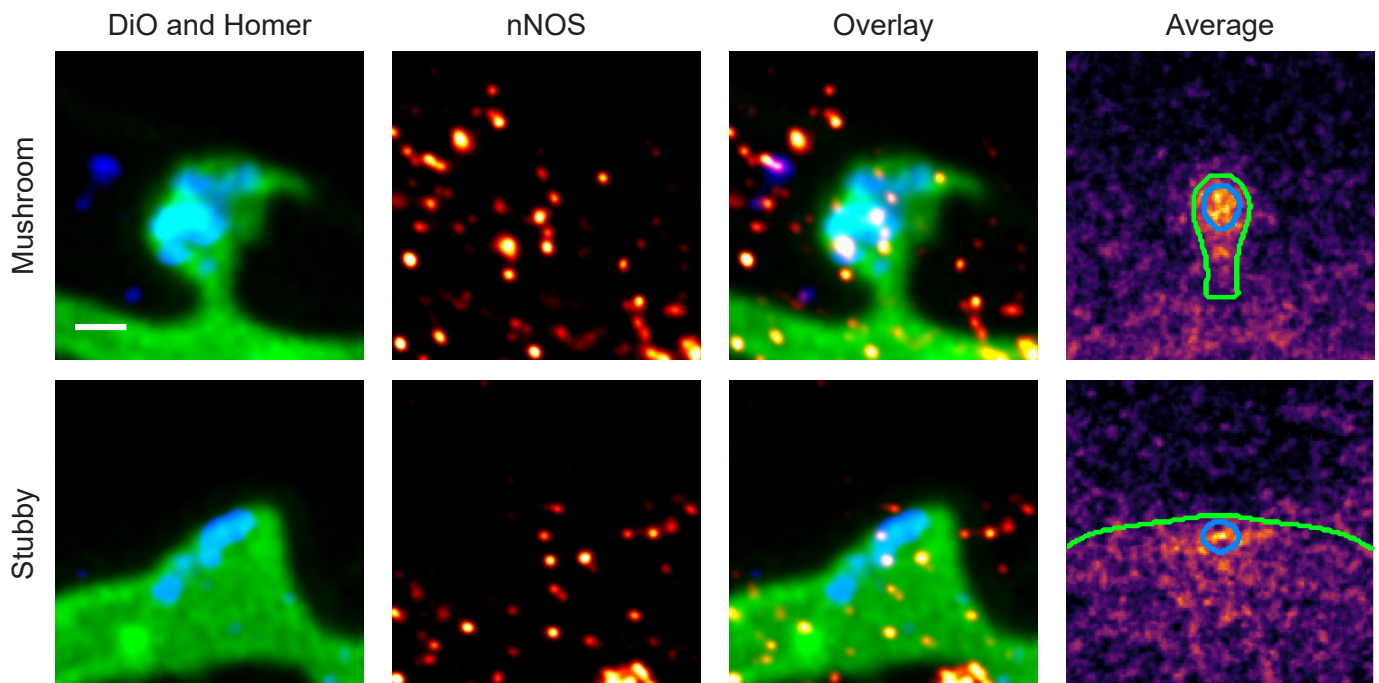
Yuan et al., 2015b, Mol. Psychiatry

Neuronal NO synthethase (nNOS, Gene: Nos1, Uniprot ID: P29476)

Known function: Production of NO, Activates cGMP production and Akt, Has neuroprotective functions by regulating glutamate and GABA release as well as NMDA receptors, Acts as retrograde signalling molecule

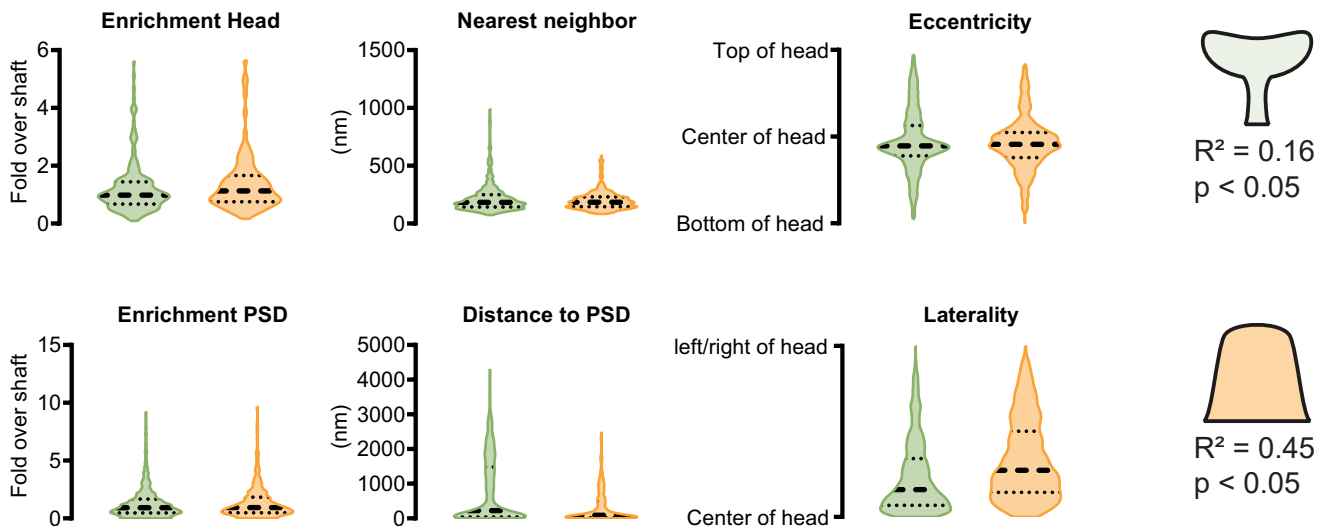
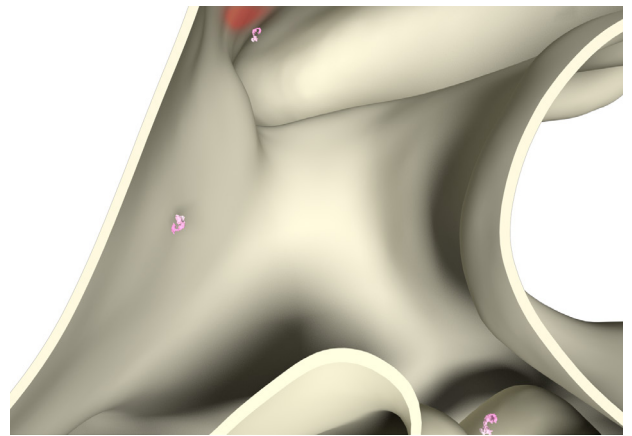
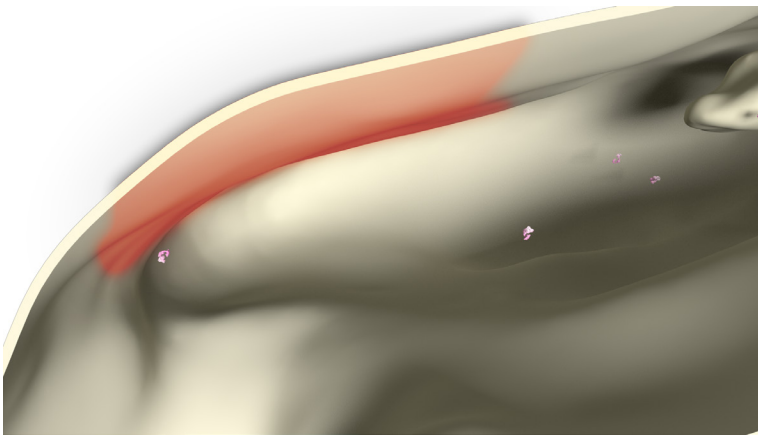
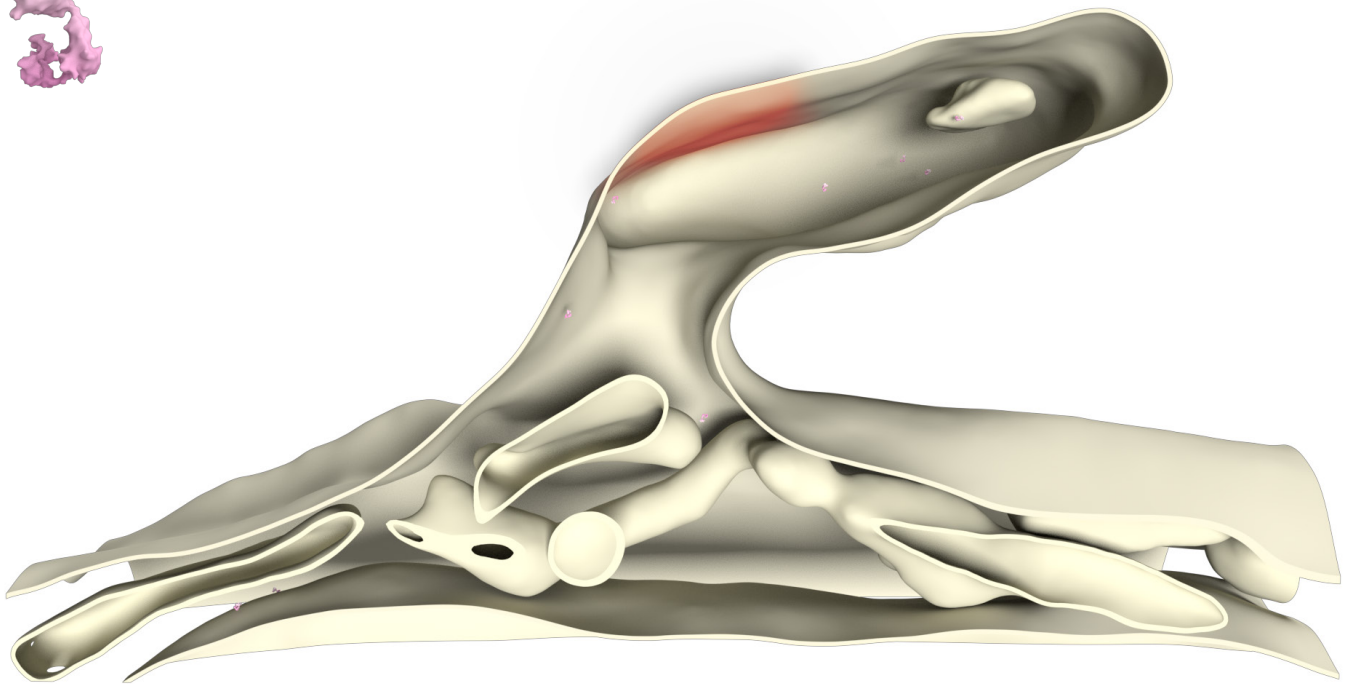
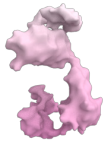
Known organization: Cytosolic

Known Interactions: Calmodulin, NMDA receptors, PSD93, PSD95

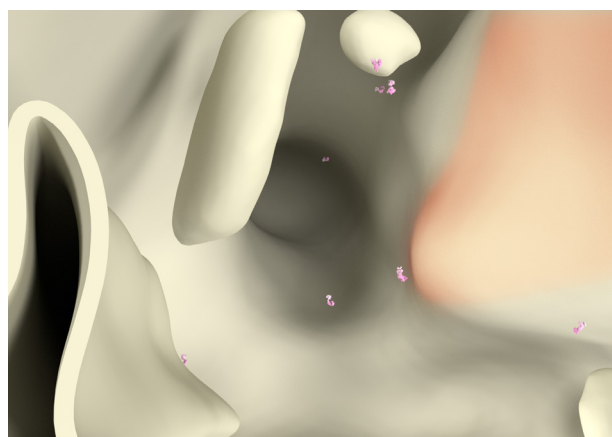
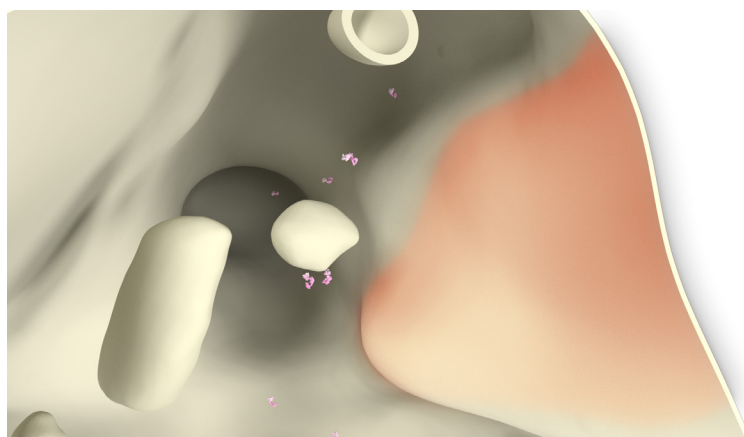
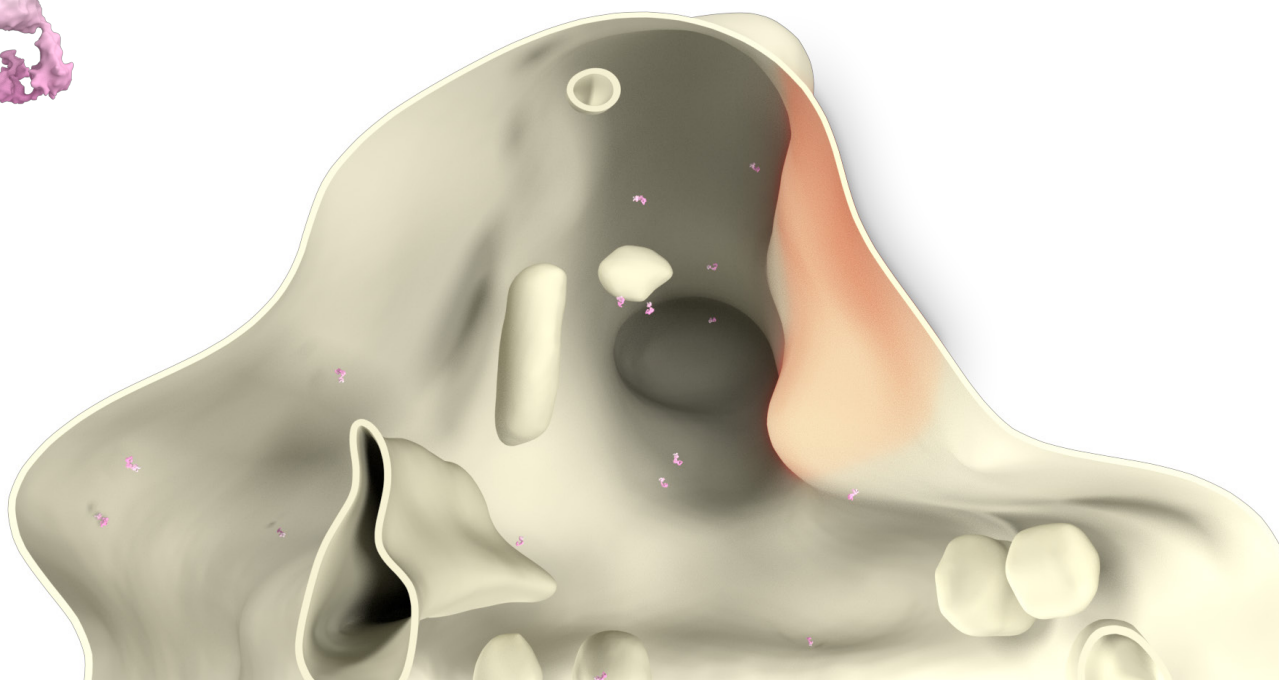
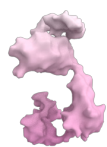


Whole cell copy number	104564.9 ± 28042.5	
Spine copy number	28.1 ± 8.2	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	23.9 ± 7.0	33.3 ± 9.7
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.3 ± 0.1	0.3 ± 0.1
PSD copy number	7 ± 2.0	5 ± 1.5
% in PSD	29.2 ± 8.5%	15.0 ± 4.4%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	23.9 ± 7.0	$0.0 \pm 0.0\%$	0.3 ± 0.1	7 ± 2.0
Stubby	33.3 ± 9.7	$0.0 \pm 0.0\%$	0.3 ± 0.1	5 ± 1.5



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	23.9 ± 7.0	$0.0 \pm 0.0\%$	0.3 ± 0.1	7 ± 2.0
Stubby	33.3 ± 9.7	$0.0 \pm 0.0\%$	0.3 ± 0.1	5 ± 1.5



References

Antibody: Thermo Scientific PA1-033

PDB Identifier: 1b8q, 1f20

Literature:

Aarts et al., 2002, Science

Aoki et al., 1997, Brain Res.

Arnold et al., 1977, Proc. Natl. Acad. Sci. U S A

Bon and Garthwaite, 2003, J. Neurosci.

Brenman et al., 1996b, Cell

Calabrese et al., 2007, Nat. Rev. Neurosci.

Choi et al., 2000, Nat. Neurosci.

Getting et al., 1996, Brain Res.

Hopper et al., 2004, Eur. J. Neurosci.

Jaffrey et al., 1998, Neuron

Lonart et al., 1992, Eur. J. Pharmacol.

Ohkuma et al., 1996, Brain Res. Mol. Brain Res.

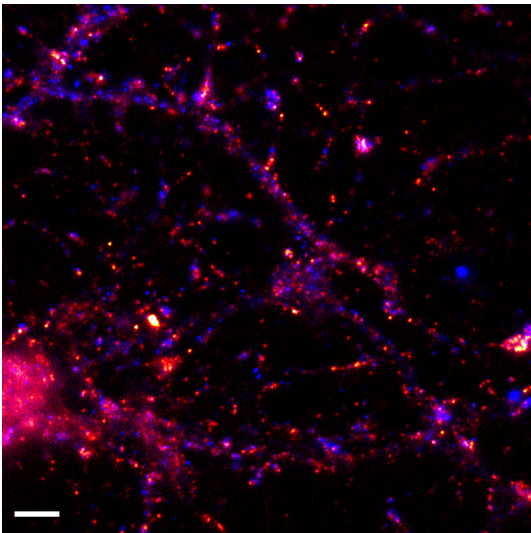
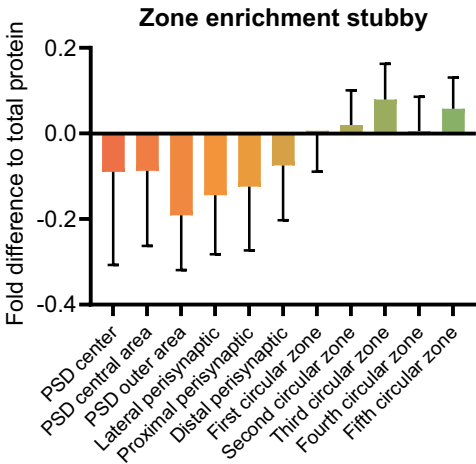
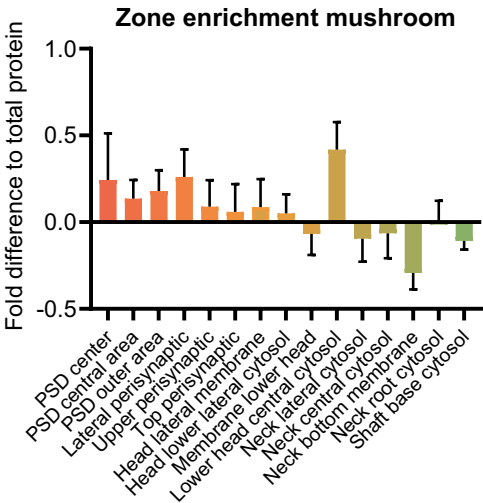
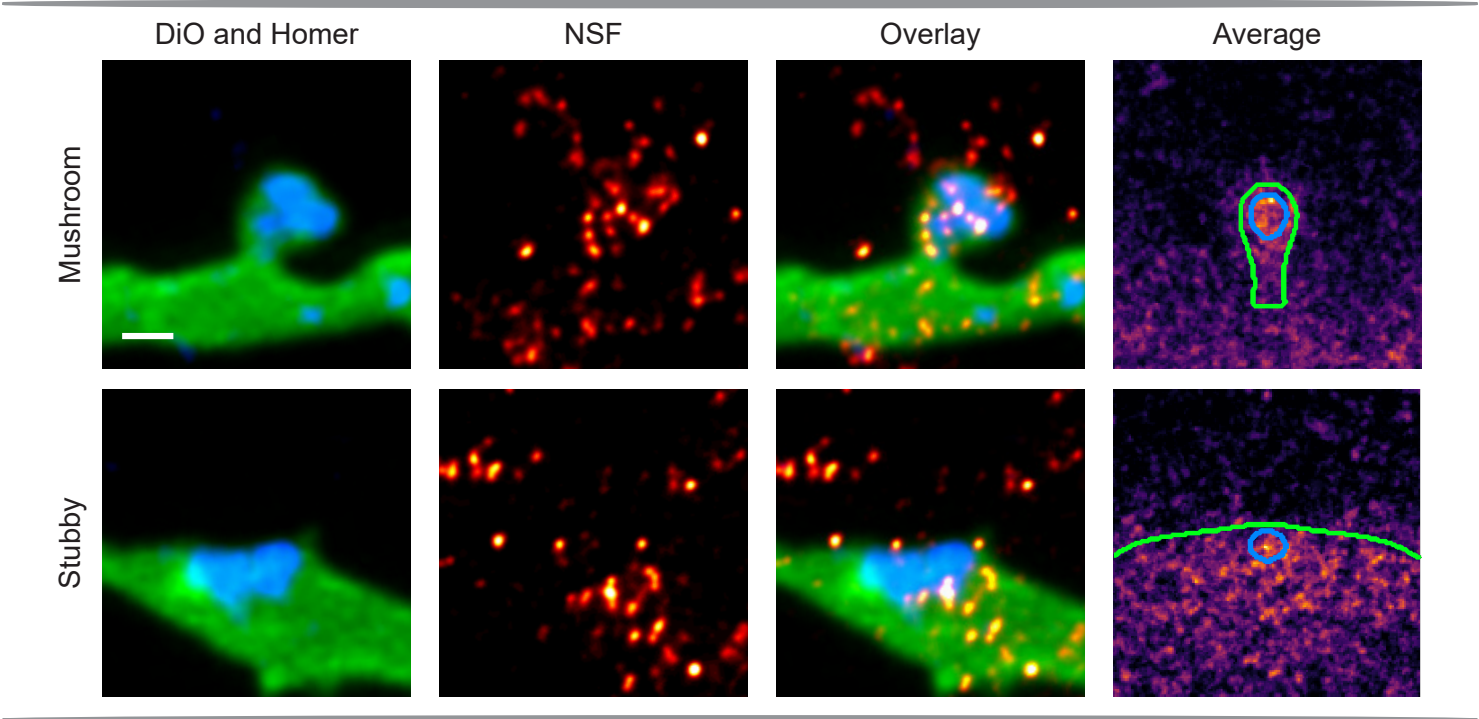
Riccio et al., 2006, Mol. Cell.

NSF (Vesicle-fusing ATPase, Gene: Nsf, Uniprot ID: Q9QUL6)

Known function: Disassembly of trans-SNARE complexes

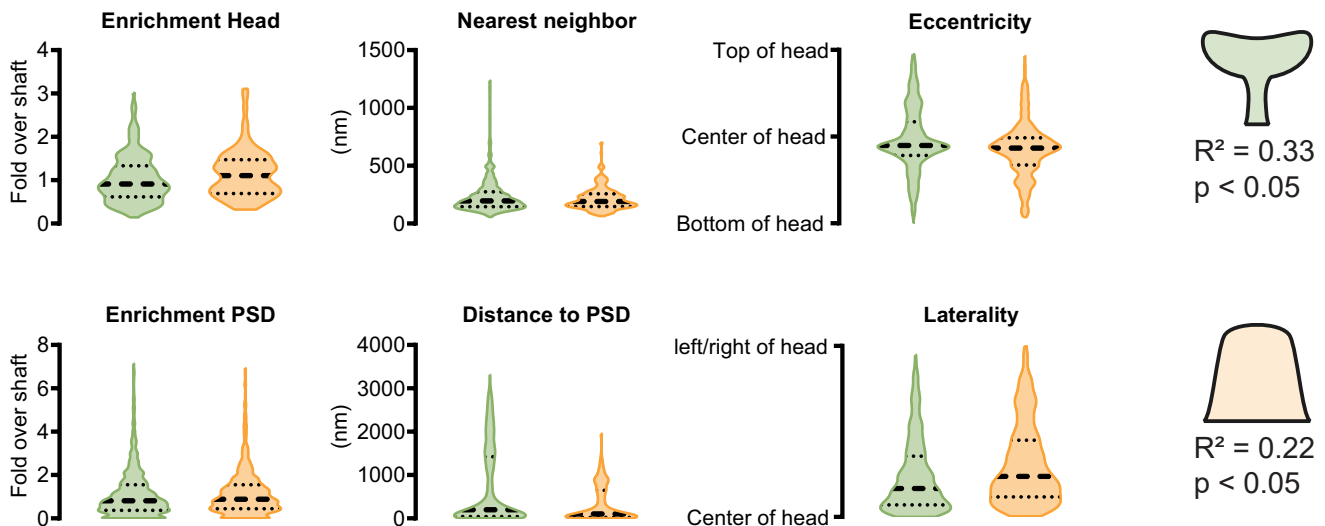
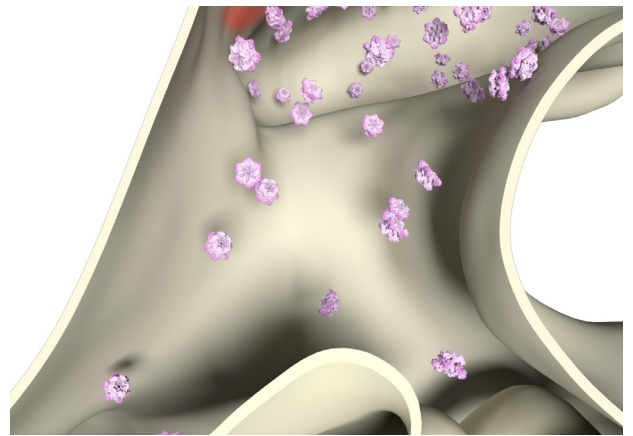
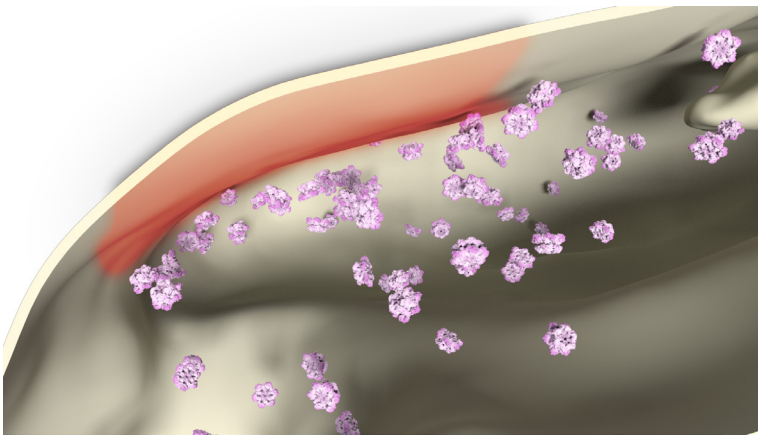
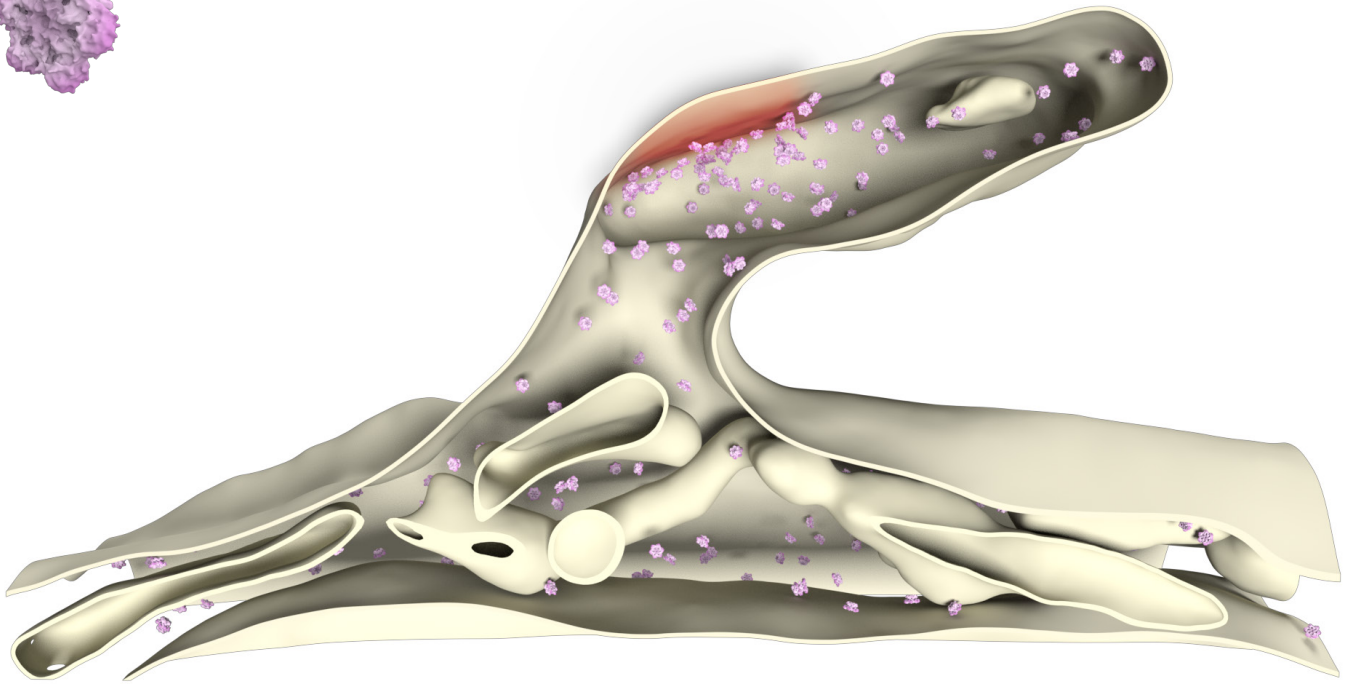
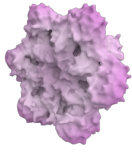
Known organization: Cytosolic, Homohexamer

Known Interactions: α and β SNAP, GluR2

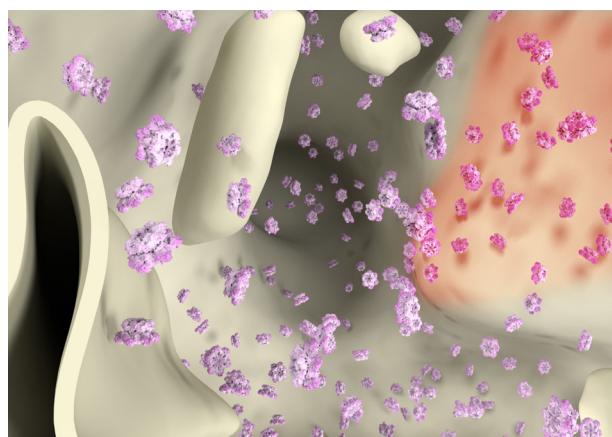
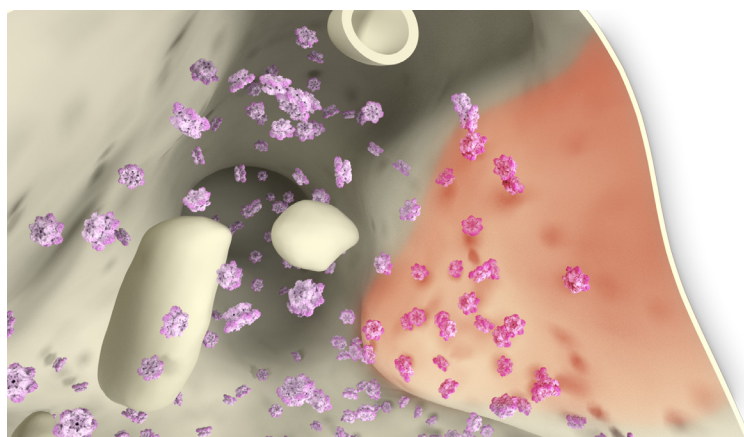
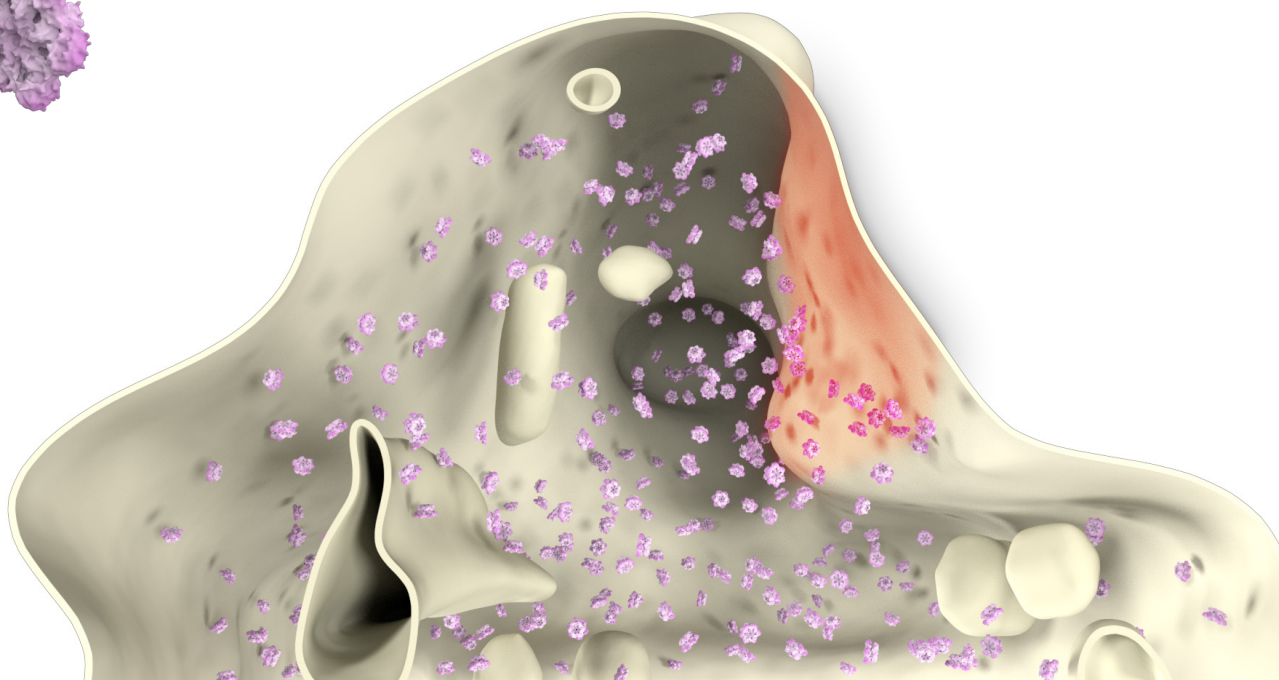
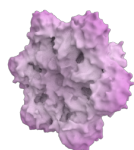


Whole cell copy number	10485623.2 ± 276848.8	
Spine copy number	2916.4 ± 400.8	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	2343.6 ± 322.1	3721.2 ± 511.4
% of total protein	0.9 ± 0.1%	1.3 ± 0.2%
Molarity (μM)	29.8 ± 4.1	35.2 ± 4.8
PSD copy number	604 ± 83.0	451 ± 62.0
% in PSD	25.8 ± 3.5%	12.1 ± 1.7%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	2343.6 ± 322.1	$0.9 \pm 0.1\%$	29.8 ± 4.1	604 ± 83.0
Stubby	3721.2 ± 511.4	$1.3 \pm 0.2\%$	35.2 ± 4.8	451 ± 62.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	2343.6 ± 322.1	$0.9 \pm 0.1\%$	29.8 ± 4.1	604 ± 83.0
Stubby	3721.2 ± 511.4	$1.3 \pm 0.2\%$	35.2 ± 4.8	451 ± 62.0



References

Antibody: Synaptic Systems 132 002

PDB Identifier: 3j94

Literature:

Block et al., 1988, Proc. Natl. Acad. Sci. U S A

Clary et al., 1990, Cell

Evers et al., 2010, Nat. Neurosci.

Hanson et al., 1995, J. Biol. Chem.

Hohl et al., 1998, Mol. Cell

Söllner et al., 1993a, Nature

Söllner et al., 1993b, Cell

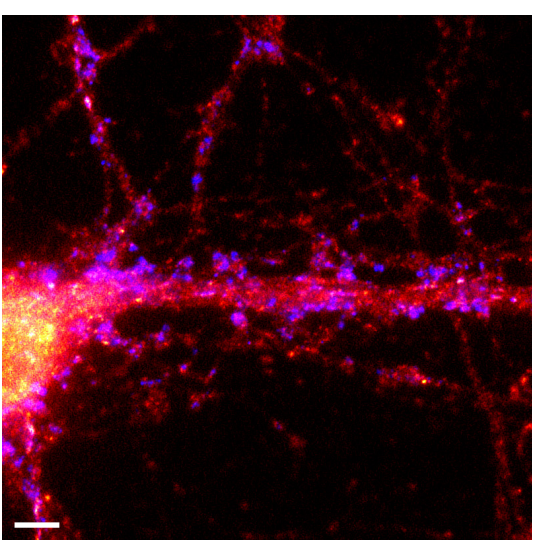
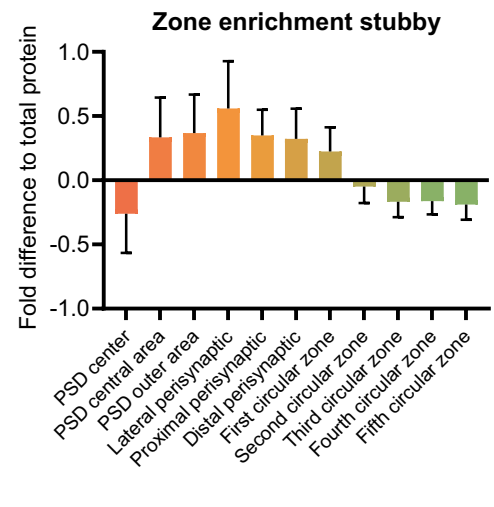
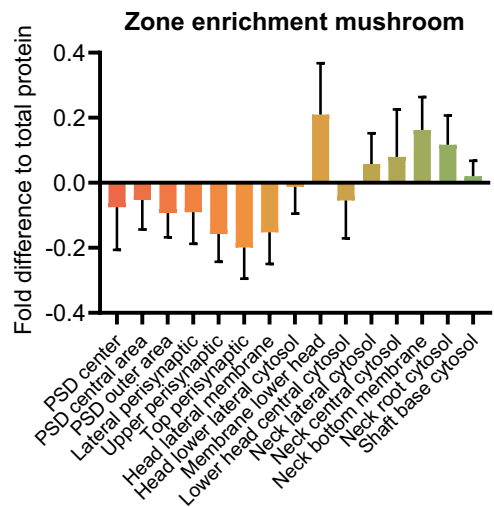
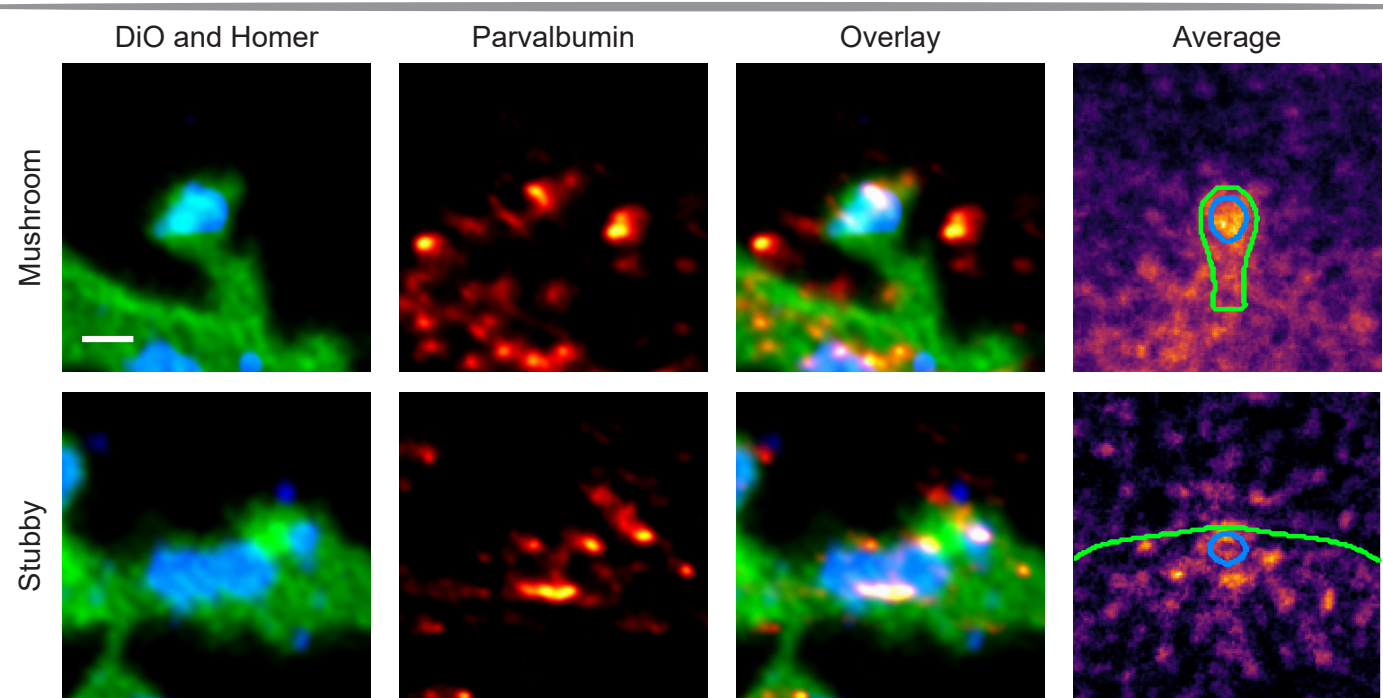
Wilson et al., 1989, Nature

Parvalbumin (Genes: Pvalb, Uniprot ID: P02625)

Known function: Calcium buffer, involved in Alzheimer’s disease

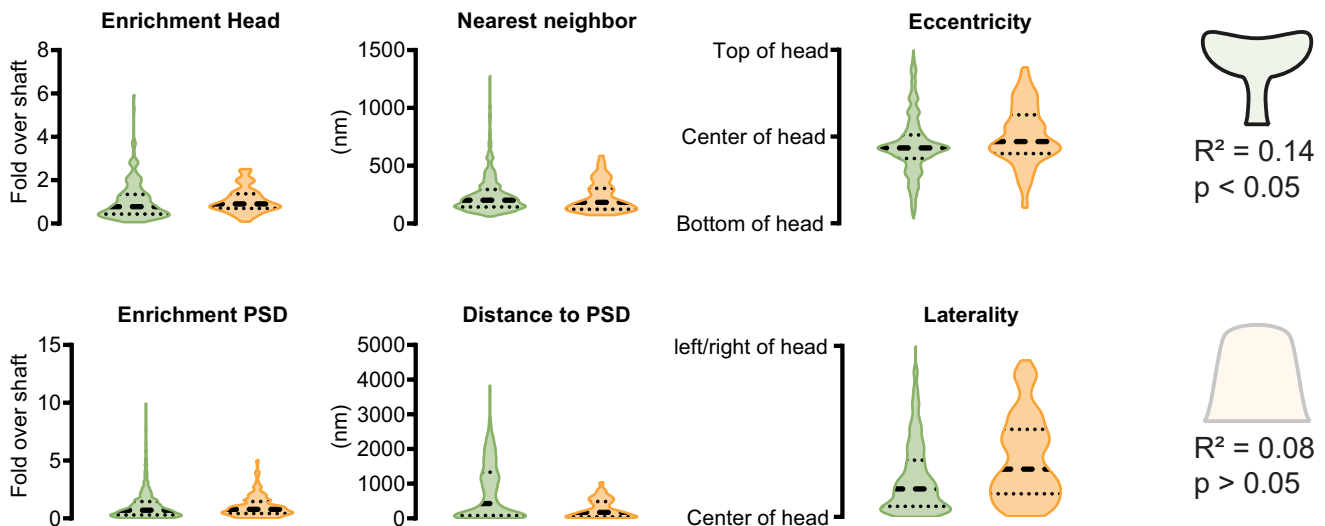
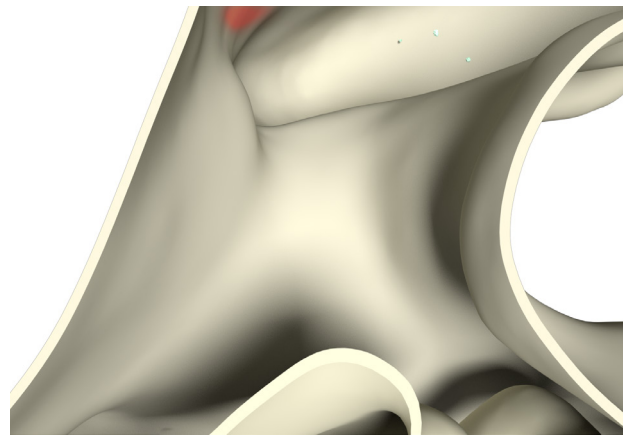
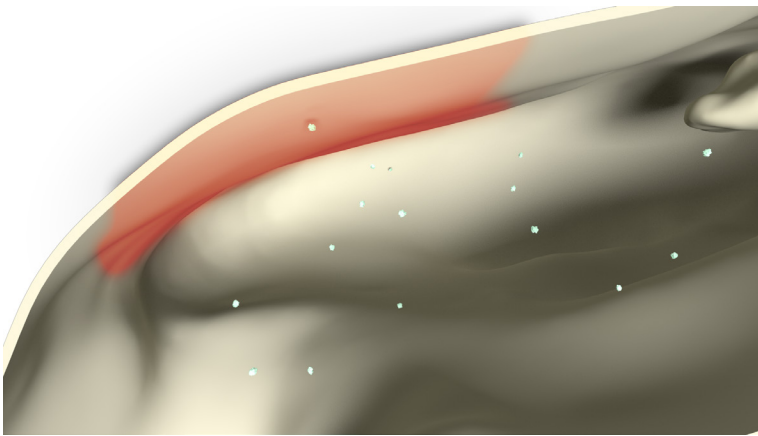
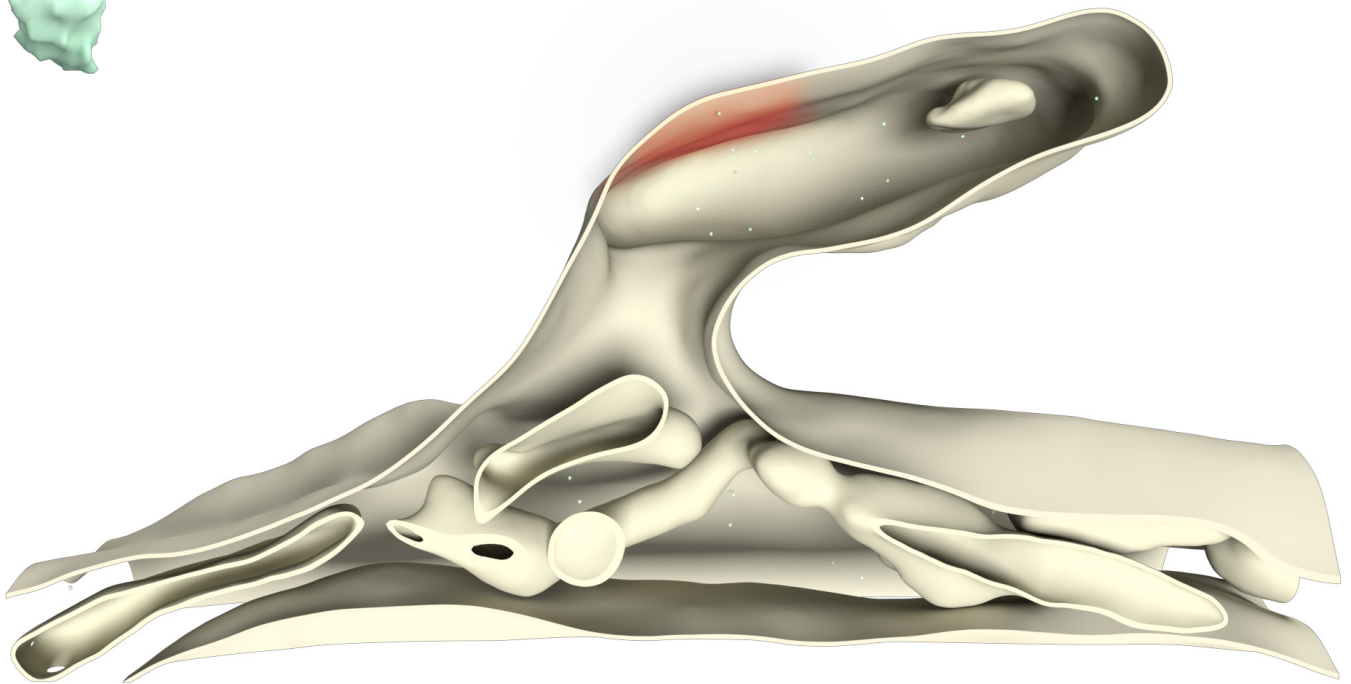
Known organization: Cytosolic

Known Interactions: None

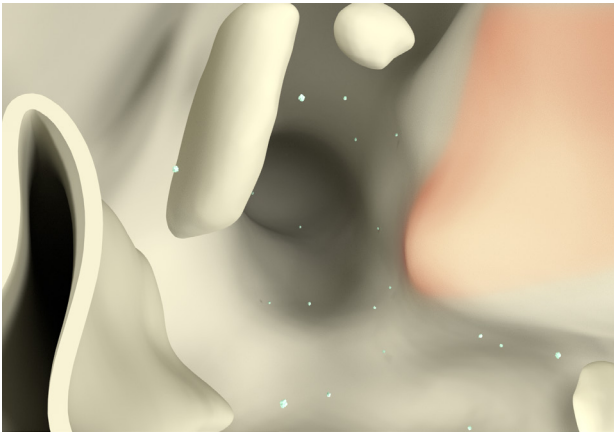
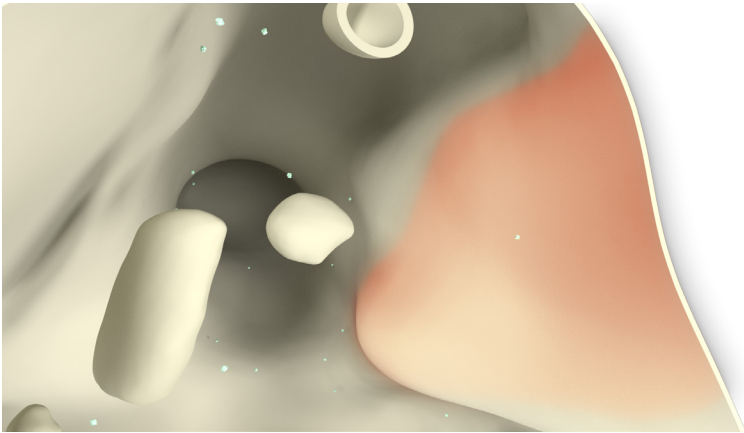
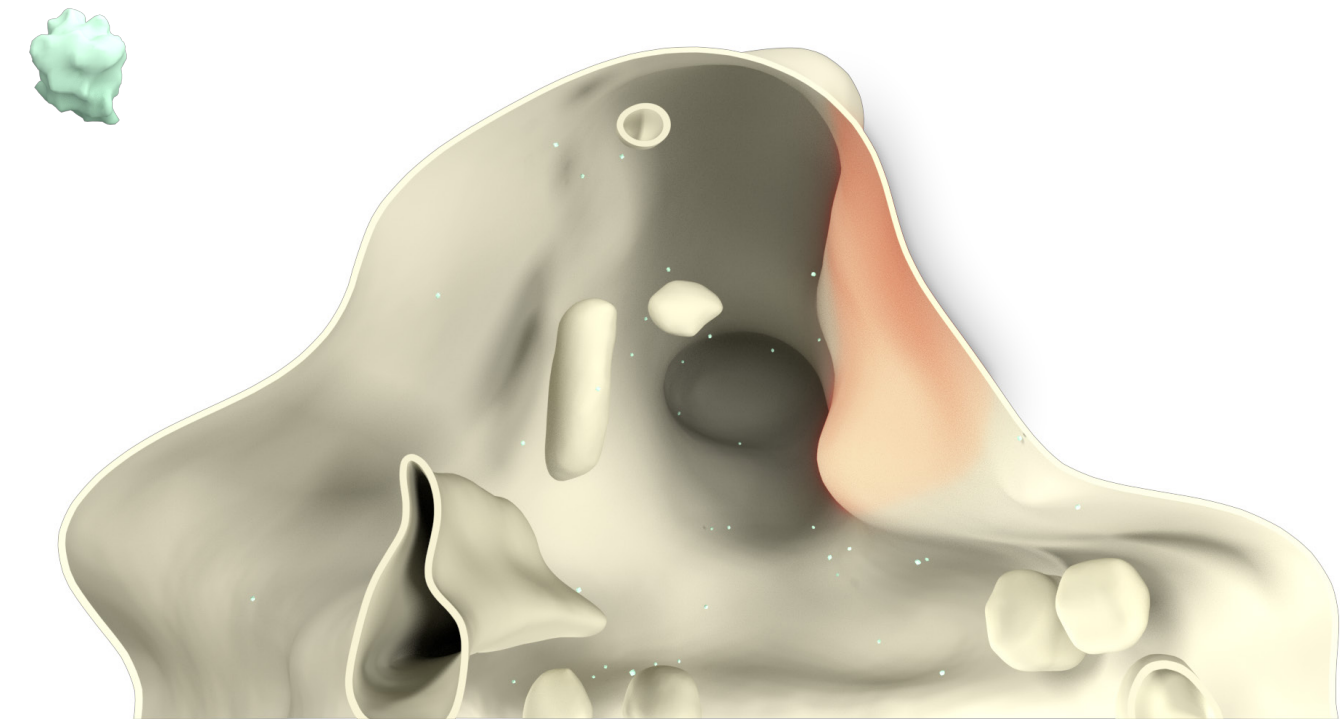


Whole cell copy number	891723.7 ± 778526.3	
Spine copy number	74.5 ± 72.2	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	65.1 ± 63.1	83.0 ± 80.5
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.8 ± 0.8	0.8 ± 0.8
PSD copy number	17 ± 16.5	12 ± 11.6
% in PSD	26.1 ± 25.3%	14.5 ± 14.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	65.1 ± 63.1	$0.0 \pm 0.0\%$	0.8 ± 0.8	17 ± 16.5
Stubby	83.0 ± 80.5	$0.0 \pm 0.0\%$	0.8 ± 0.8	12 ± 11.6



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	65.1 ± 63.1	$0.0 \pm 0.0\%$	0.8 ± 0.8	17 ± 16.5
Stubby	83.0 ± 80.5	$0.0 \pm 0.0\%$	0.8 ± 0.8	12 ± 11.6



References

Antibody: Swant PV25

PDB Identifier: 1rtp

Literature:

Cates et al., 2002, Biophys. J.

Klausberger et al., 2005, J. Neurosci.

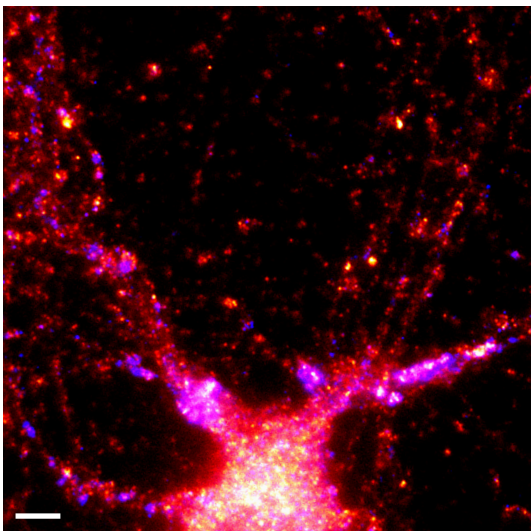
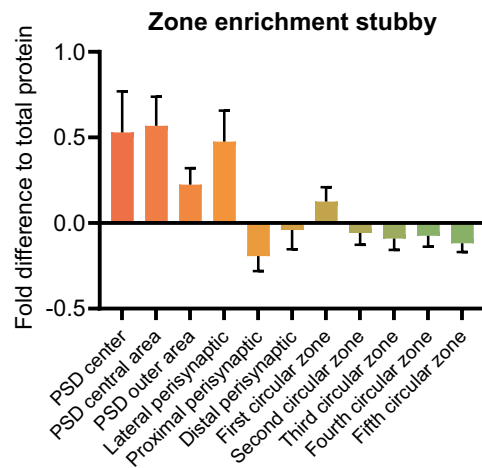
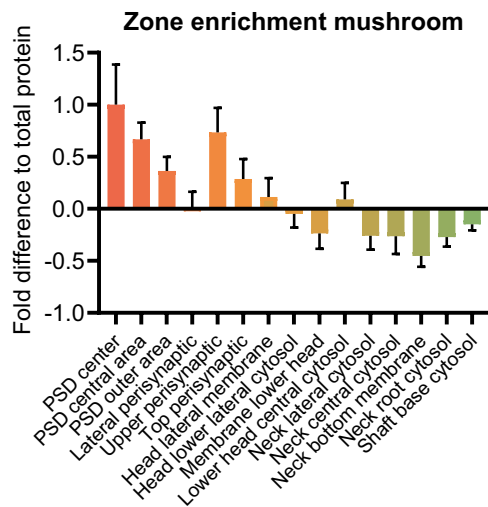
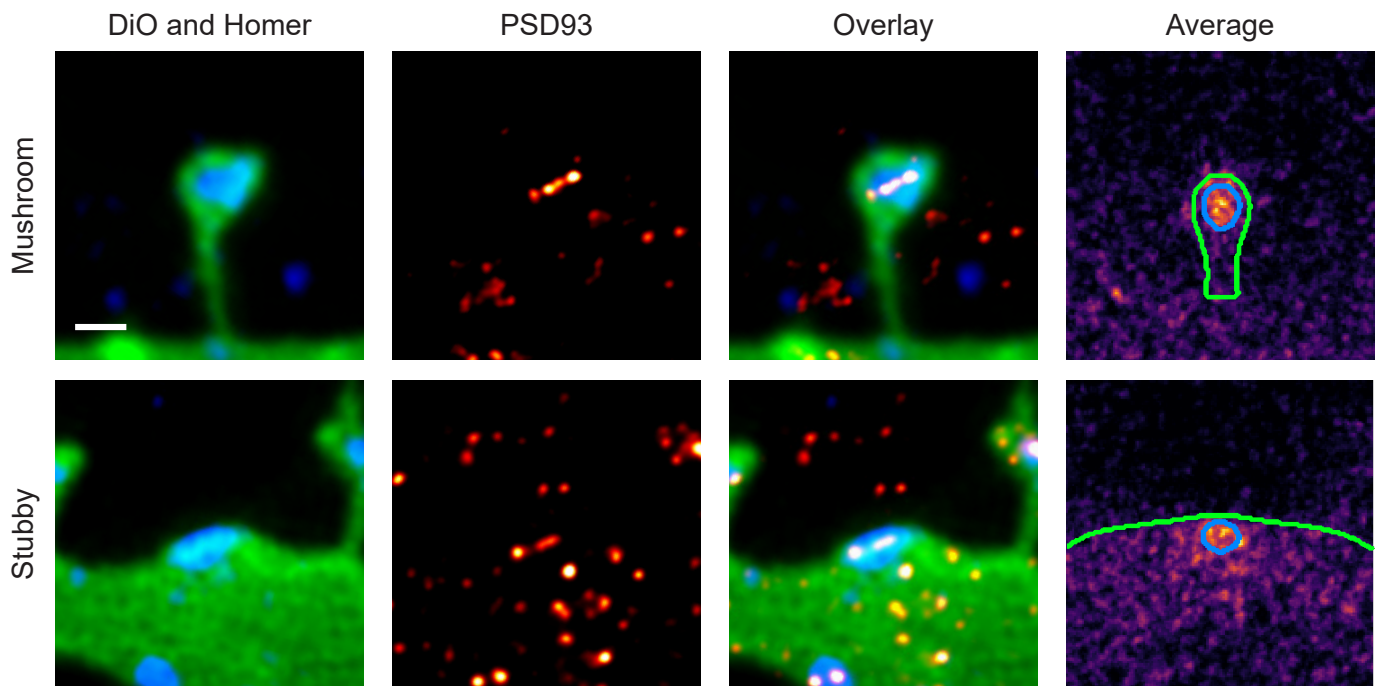
Verret et al., 2012, Cell

PSD93 (Dlg2, Chapsyn-110, Gene: Dlg2, Uniprot ID: Q63622)

Known function: Major organizer of the PSD

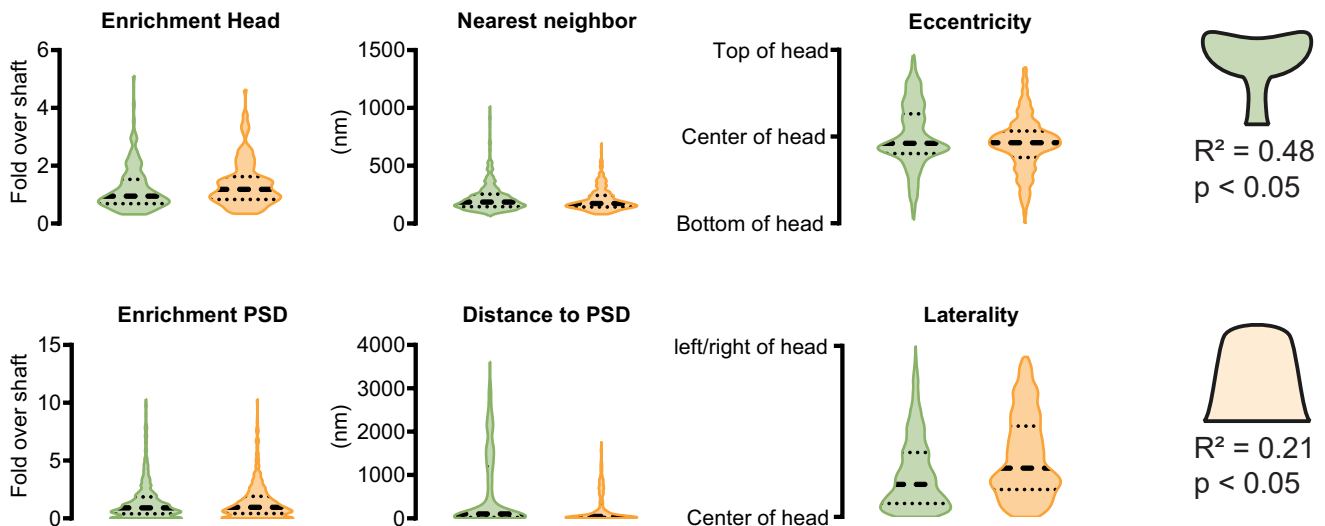
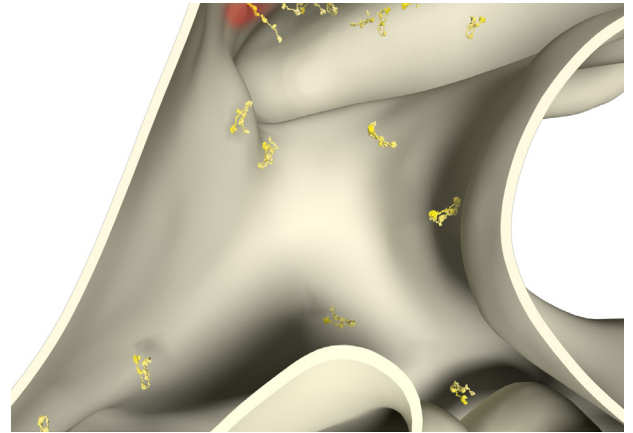
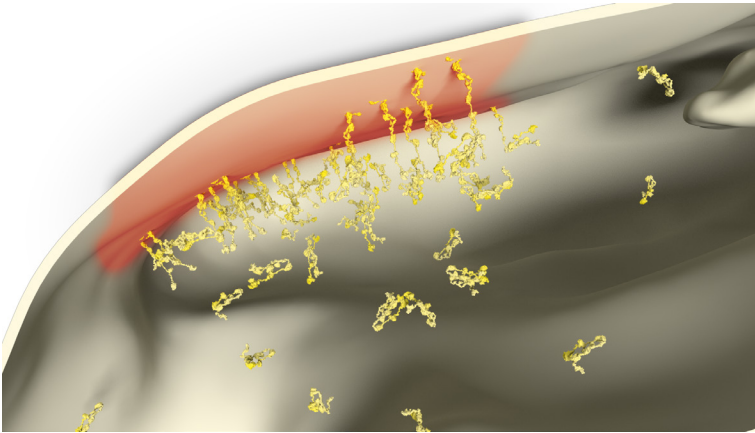
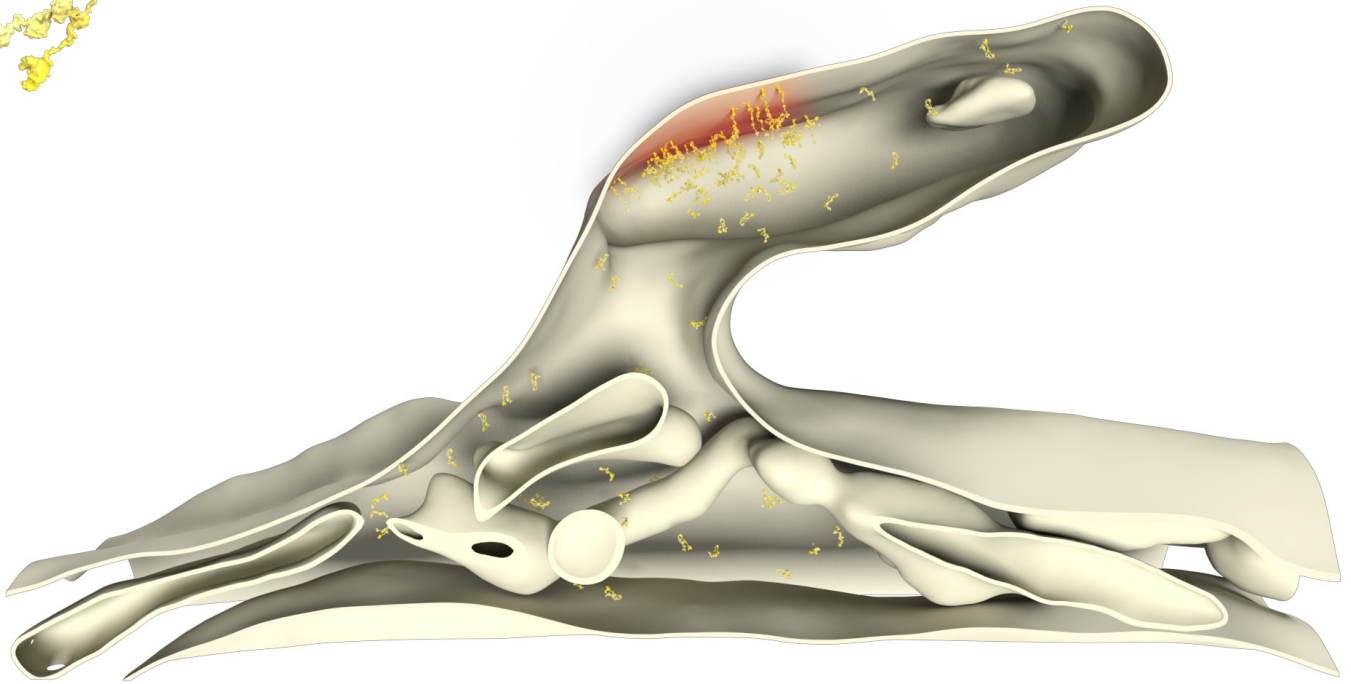
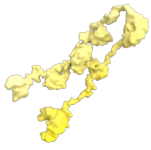
Known organization: Membrane-associated, Forms supercomplexes with other scaffolds, receptors and other proteins

Known Interactions: PSD95, NMDA receptors, nNOS, Kir2.1

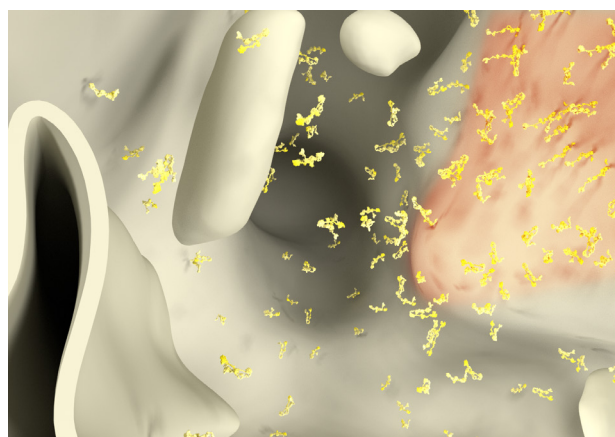
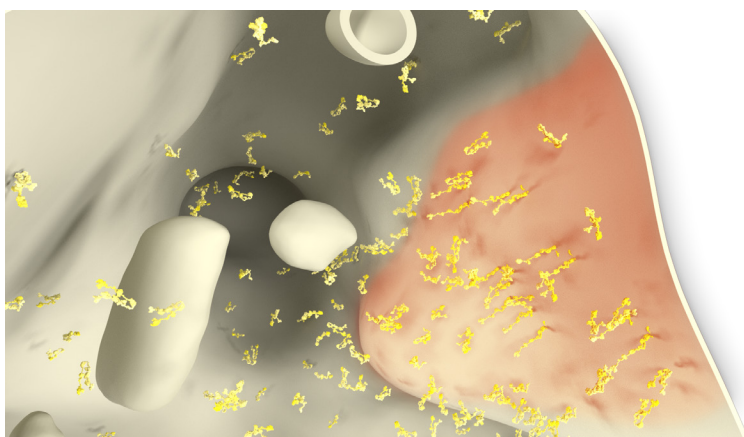
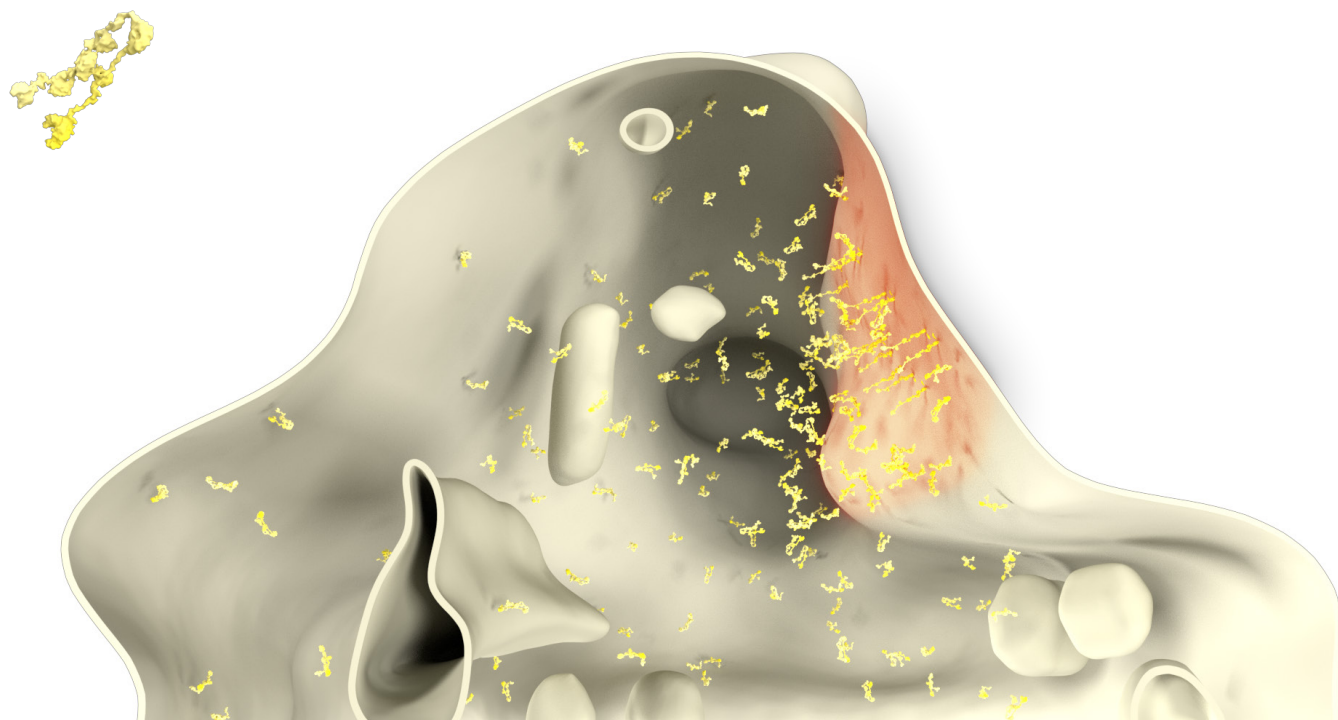


Whole cell copy number	765847.1 ± 25826.4	
Spine copy number	255.8 ± 23.6	
Function	PSD scaffolds	
	Mushroom	Stubby
Spine copy number	220.7 ± 20.4	318.7 ± 29.4
% of total protein	0.1 ± 0.0%	0.1 ± 0.0%
Molarity (μM)	2.8 ± 0.3	3.0 ± 0.3
PSD copy number	72 ± 6.7	88 ± 8.1
% in PSD	32.6 ± 3.0%	27.6 ± 2.6%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	220.7 ± 20.4	$0.1 \pm 0.0\%$	2.8 ± 0.3	72 ± 6.7
Stubby	318.7 ± 29.4	$0.1 \pm 0.0\%$	3.0 ± 0.3	88 ± 8.1



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	220.7 ± 20.4	$0.1 \pm 0.0\%$	2.8 ± 0.3	72 ± 6.7
Stubby	318.7 ± 29.4	$0.1 \pm 0.0\%$	3.0 ± 0.3	88 ± 8.1



References

Antibody: Invitrogen 34-4700

PDB Identifier: 2wl7

Literature:

Brenman et al., 1996a, J. Neurosci.

Dakoji et al., 2003, Neuropharmacology

Frank et al., 2016, Nat. Commun.

Leyland and Dart, 2004, J. Biol. Chem.

Niethammer et al., 1996, J. Neurosci.

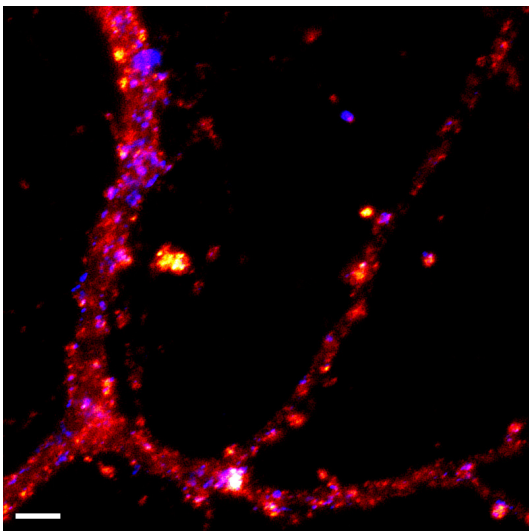
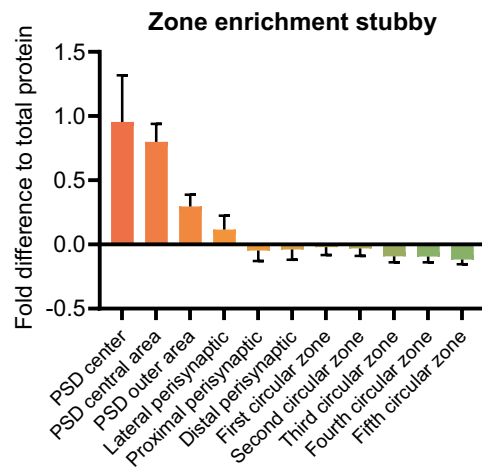
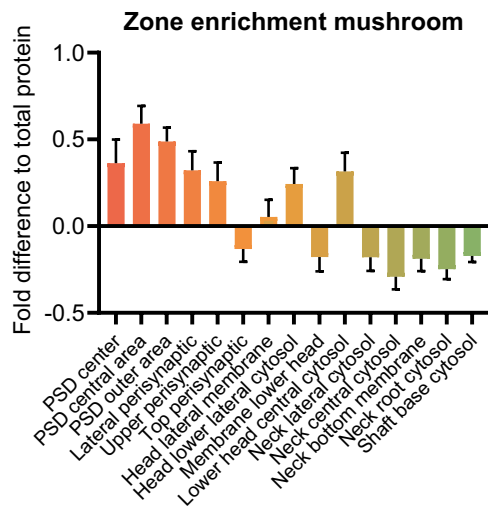
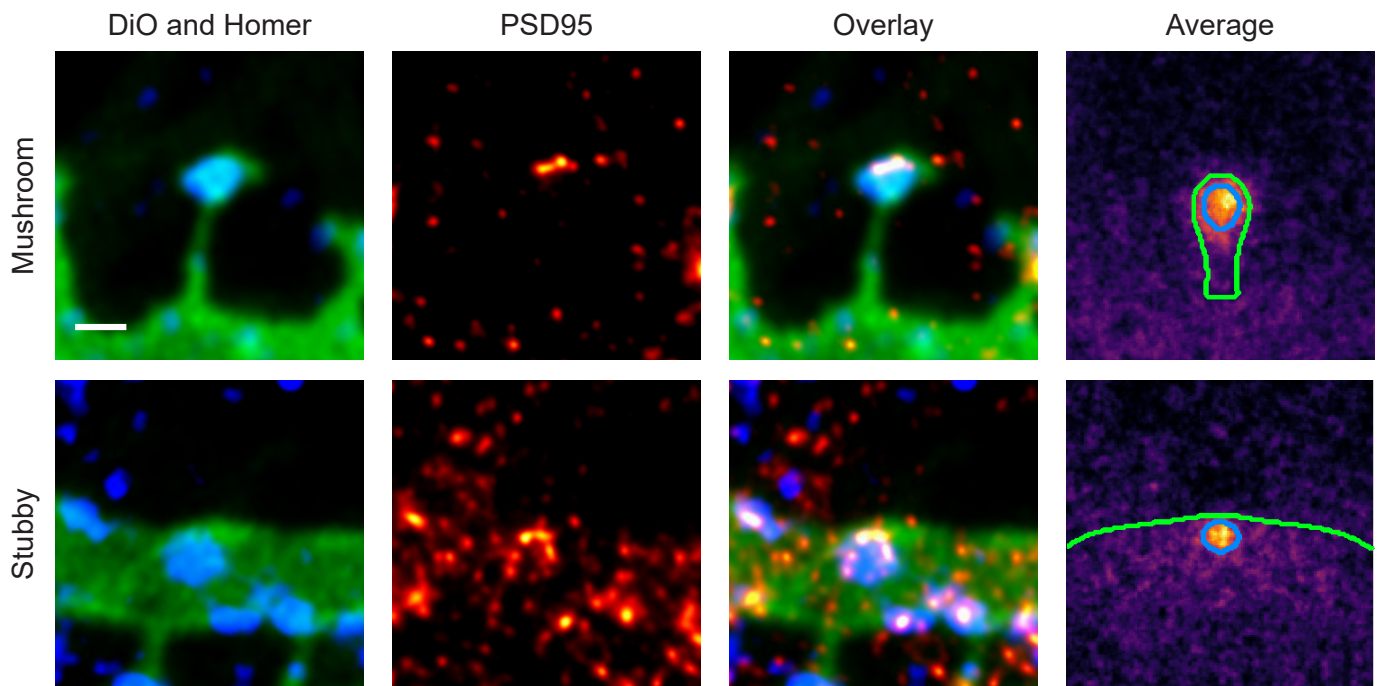
Parker, 2004, J. Neurosci.

PSD95 (Dlg4, Sap90, Gene: Dlg4, Uniprot ID: P31016)

Known function: Major organizer of the PSD

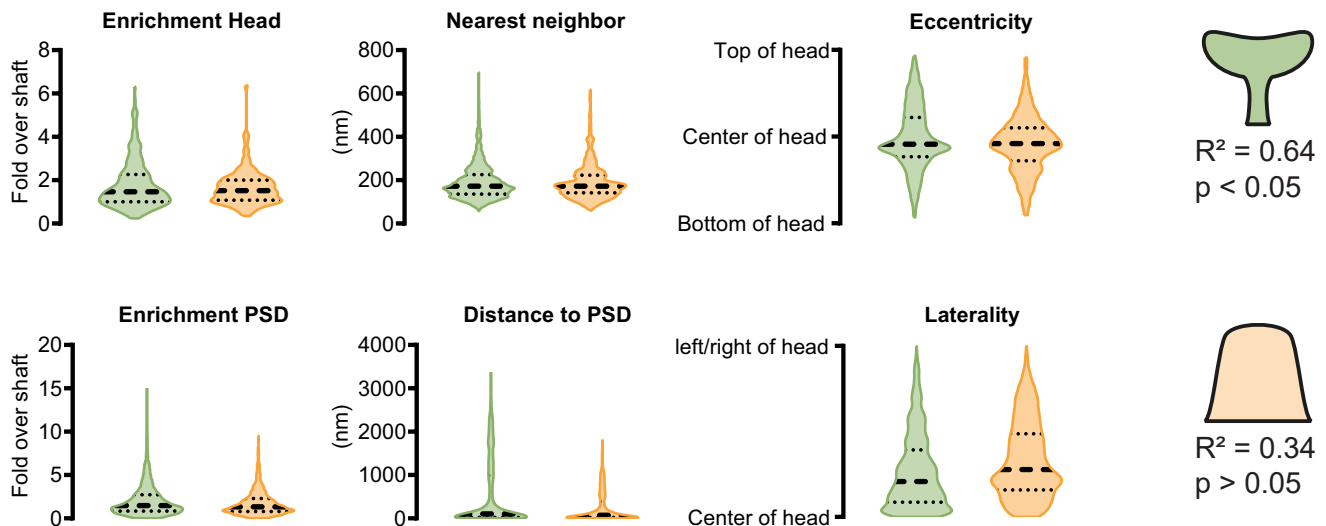
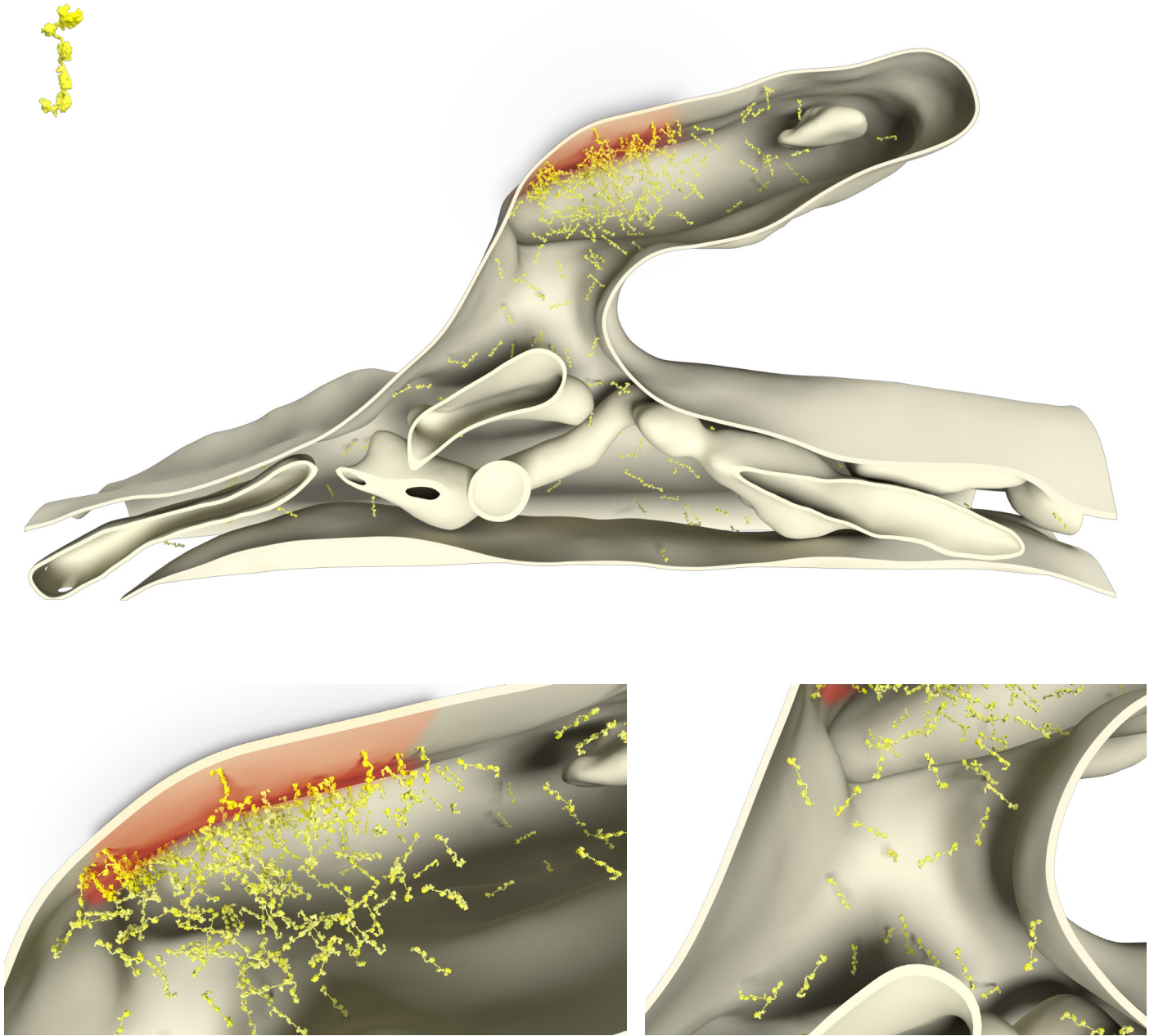
Known organization: Membrane-associated and cytosolic, Forms supercomplexes with other scaffolds, receptors and other proteins, Forms Nanodomains

Known Interactions: PSD93, NMDA receptors, nNOS, Potassium channels

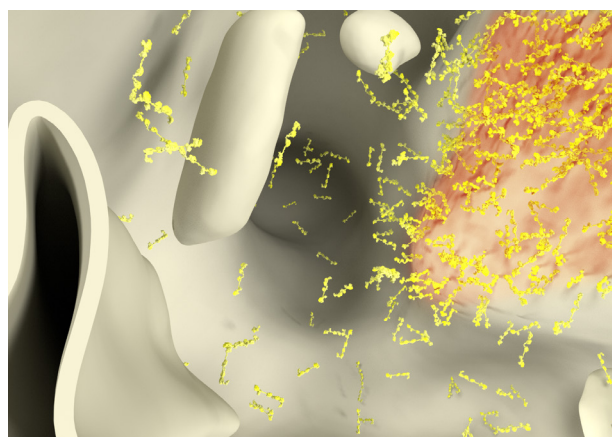
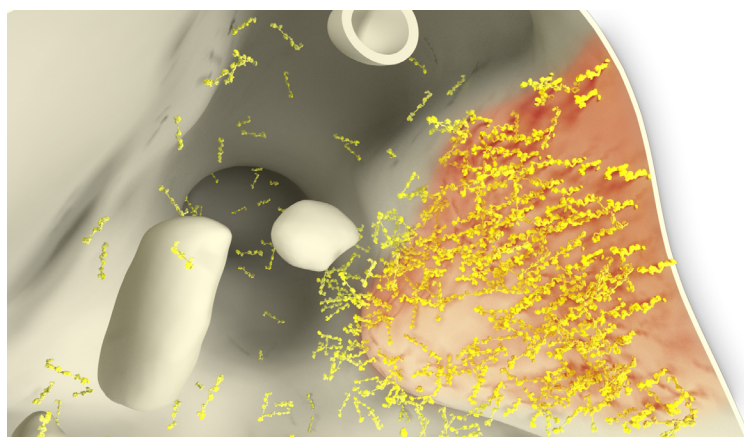
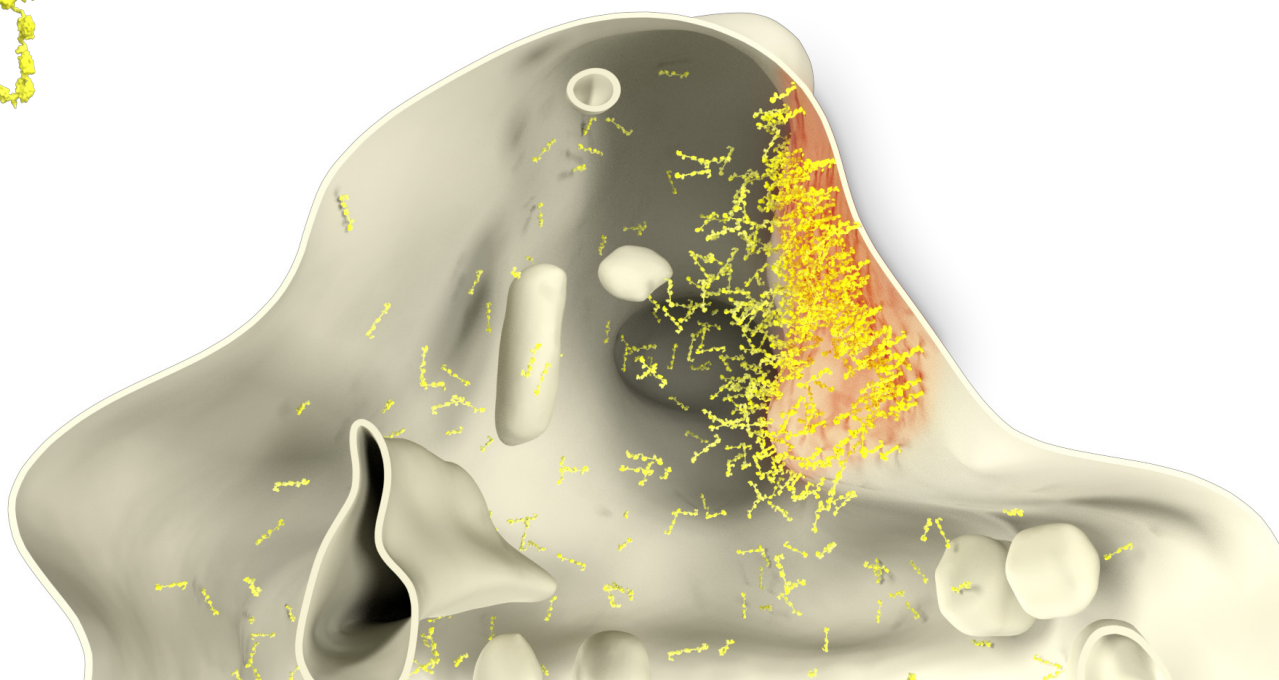


Whole cell copy number	1149048.0 ± 116158.6	
Spine copy number	525.2 ± 76.7	
Function	PSD scaffolds	
	Mushroom	Stubby
Spine copy number	550.3 ± 80.4	539.1 ± 78.8
% of total protein	0.2 ± 0.0%	0.2 ± 0.0%
Molarity (μM)	7.0 ± 1.0	5.1 ± 0.7
PSD copy number	240 ± 35.1	261 ± 38.1
% in PSD	43.6 ± 6.4%	48.4 ± 7.1%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	550.3 ± 80.4	$0.2 \pm 0.0\%$	7.0 ± 1.0	240 ± 35.1
Stubby	539.1 ± 78.8	$0.2 \pm 0.0\%$	5.1 ± 0.7	261 ± 38.1



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	550.3 ± 80.4	$0.2 \pm 0.0\%$	7.0 ± 1.0	240 ± 35.1
Stubby	539.1 ± 78.8	$0.2 \pm 0.0\%$	5.1 ± 0.7	261 ± 38.1



References

Antibody: Cell Signaling 3450

PDB Identifier: 2xkx, 5jxb

Literature:

Bhattacharyya et al., 2009, Na. Neurosci.

Broadhead et al., 2016, Sci. Rep.

Dani et al., 2010, Neuron

Frank et al., 2017, J. Neurochem.

Garner et al., 2000, J. Neurochem.

Hruska et al., 2018, Nat. Neurosci.

Inagaki et al., 2001, J. Biol. Chem.

Kim et al., 1997, J. Cell. Biol.

MacGillavry et al., 2013, Neuron

Nair et al., 2013, J. Neurosci.

Niethammer et al., 1996, J. Neurosci.

Schultze et al., 2001, J. Neurochem.

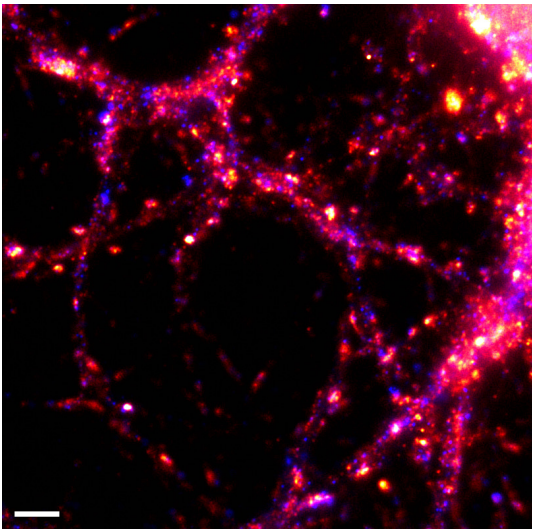
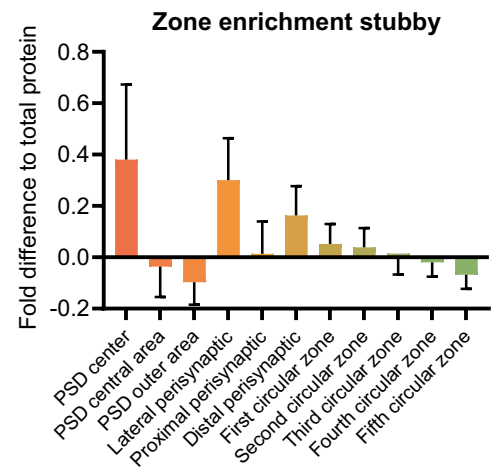
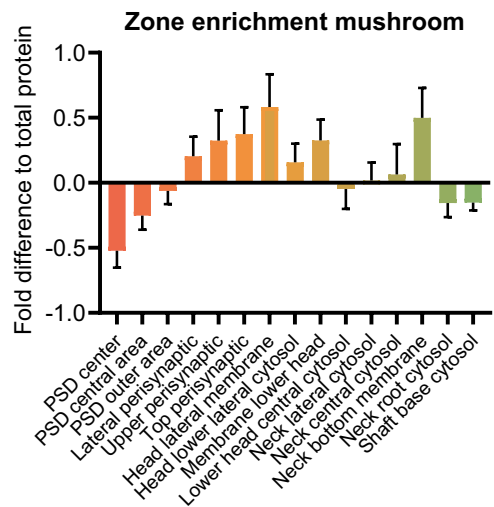
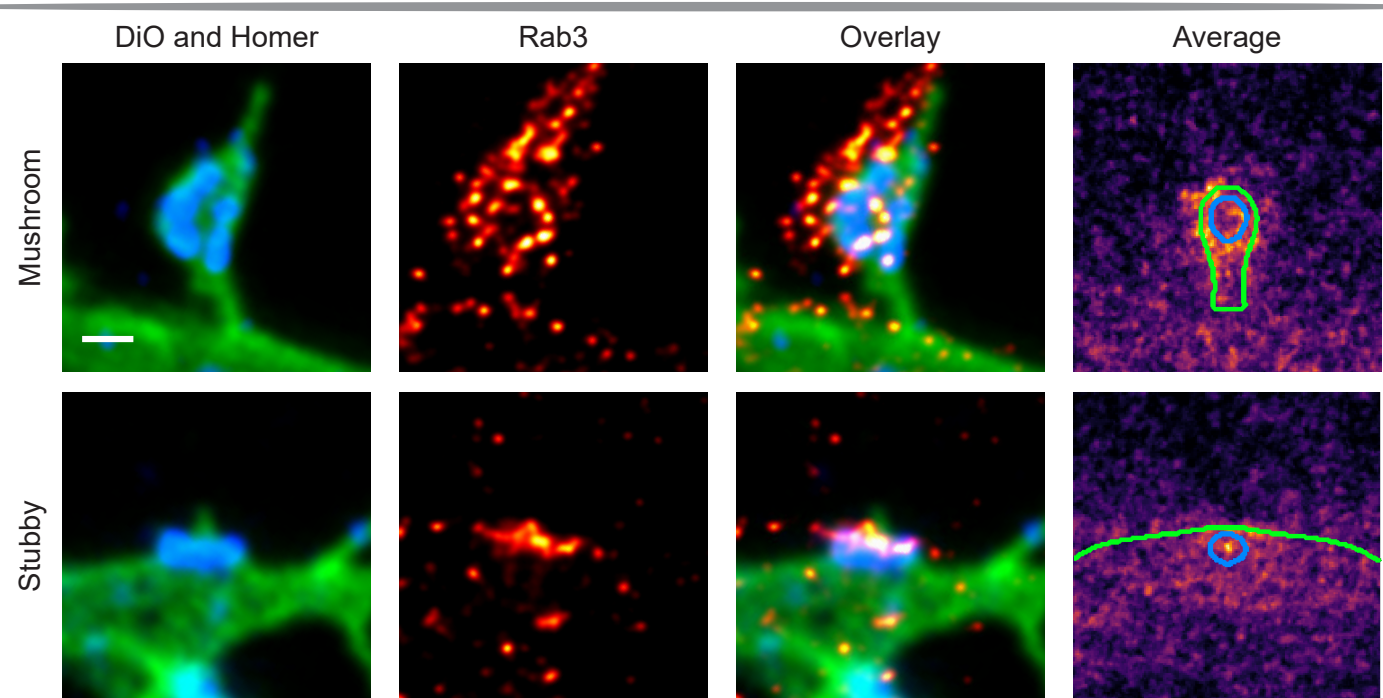
Sheng and Sala, 2001, Annu. Rev. Neurosci.

Takeuchi et al., 1997, J. Biol. Chem.

Tang et al., 2016, Nature

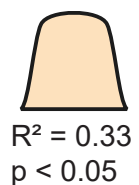
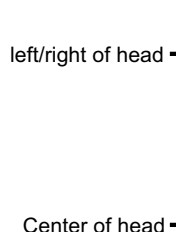
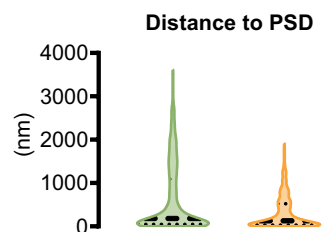
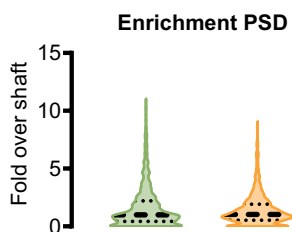
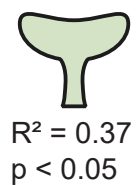
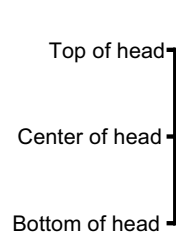
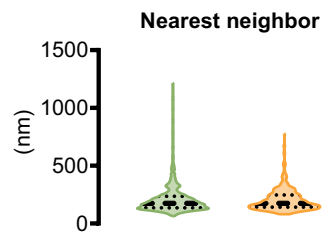
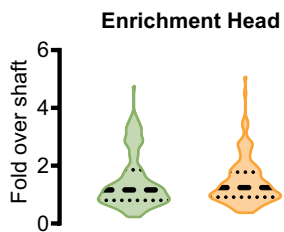
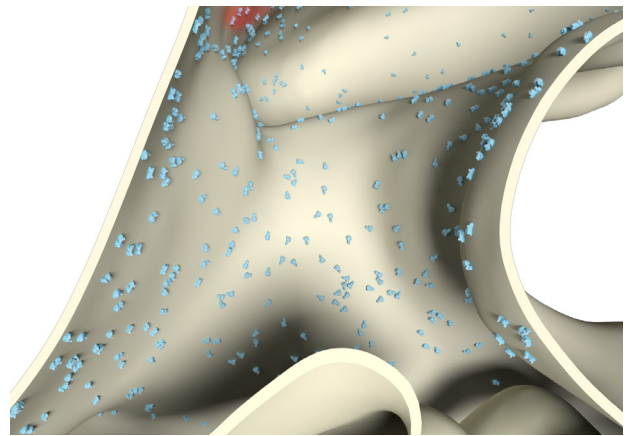
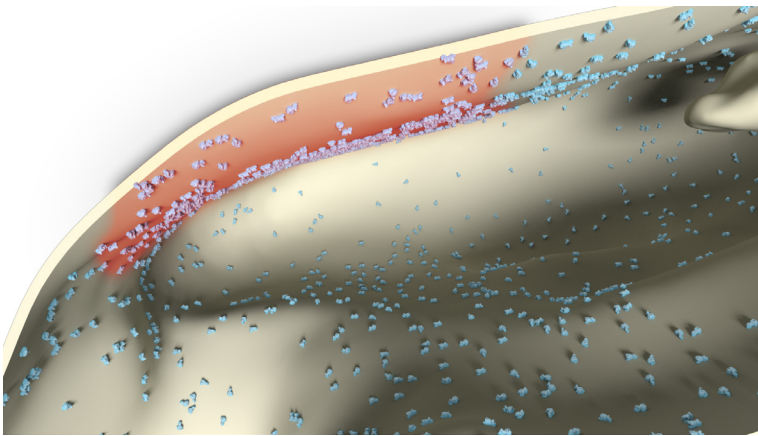
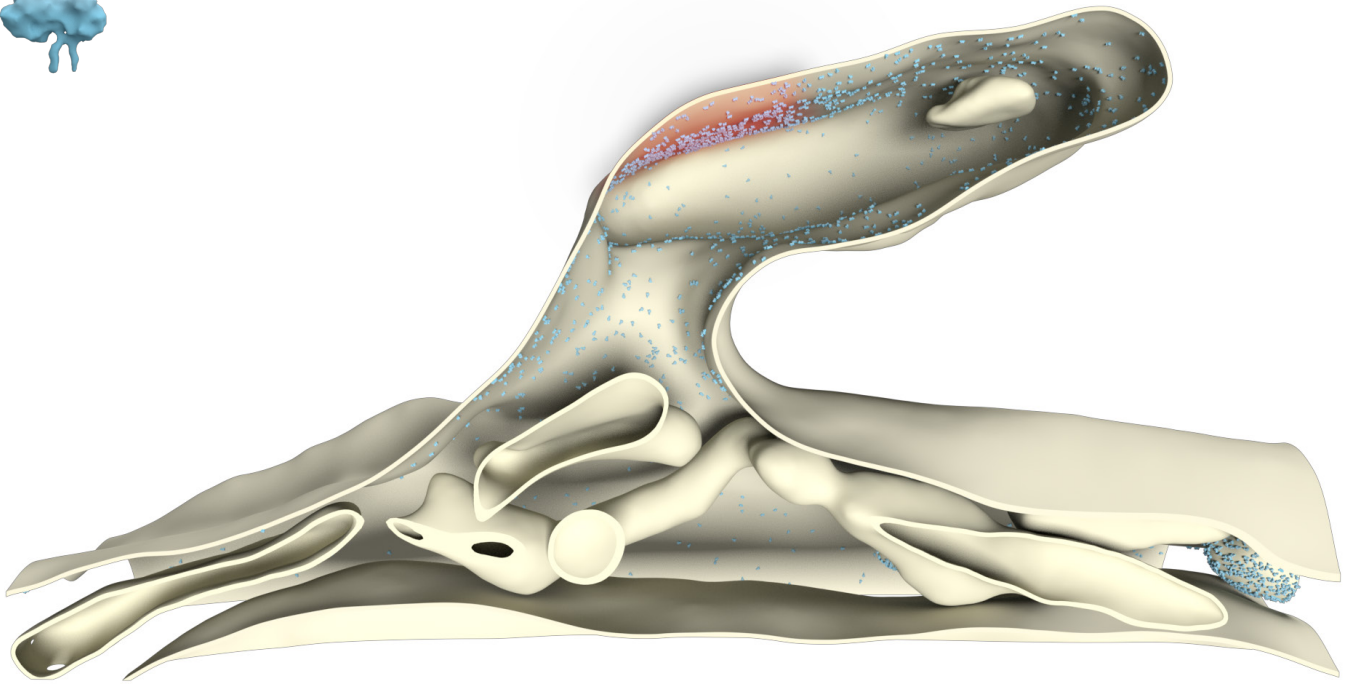
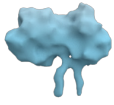
Rab3 (Gene: Rab3a, Uniprot ID: P63012)

Known function: SV and neuroendocrine exocytosis
Known organization: Membrane-associated and cytosolic
Known Interactions: None

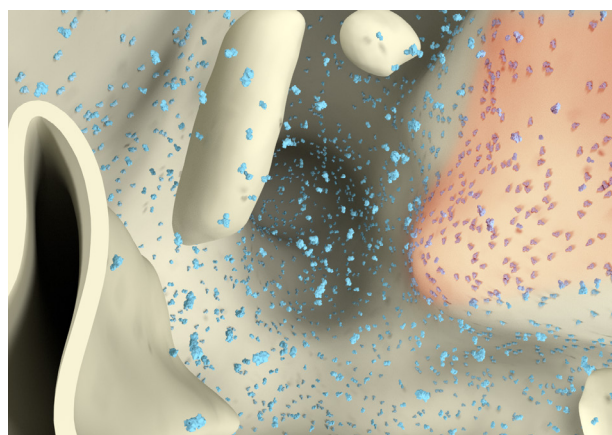
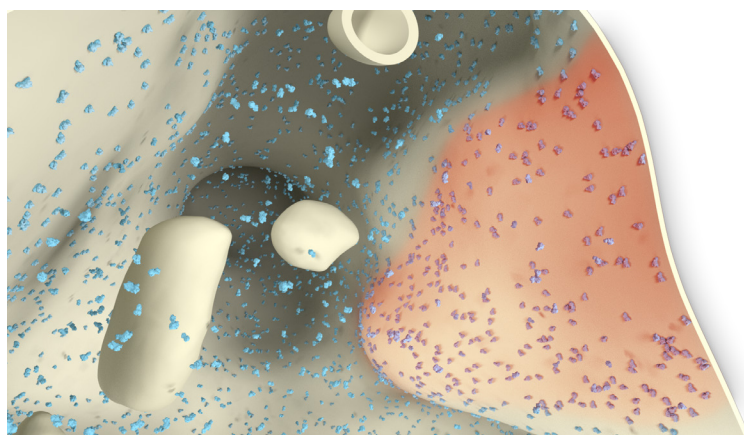
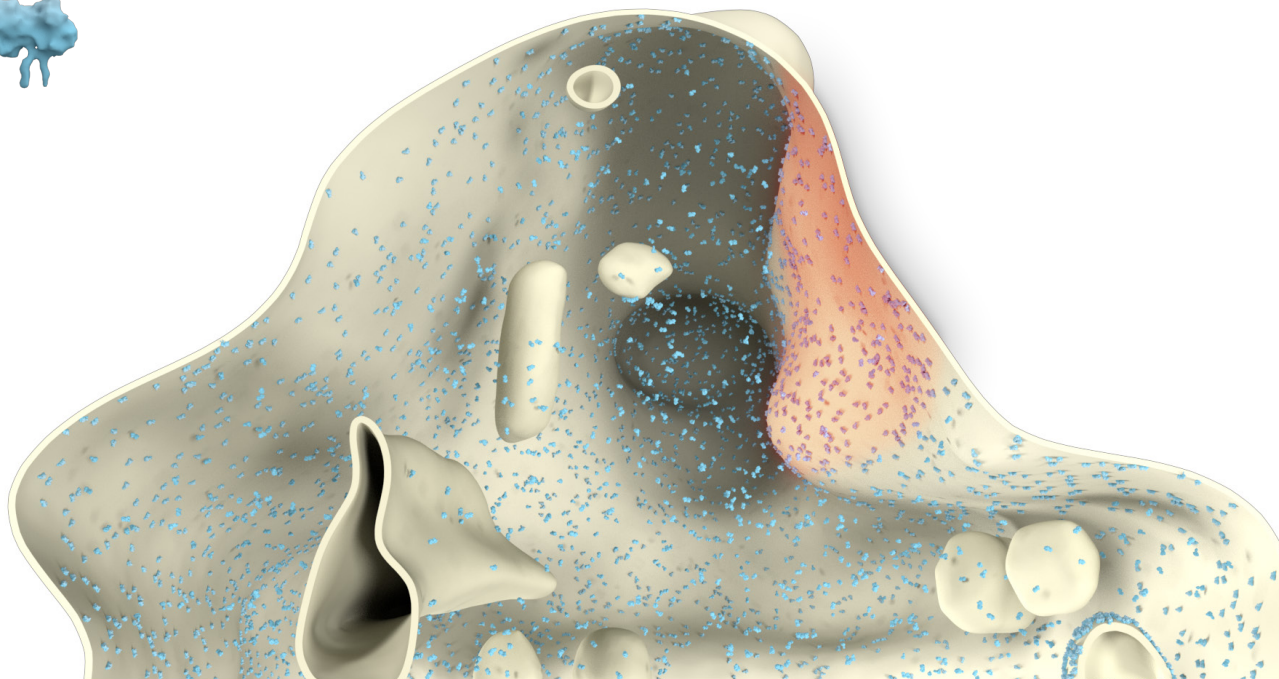
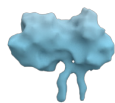


Whole cell copy number	54783683.8 ± 2509720.8	
Spine copy number	7270.0 ± 2572.7	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	7012.6 ± 2481.6	8139.6 ± 2880.5
% of total protein	0.9 ± 0.3%	0.9 ± 0.3%
Molarity (μM)	89.1 ± 31.5	76.9 ± 27.2
PSD copy number	543 ± 192.2	954 ± 337.6
% in PSD	7.7 ± 2.7%	11.7 ± 4.1%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	7012.6 ± 2481.6	$0.9 \pm 0.3\%$	89.1 ± 31.5	543 ± 192.2
Stubby	8139.6 ± 2880.5	$0.9 \pm 0.3\%$	76.9 ± 27.2	954 ± 337.6



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	7012.6 ± 2481.6	$0.9 \pm 0.3\%$	89.1 ± 31.5	543 ± 192.2
Stubby	8139.6 ± 2880.5	$0.9 \pm 0.3\%$	76.9 ± 27.2	954 ± 337.6



References

Antibody: BD Biosciences 610379

PDB Identifier: 3rab

Literature:

Fischer von Mollard et al., 1990, Proc. Natl. Acad. Sci. U S A

Schlüter et al., 2002, J. Biol. Chem.

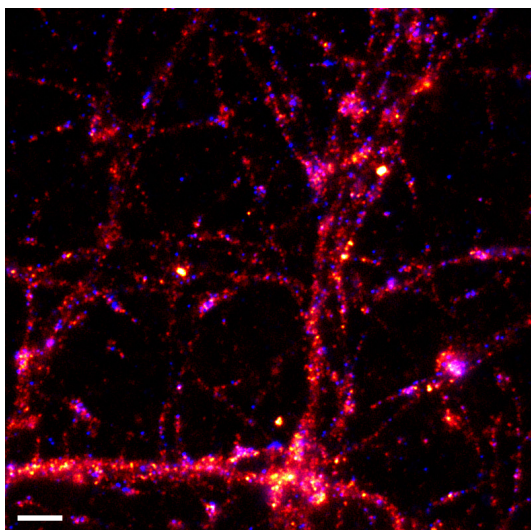
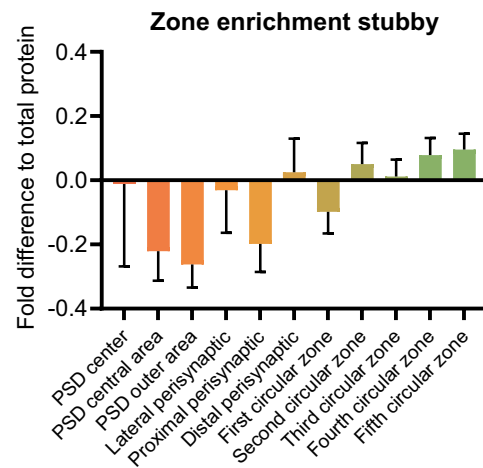
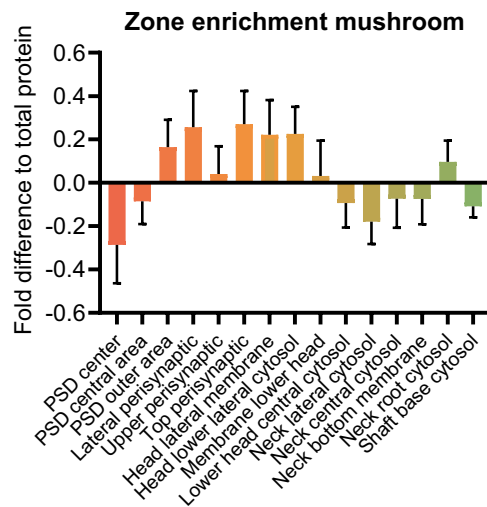
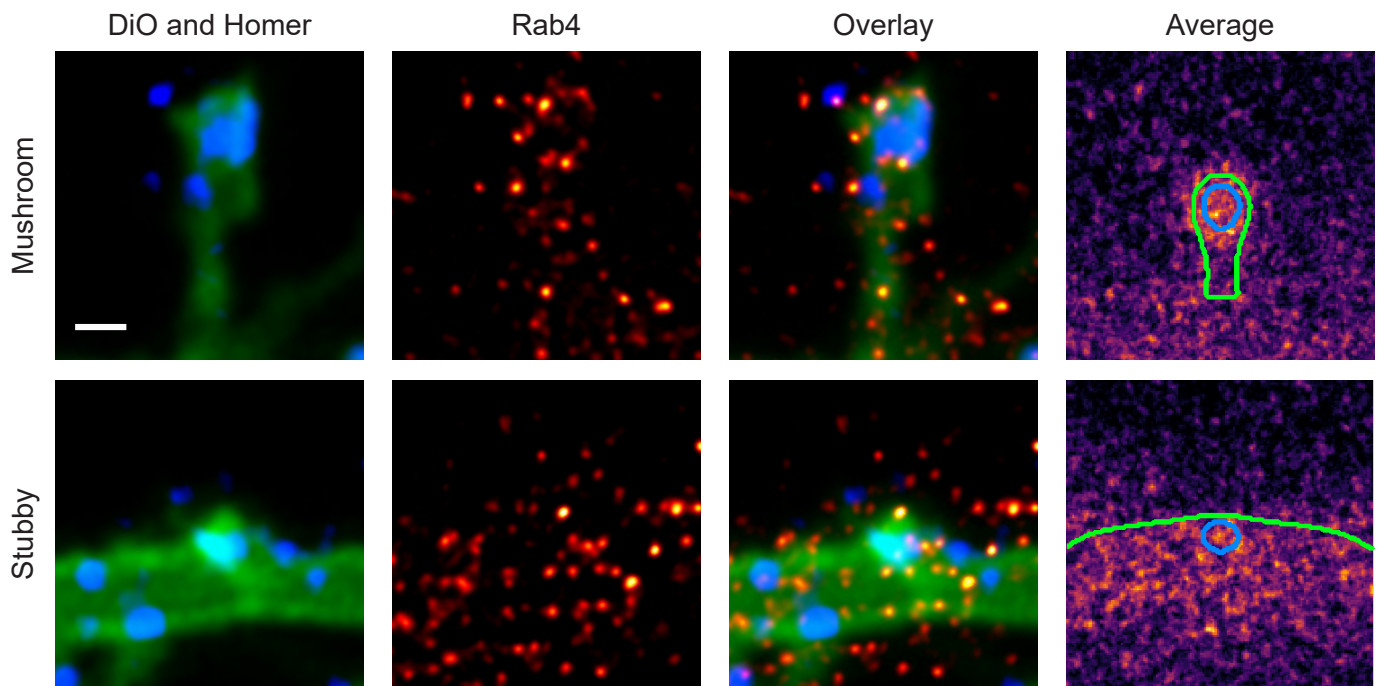
von Mollard et al., 1991, Nature

Rab4 (Gene: Rab4a, Uniprot ID: P05714)

Known function: Early/recycling endosomes to PM traffick, Basal AMPAR recycling

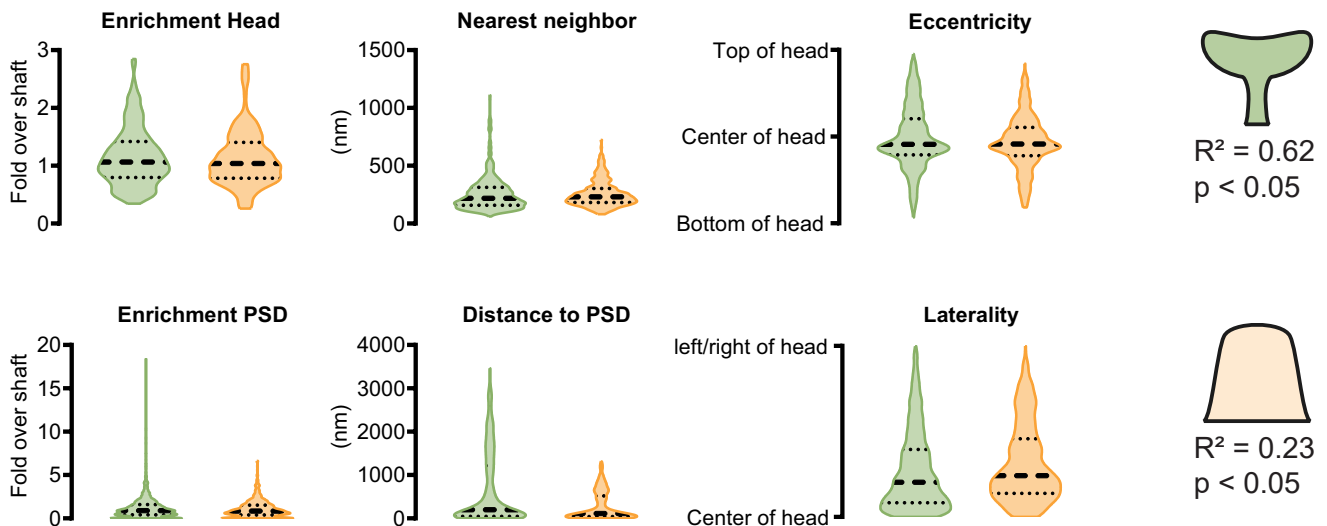
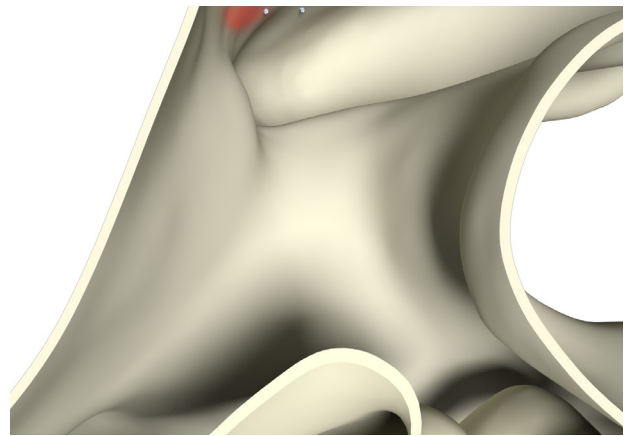
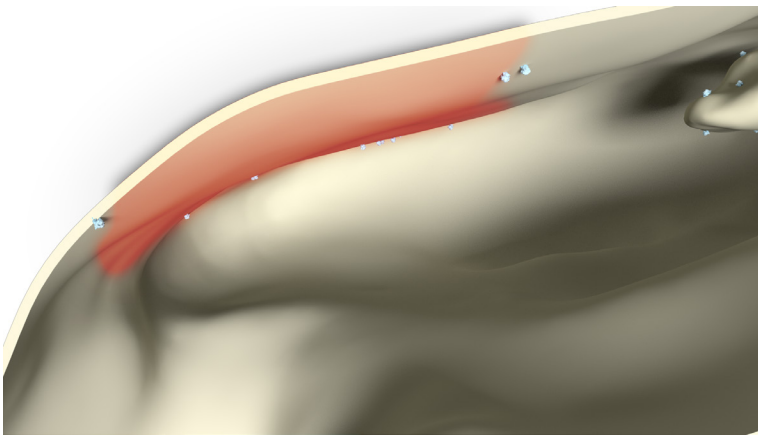
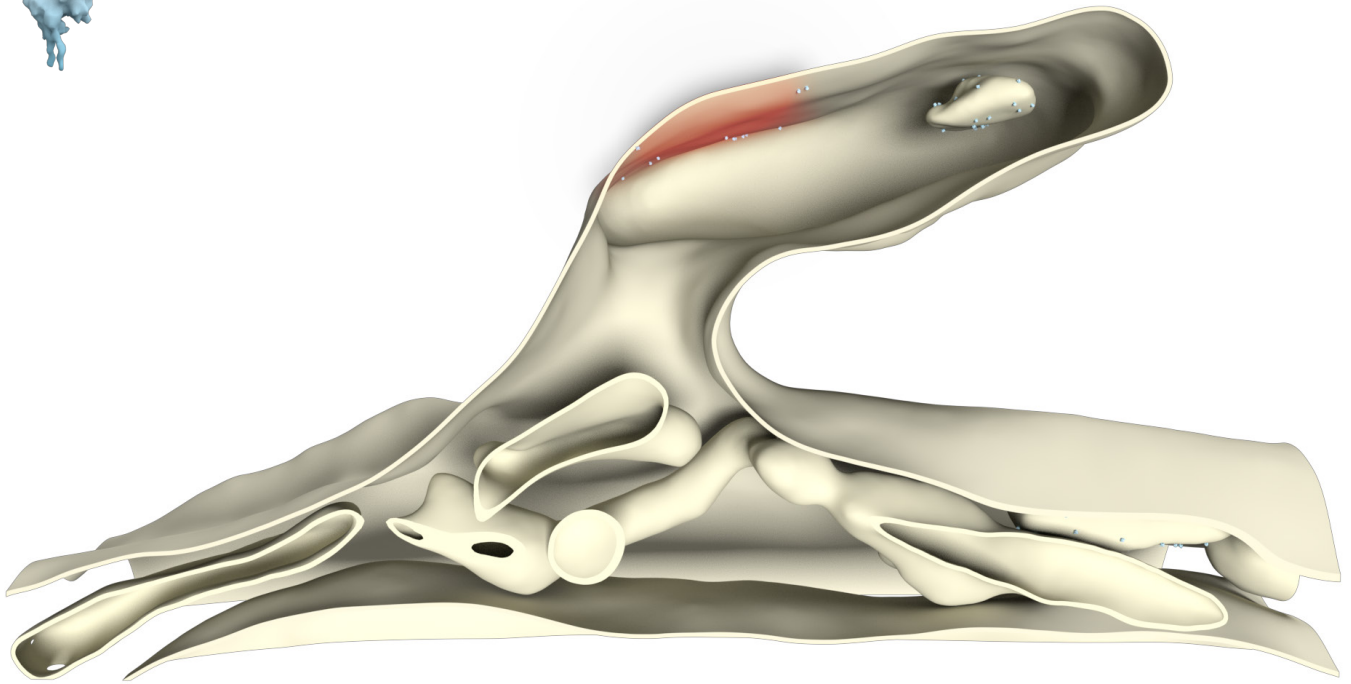
Known organization: Membrane-associated and cytosolic

Known Interactions: None

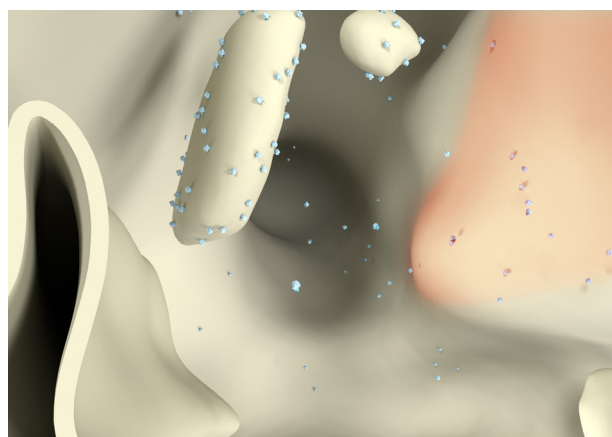
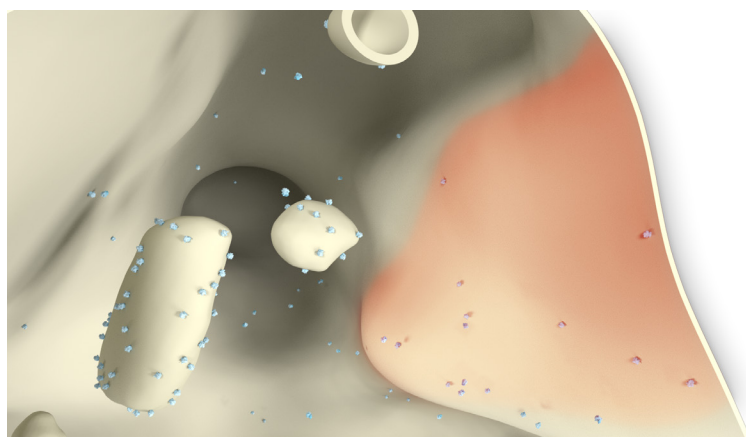
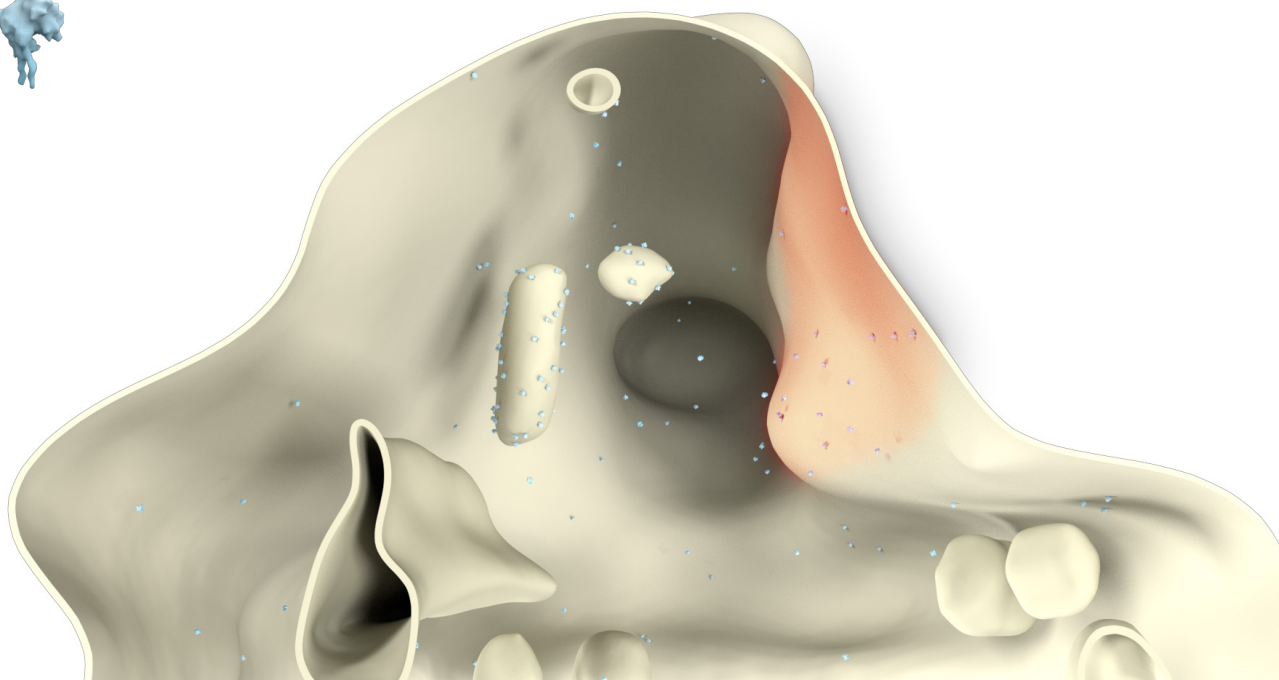
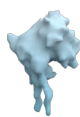


Whole cell copy number	2359845.6 ± 220211.7	
Spine copy number	212.8 ± 55.2	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	197.2 ± 51.2	233.3 ± 60.5
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	2.5 ± 0.6	2.2 ± 0.6
PSD copy number	10 ± 0.6	14 ± 3.6
% in PSD	5.1 ± 1.3%	6.0 ± 1.6%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	197.2 ± 51.2	$0.0 \pm 0.0\%$	2.5 ± 0.6	10 ± 0.6
Stubby	233.3 ± 60.5	$0.0 \pm 0.0\%$	2.2 ± 0.6	14 ± 3.6



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	197.2 ± 51.2	$0.0 \pm 0.0\%$	2.5 ± 0.6	10 ± 0.6
Stubby	233.3 ± 60.5	$0.0 \pm 0.0\%$	2.2 ± 0.6	14 ± 3.6



References

Antibody: BD Biosciences 610888

PDB Identifier: 1yu9

Literature:

Brown et al., 2007, J. Neurosci.

de Wit et al., 2001, Mol. Biol. Cell.

Gu and Huganir, 2016, Proc. Natl. Acad. Sci. U S A

Hoogenraad et al., 2010, PLoS Biol.

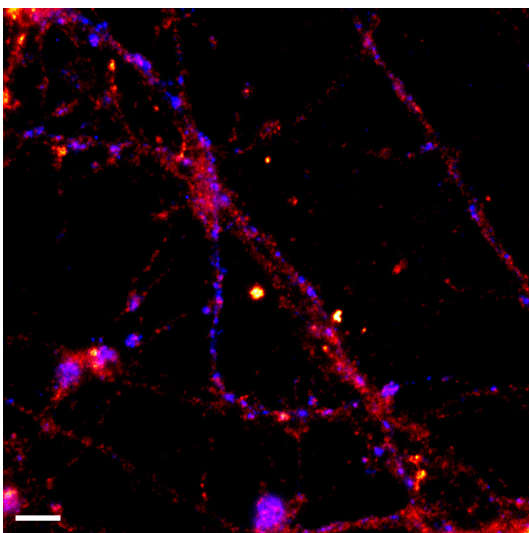
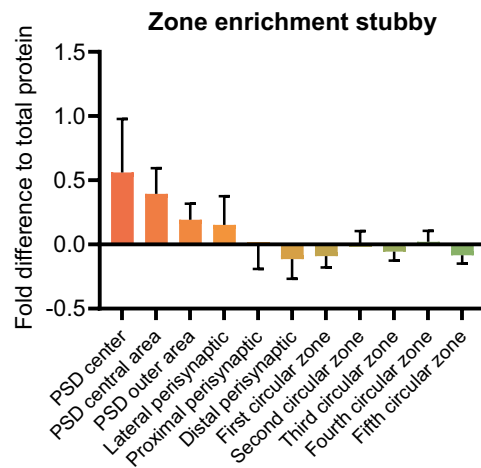
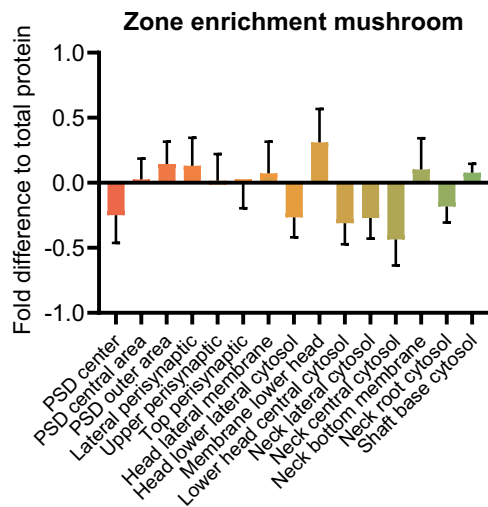
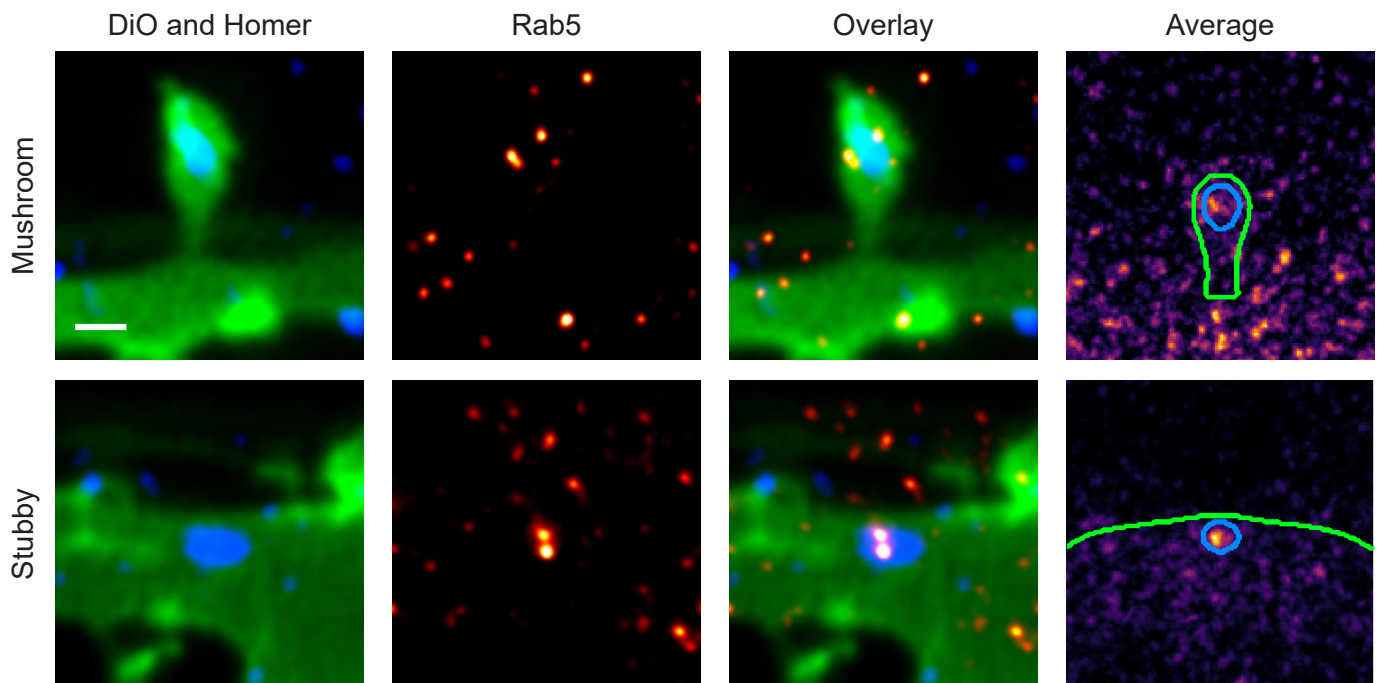
Mohrmann et al., 2002, J. Biol. Chem.

Rab5 (Gene: Rab5a, Uniprot ID: M0RC99)

Known function: Early endosome trafficking, Basal AMPAR recycling

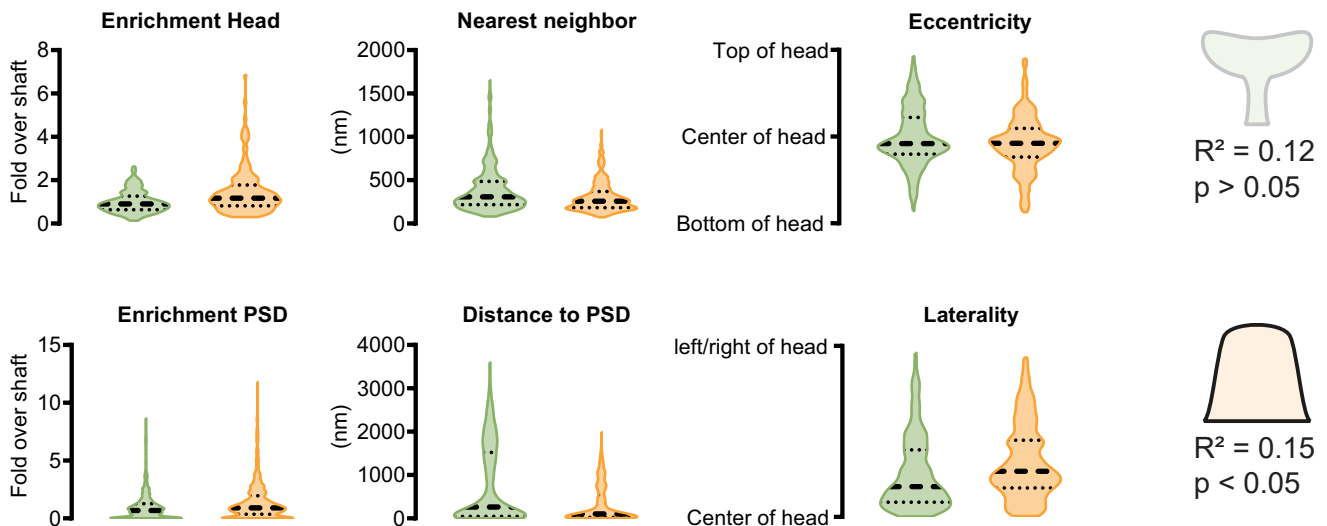
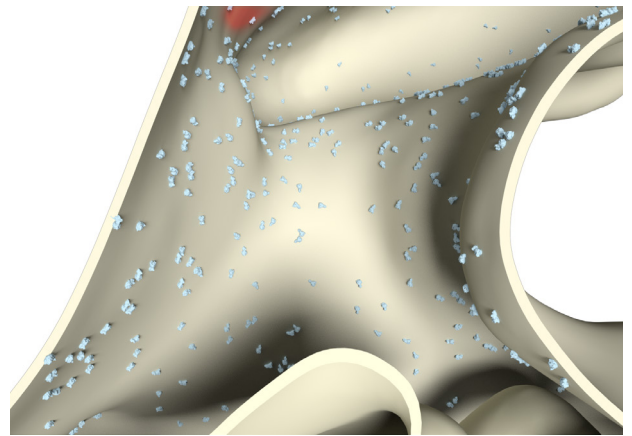
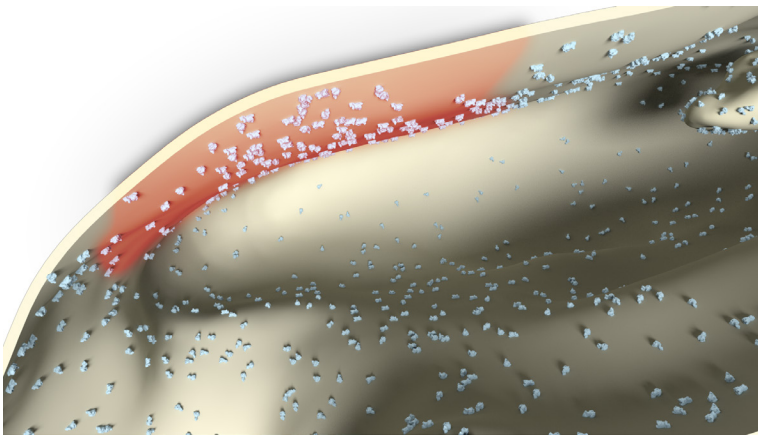
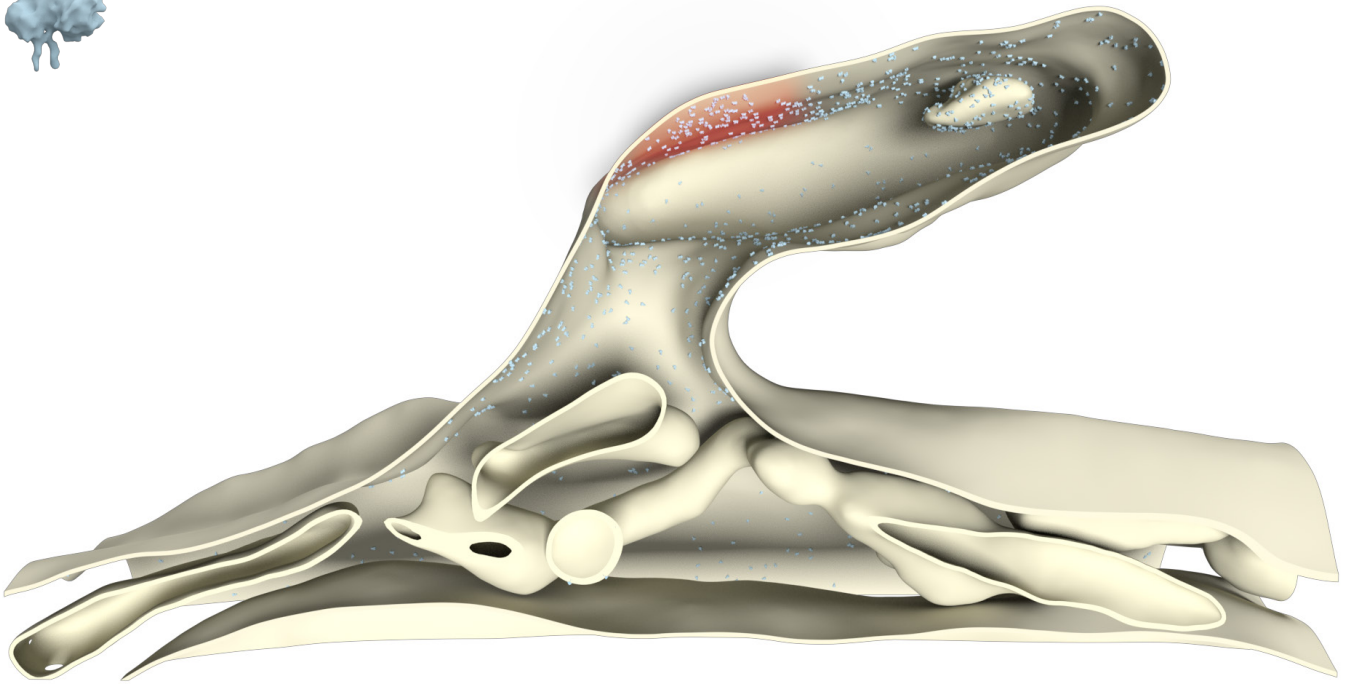
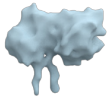
Known organization: Membrane-associated and cytosolic

Known Interactions: Syntaxin13

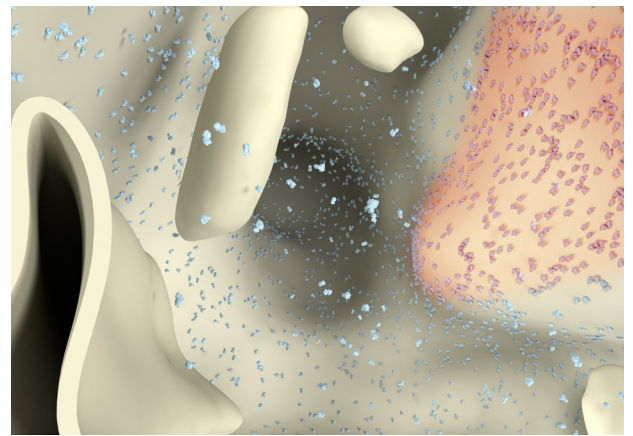
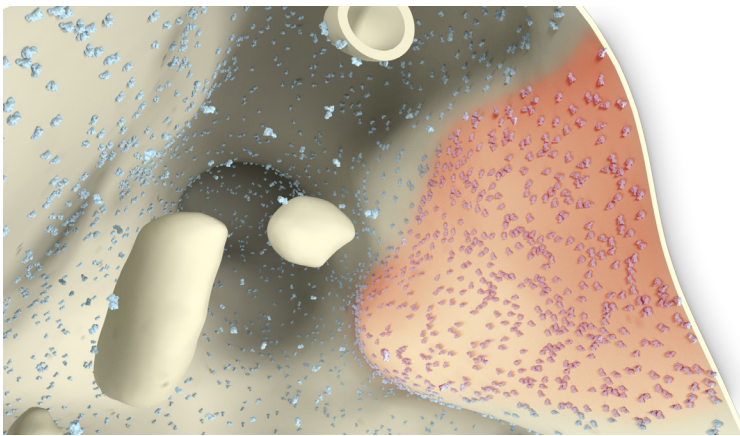
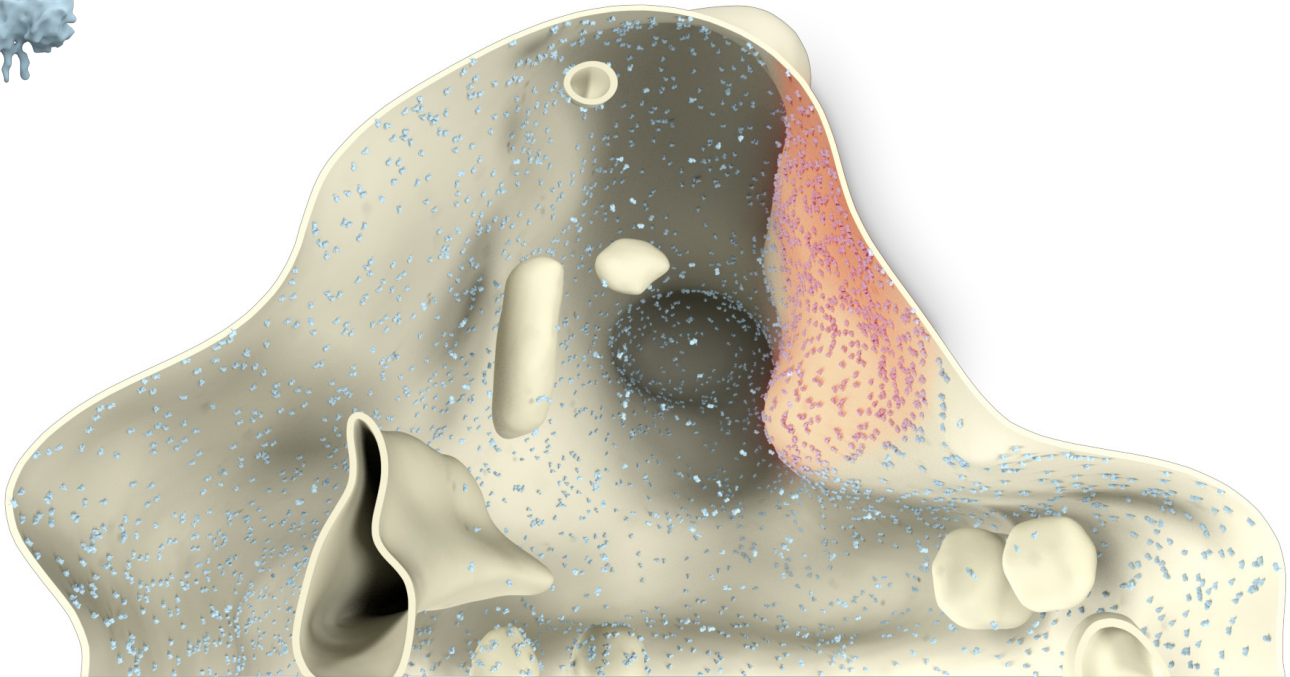
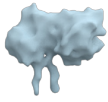


Whole cell copy number	22383583.4 ± 1784814.1	
Spine copy number	4850.6 ± 827.7	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	3574.0 ± 609.9	6685.3 ± 1140.8
% of total protein	0.4 ± 0.1%	0.7 ± 0.1%
Molarity (μM)	45.4 ± 7.7	63.2 ± 10.8
PSD copy number	439 ± 74.9	1418 ± 242.0
% in PSD	12.3 ± 2.1%	21.2 ± 3.6%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	3574.0 ± 609.9	$0.4 \pm 0.1\%$	45.4 ± 7.7	439 ± 74.9
Stubby	6685.3 ± 1140.8	$0.7 \pm 0.1\%$	63.2 ± 10.8	1418 ± 242.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	3574.0 ± 609.9	$0.4 \pm 0.1\%$	45.4 ± 7.7	439 ± 74.9
Stubby	6685.3 ± 1140.8	$0.7 \pm 0.1\%$	63.2 ± 10.8	1418 ± 242.0



References

Antibody: Reinhard Jahn laboratory cl. 621.3

PDB Identifier: 1tu4

Literature:

Brown et al., 2005, Neuron

Bucci et al., 1992, Cell

Deinhardt et al., 2006, Neuron

Fischer von Mollard et al., 1994, Eur J Cell Biol.

Gu et al., 2016, Proc. Natl. Acad. Sci. U S A

McBride et al., 1999, Cell

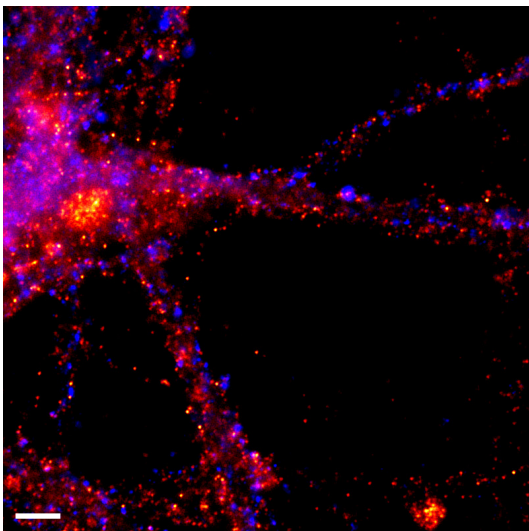
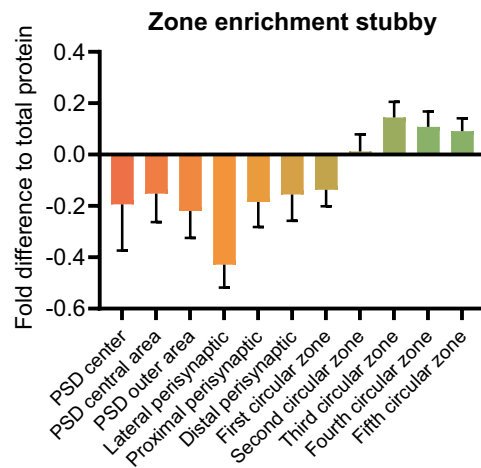
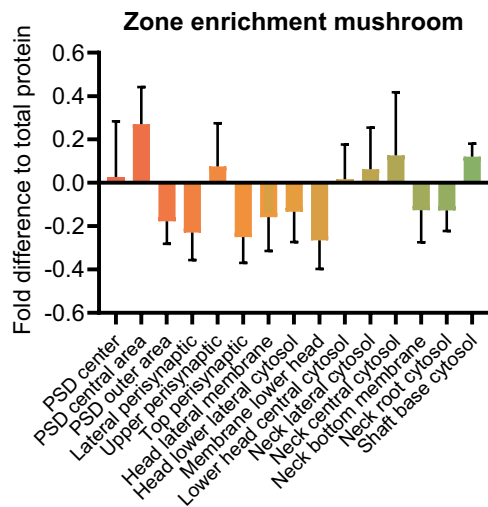
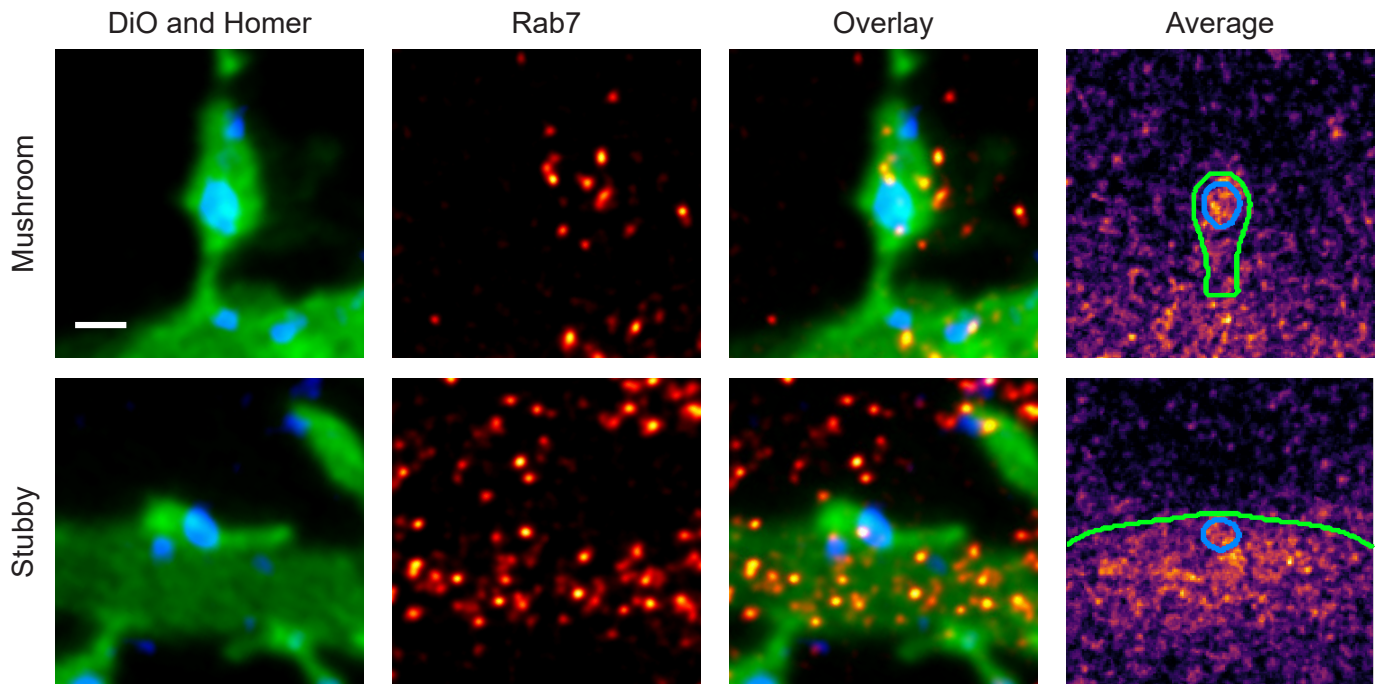
Szíber et al., 2017, Mol. Biol. Cell.

Rab7 (Gene: Rab7a, Uniprot ID: P09527)

Known function: Late endosome to lysosome trafficking, Involved in AMPAR trafficking

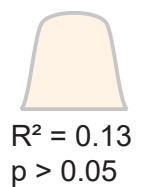
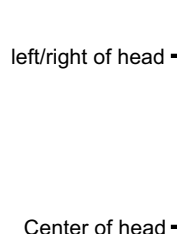
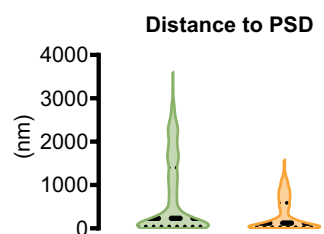
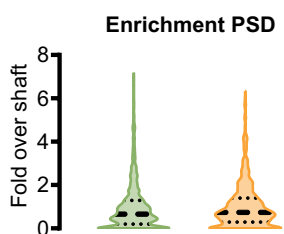
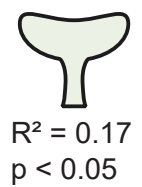
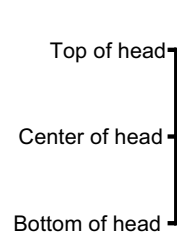
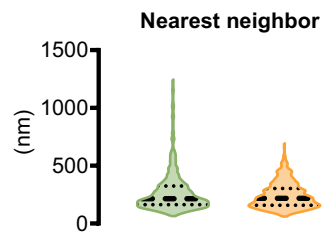
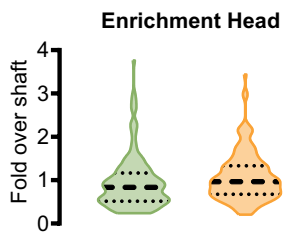
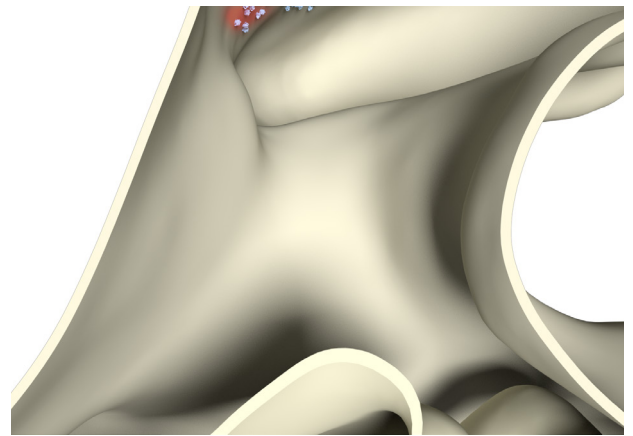
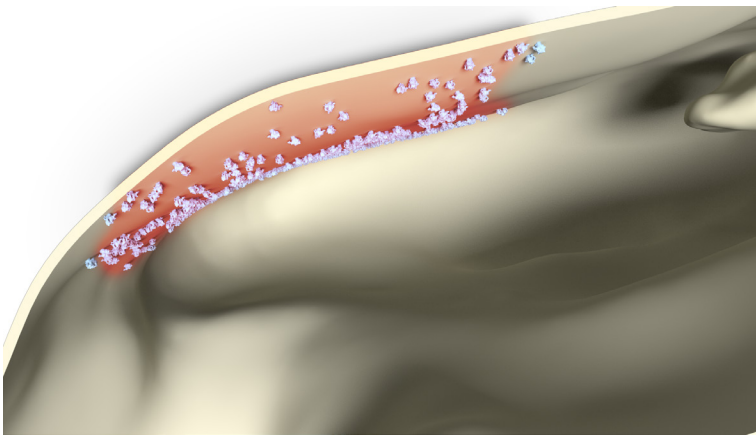
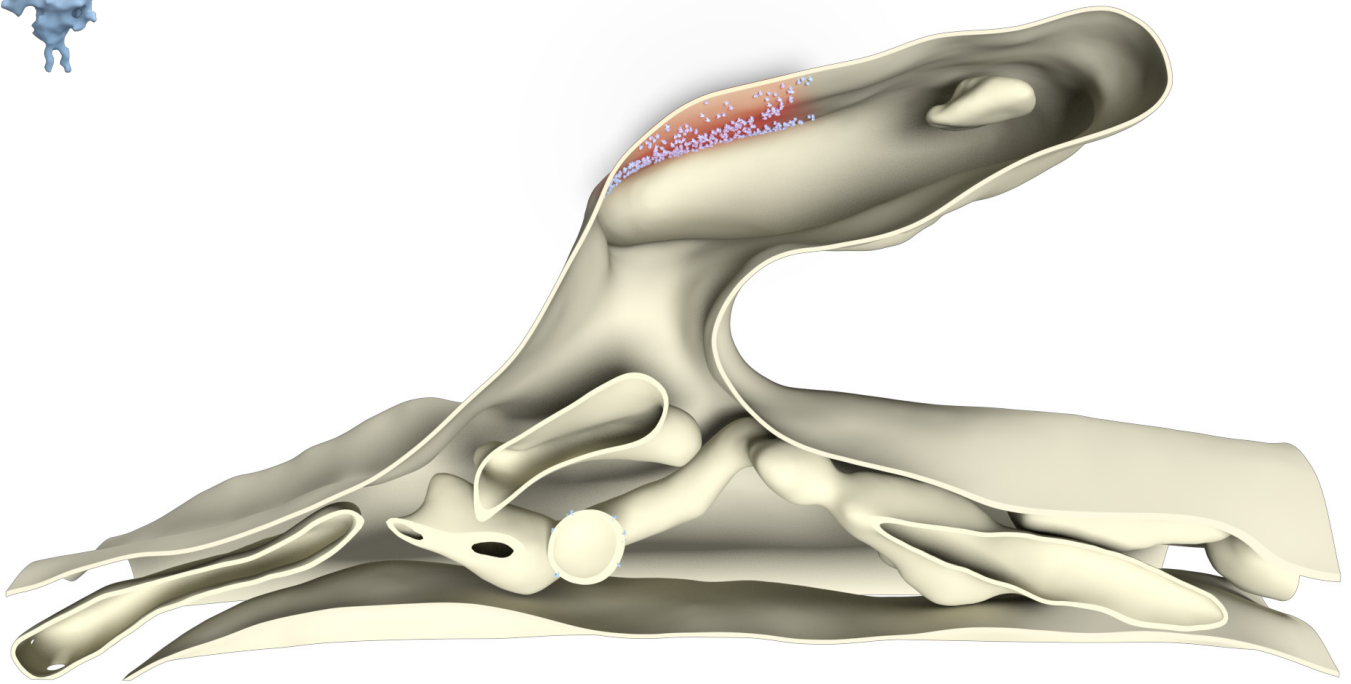
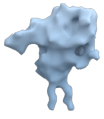
Known organization: Membrane-associated and cytosolic

Known Interactions: None

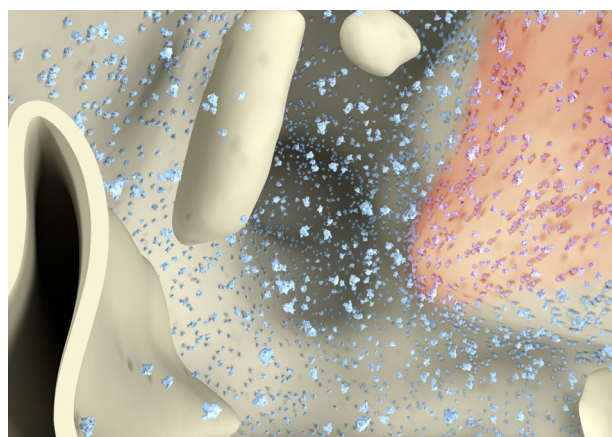
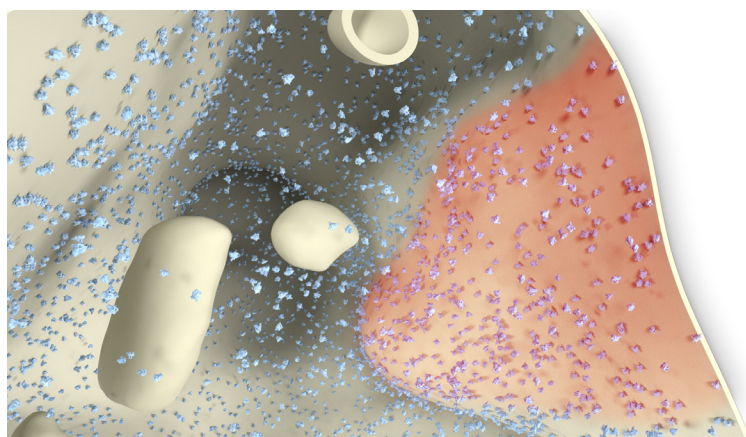
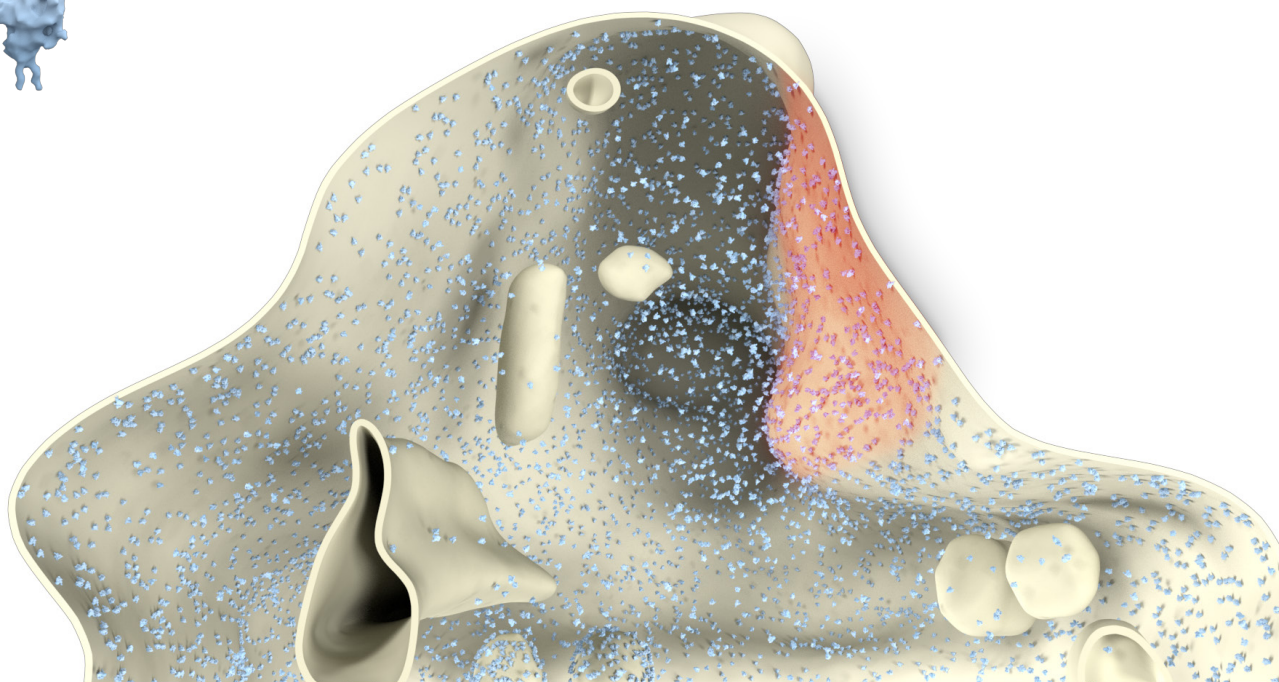
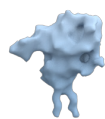


Whole cell copy number	36822225.3 ± 1784814.1	
Spine copy number	7539.5 ± 1488.4	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	5658.7 ± 1117.1	9802.5 ± 1935.2
% of total protein	0.6 ± 0.1%	1.0 ± 0.2%
Molarity (μM)	71.9 ± 14.2	92.6 ± 18.3
PSD copy number	538 ± 106.2	708 ± 139.8
% in PSD	9.5 ± 1.9%	7.2 ± 1.4%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	5658.7 ± 1117.1	$0.6 \pm 0.1\%$	71.9 ± 14.2	538 ± 106.2
Stubby	9802.5 ± 1935.2	$1.0 \pm 0.2\%$	92.6 ± 18.3	708 ± 139.8



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	5658.7 ± 1117.1	$0.6 \pm 0.1\%$	71.9 ± 14.2	538 ± 106.2
Stubby	9802.5 ± 1935.2	$1.0 \pm 0.2\%$	92.6 ± 18.3	708 ± 139.8



References

Antibody: Cell Signaling 9367

PDB Identifier: 1vg1

Literature:

Deinhardt et al., 2006, Neuron

Gutierrez et al., 2004, J. Cell. Sci.

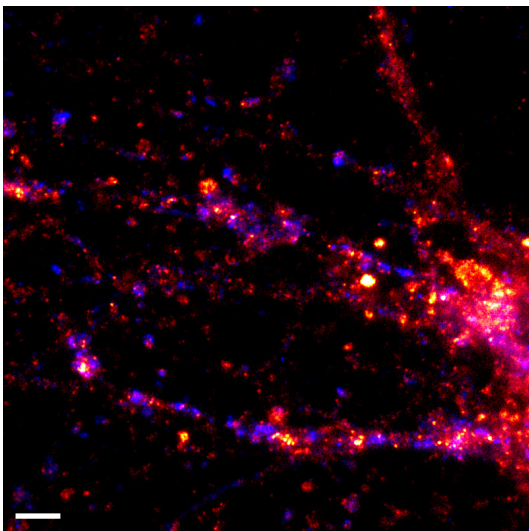
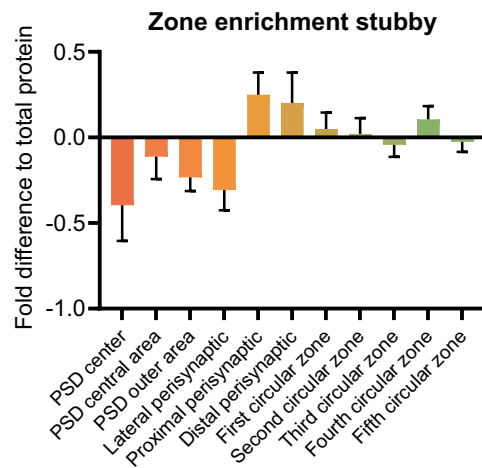
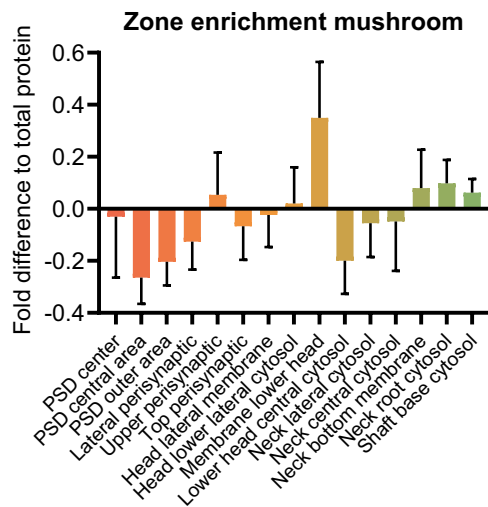
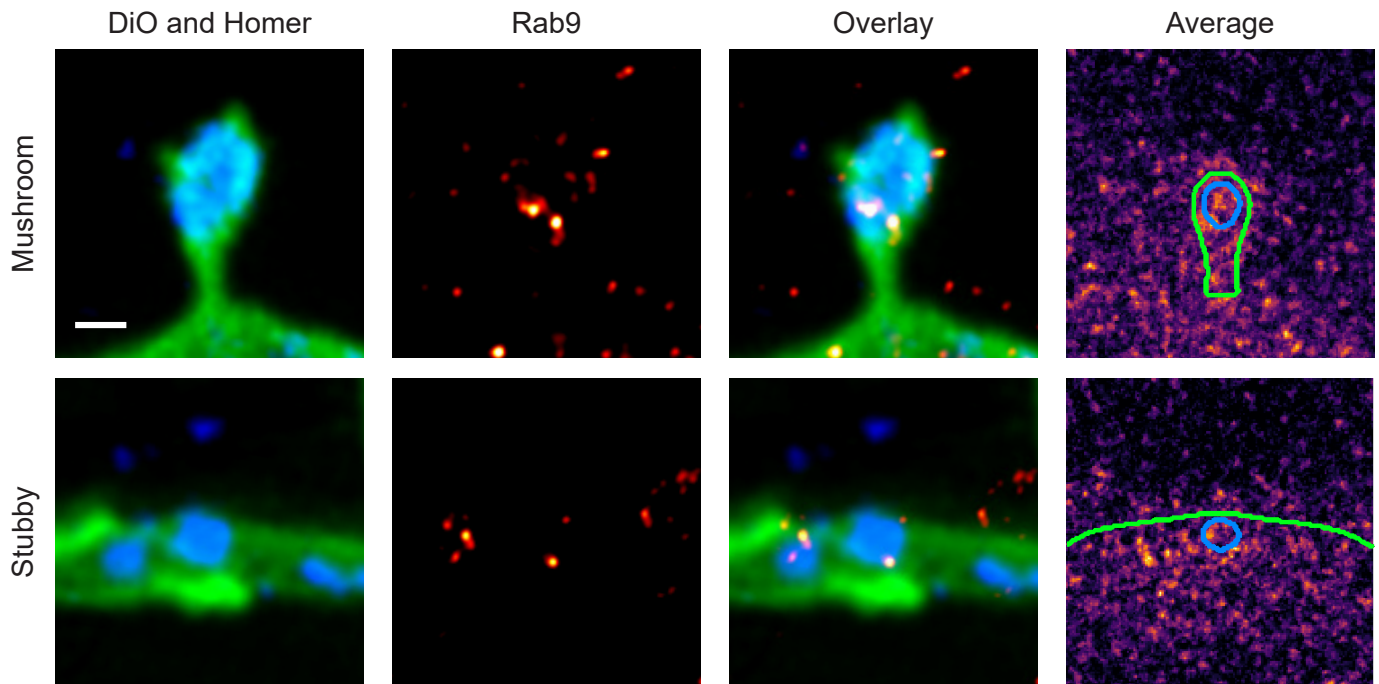
Lee et al., 2013, Mol. Cells.

Rab9 (Gene: Rab9a, Uniprot ID: Q99P75)

Known function: Late endosome to TGN trafficking

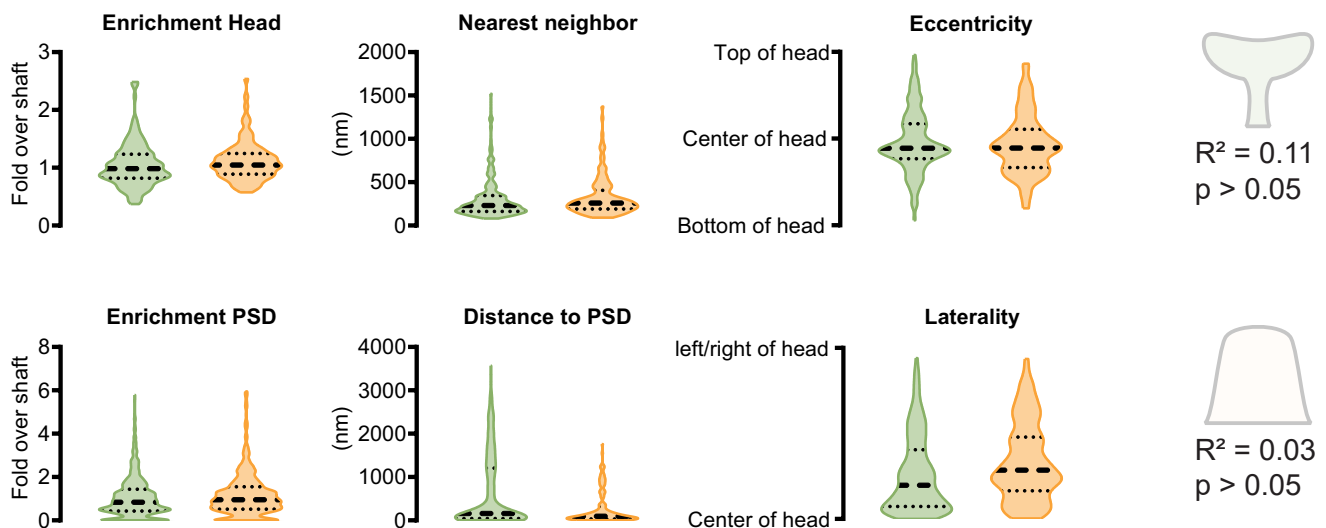
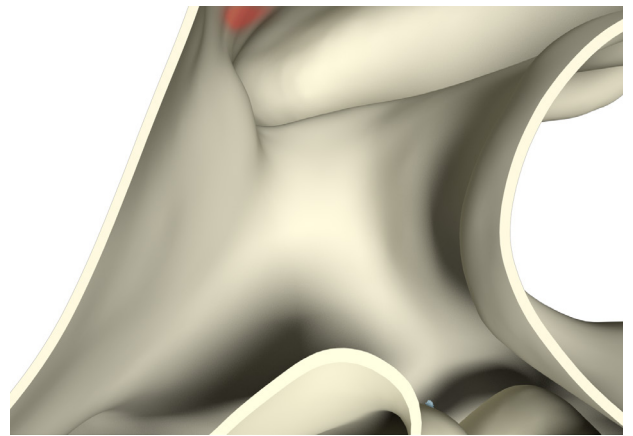
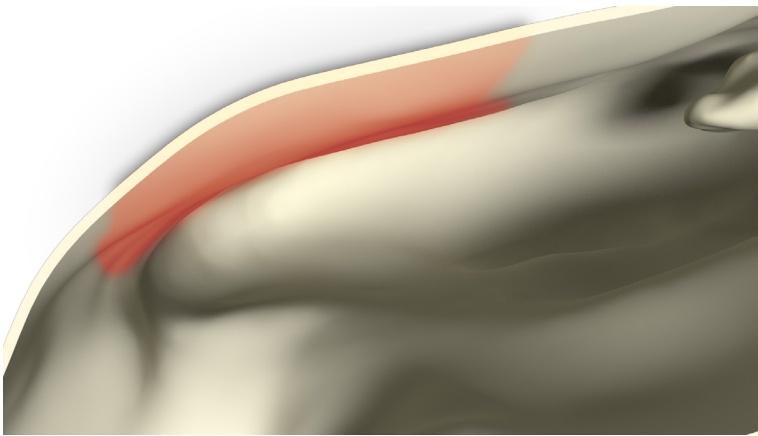
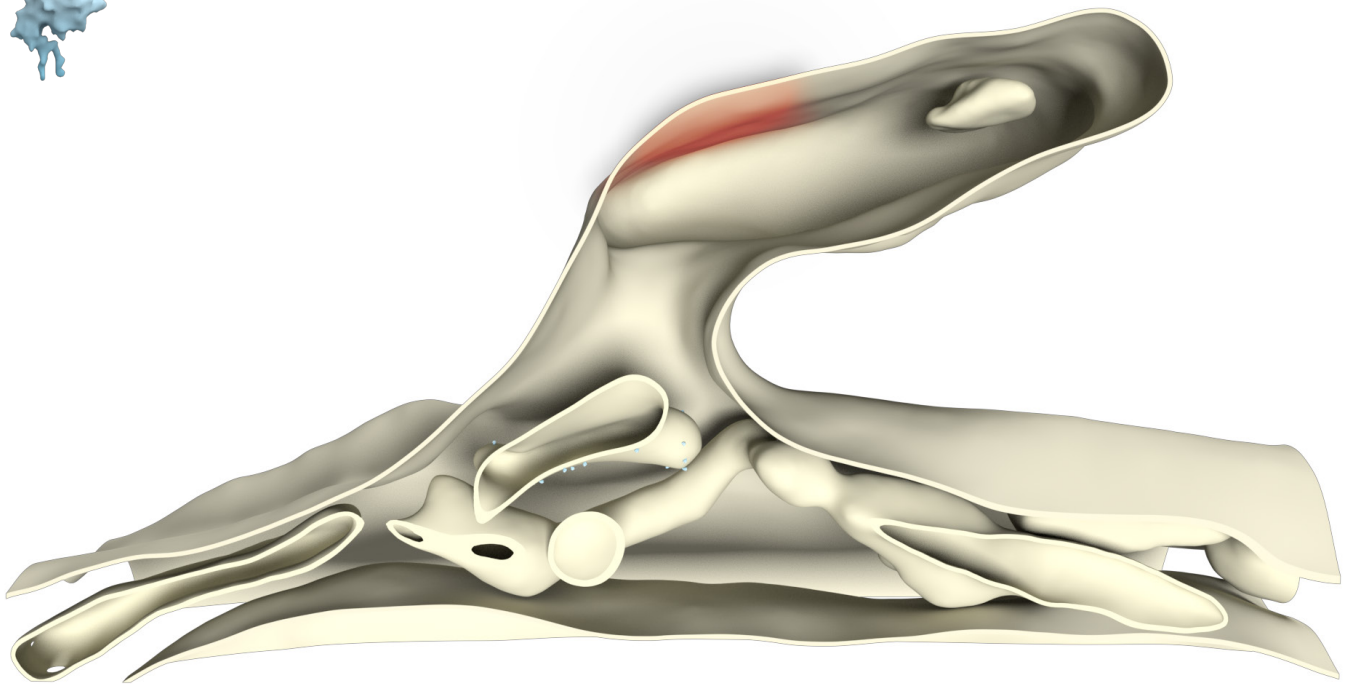
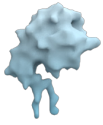
Known organization: Membrane-associated and cytosolic

Known Interactions: None

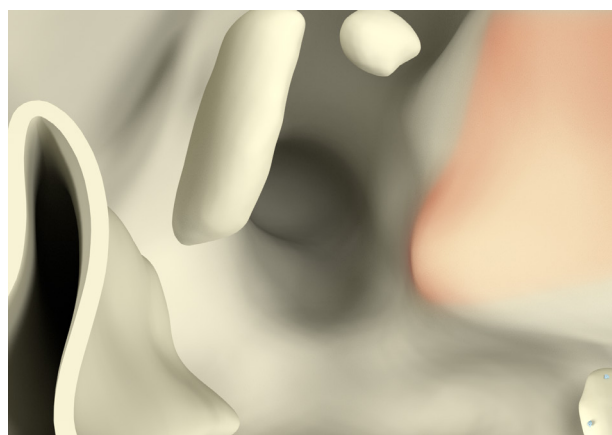
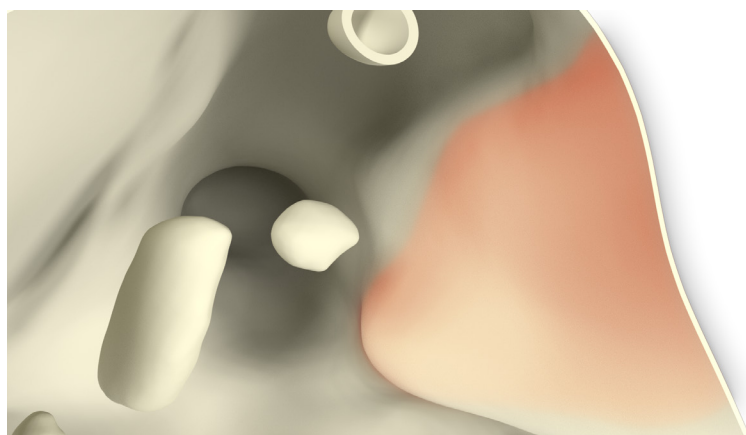
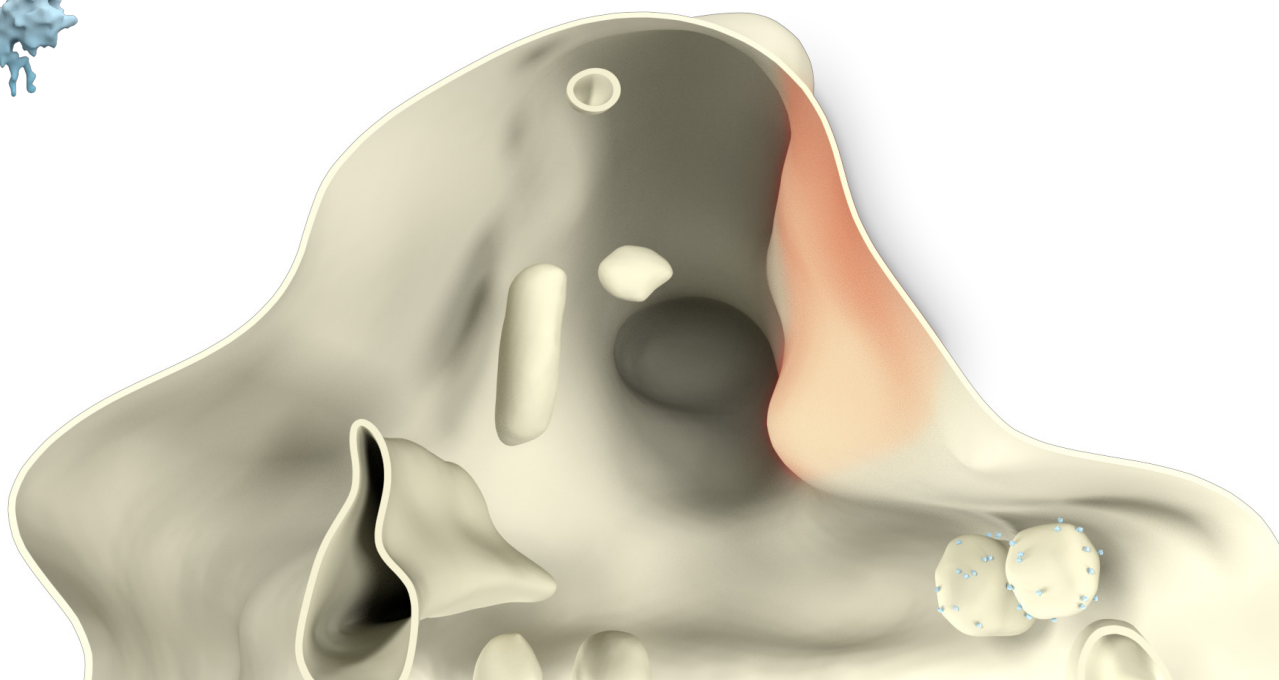
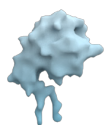


Whole cell copy number	3743037.1 ± 1160145.4	
Spine copy number	53.4 ± 104.1	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	51.5 ± 100.3	56.3 ± 109.7
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.7 ± 1.3	0.5 ± 1.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	51.5 ± 100.3	$0.0 \pm 0.0\%$	0.7 ± 1.3	0 ± 0.0
Stubby	56.3 ± 109.7	$0.0 \pm 0.0\%$	0.5 ± 1.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	51.5 ± 100.3	$0.0 \pm 0.0\%$	0.7 ± 1.3	0 ± 0.0
Stubby	56.3 ± 109.7	$0.0 \pm 0.0\%$	0.5 ± 1.0	0 ± 0.0



References

Antibody: Cell Signaling 5118

PDB Identifier: 4qxa

Literature:

Díaz et al., 1997, J. Cell. Biol.

Ganley et al., 2004, Mol. Biol. Cell.

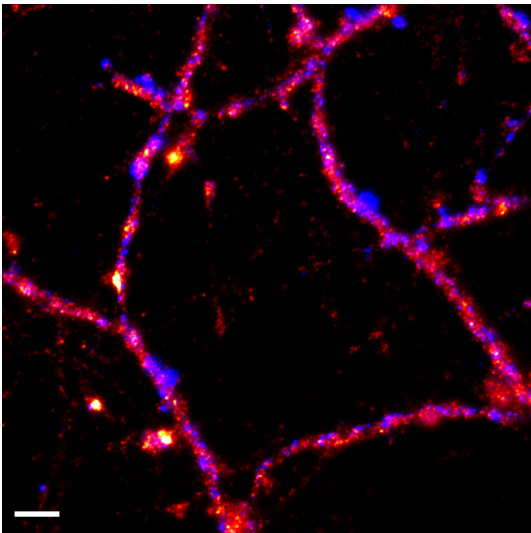
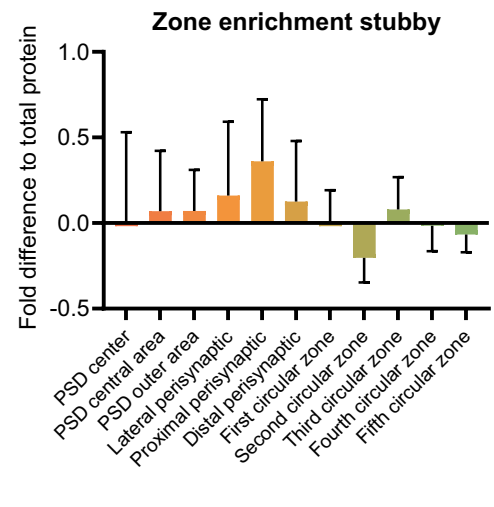
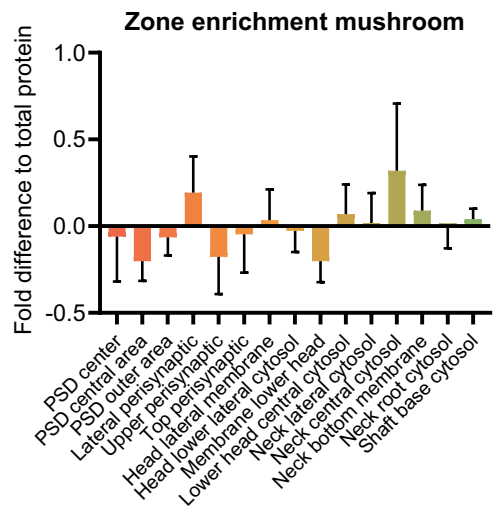
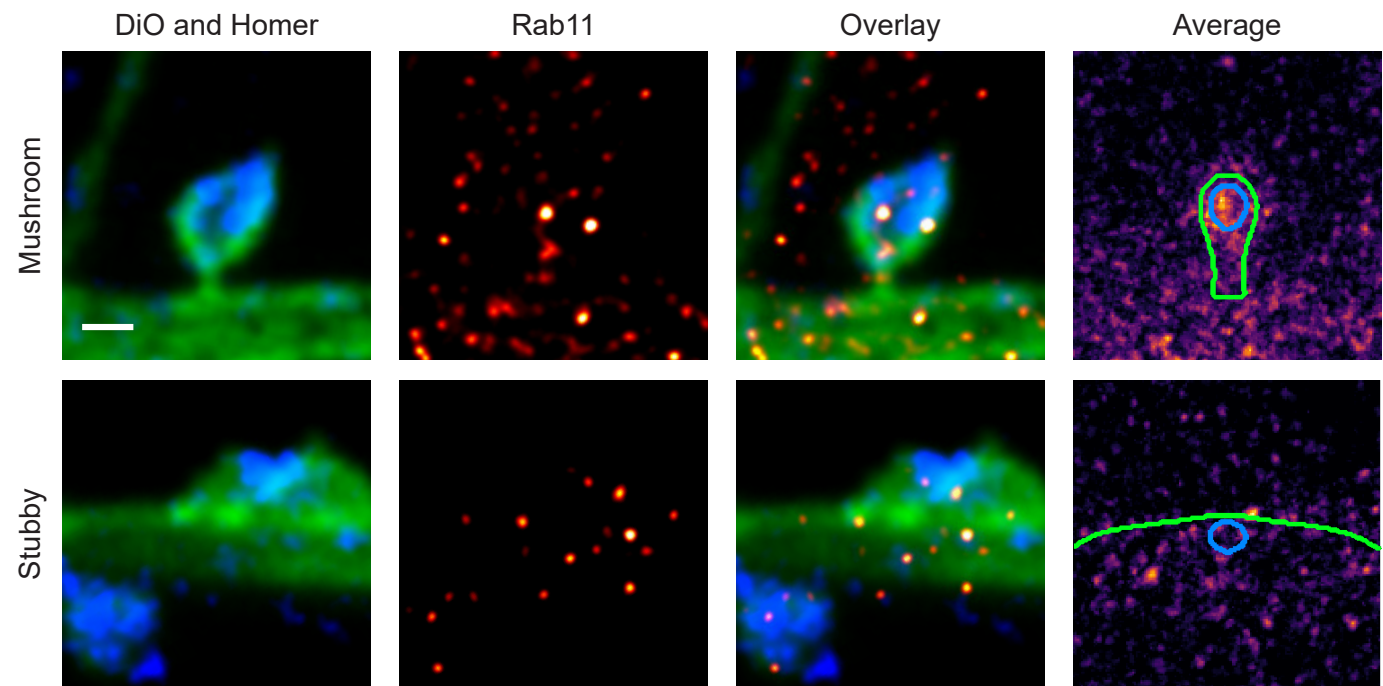
Lombardi et al., 1993, EMBO J.

Rab11 (Gene: Rab11a, Uniprot ID: P62494)

Known function: TGN to PM trafficking, Involved in basal and regulated AMPAR and TrkB trafficking, Involved in neurite growth

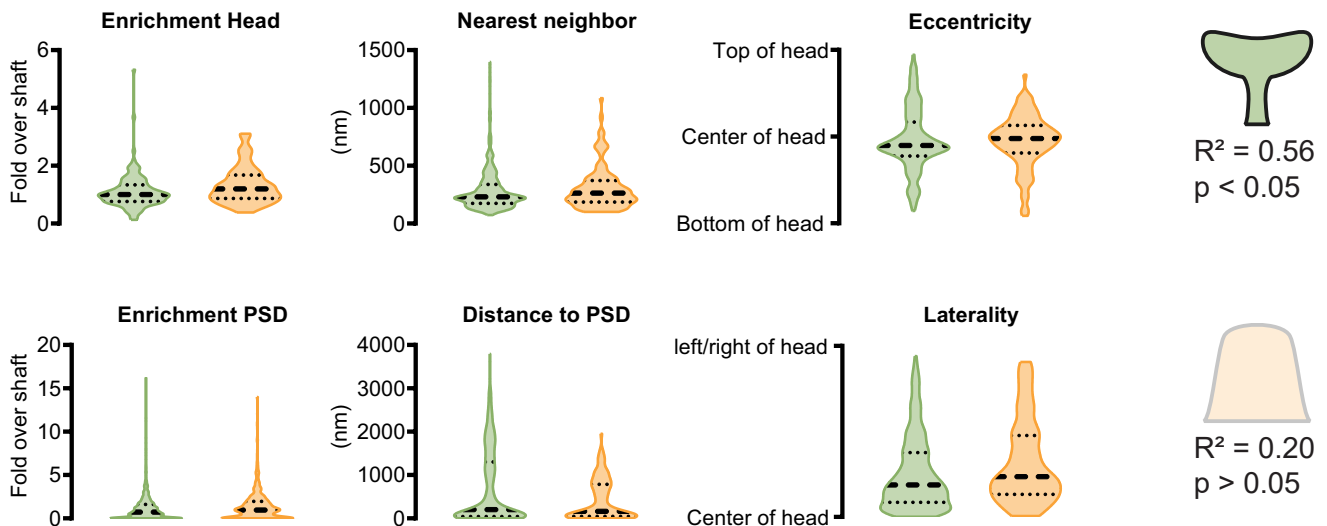
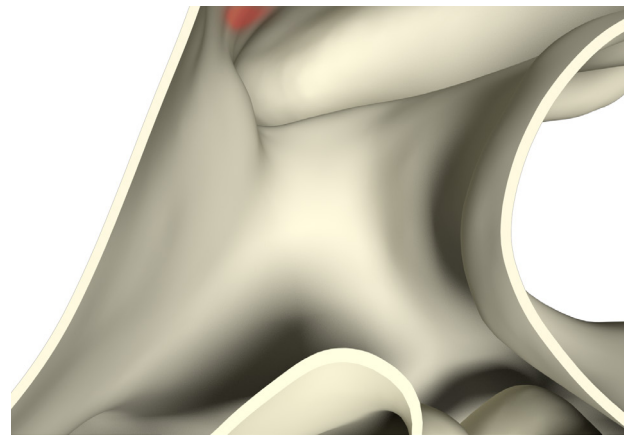
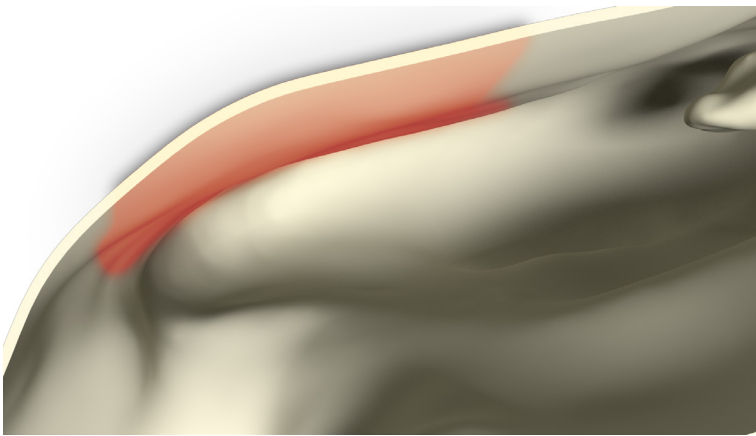
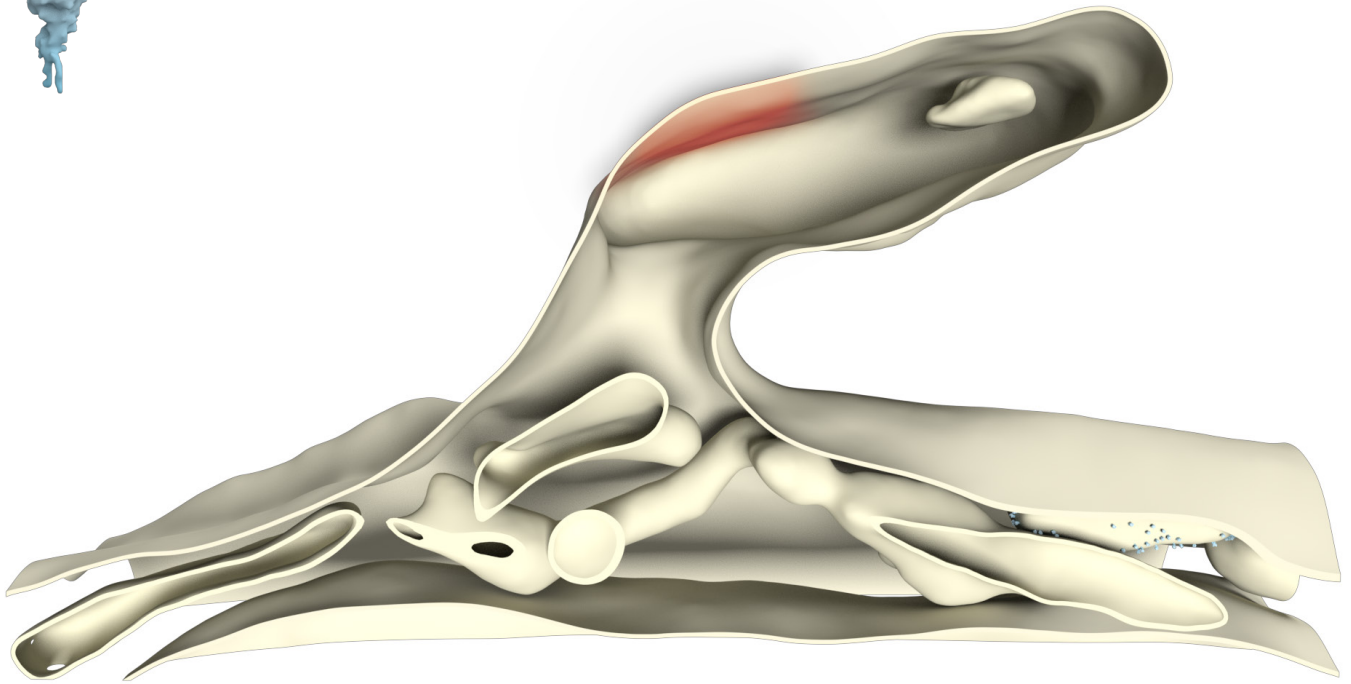
Known organization: Membrane-associated and cytosolic

Known Interactions: None

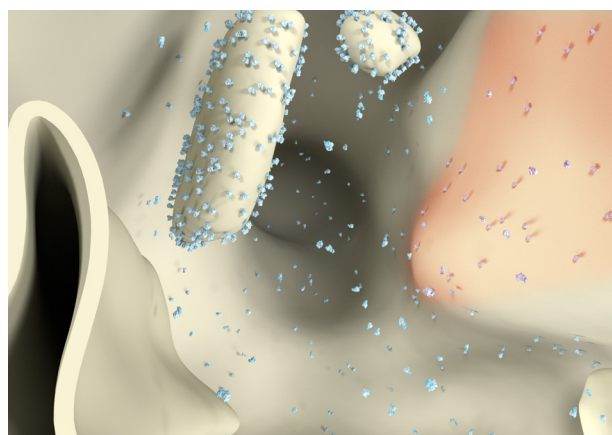
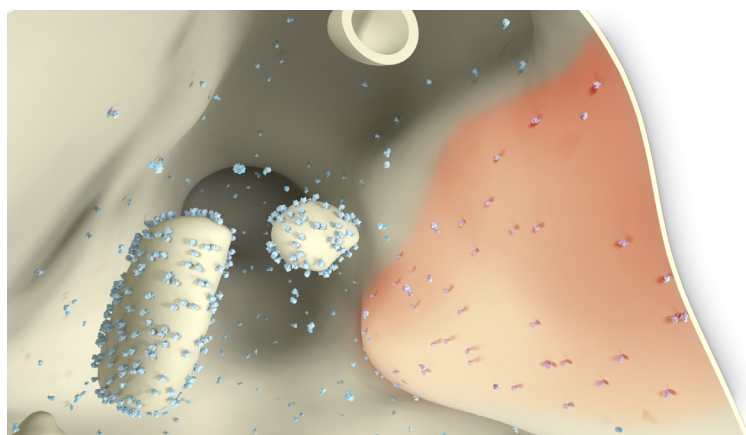
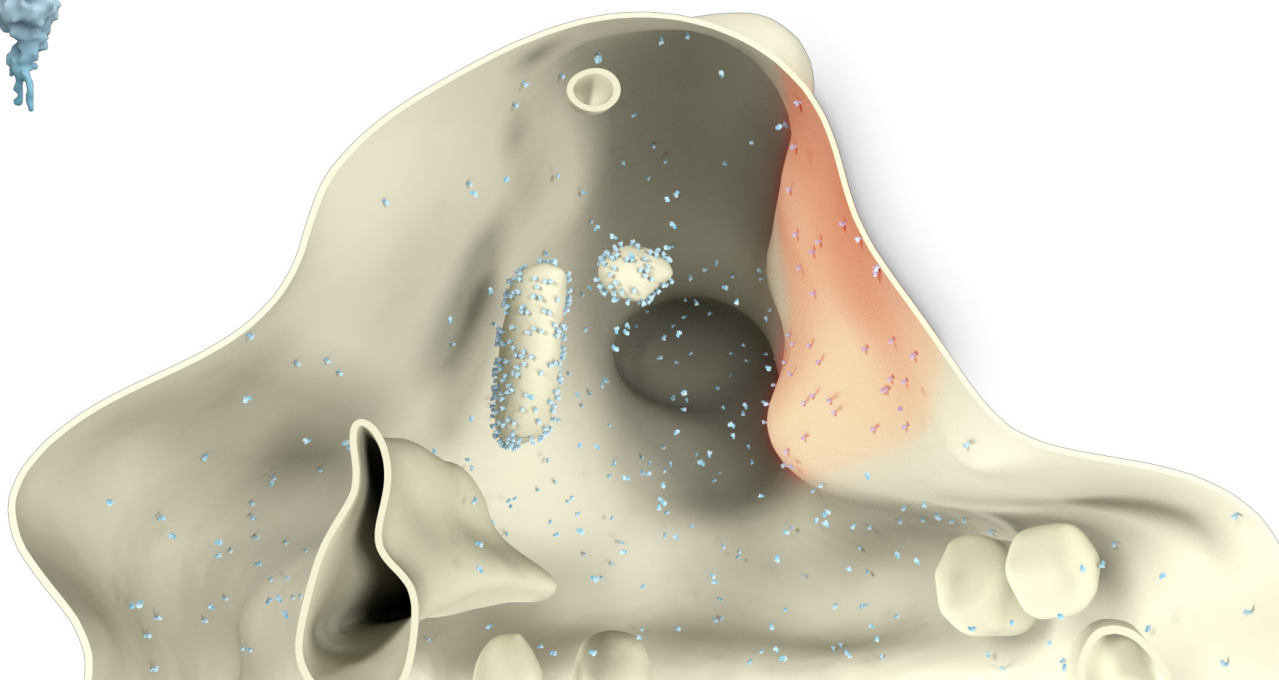


Whole cell copy number	18244831.1 ± 1801809.0	
Spine copy number	863.5 ± 506.1	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	1059.3 ± 620.9	749.3 ± 439.2
% of total protein	0.1 ± 0.1%	0.1 ± 0.0%
Molarity (µM)	13.5 ± 7.9	7.1 ± 4.2
PSD copy number	206 ± 120.8	76 ± 44.5
% in PSD	19.4 ± 11.4%	10.1 ± 5.9%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1059.3 ± 620.9	$0.1 \pm 0.1\%$	13.5 ± 7.9	206 ± 120.8
Stubby	749.3 ± 439.2	$0.1 \pm 0.0\%$	7.1 ± 4.2	76 ± 44.5



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1059.3 ± 620.9	$0.1 \pm 0.1\%$	13.5 ± 7.9	206 ± 120.8
Stubby	749.3 ± 439.2	$0.1 \pm 0.0\%$	7.1 ± 4.2	76 ± 44.5



References

Antibody: Cell Signaling 3539

PDB Identifier: 1yzk

Literature:

Bacaj et al., 2015a, J. Neurosci.

Brown et al., 2007, J. Neurosci.

Chen et al., 1998, Mol. Biol. Cell.

Gu et al., 2016, Proc. Natl. Acad. Sci. U S A

Huang et al., 2013, J. Neurosci.

Khvotchev et al., 2003, J. Neurosci.

Lazo et al., 2013, J. Neurosci.

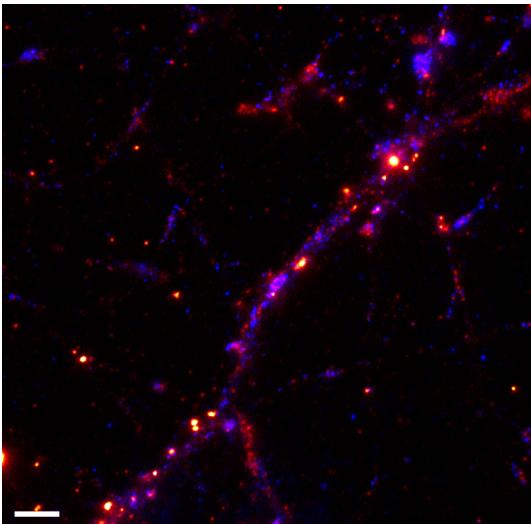
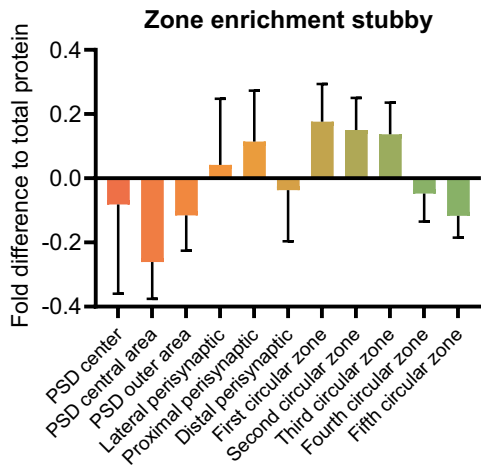
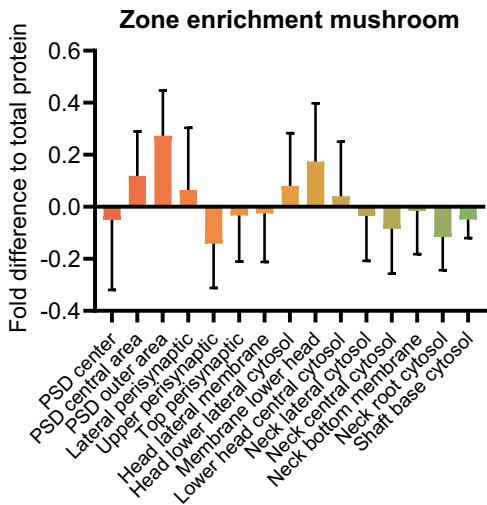
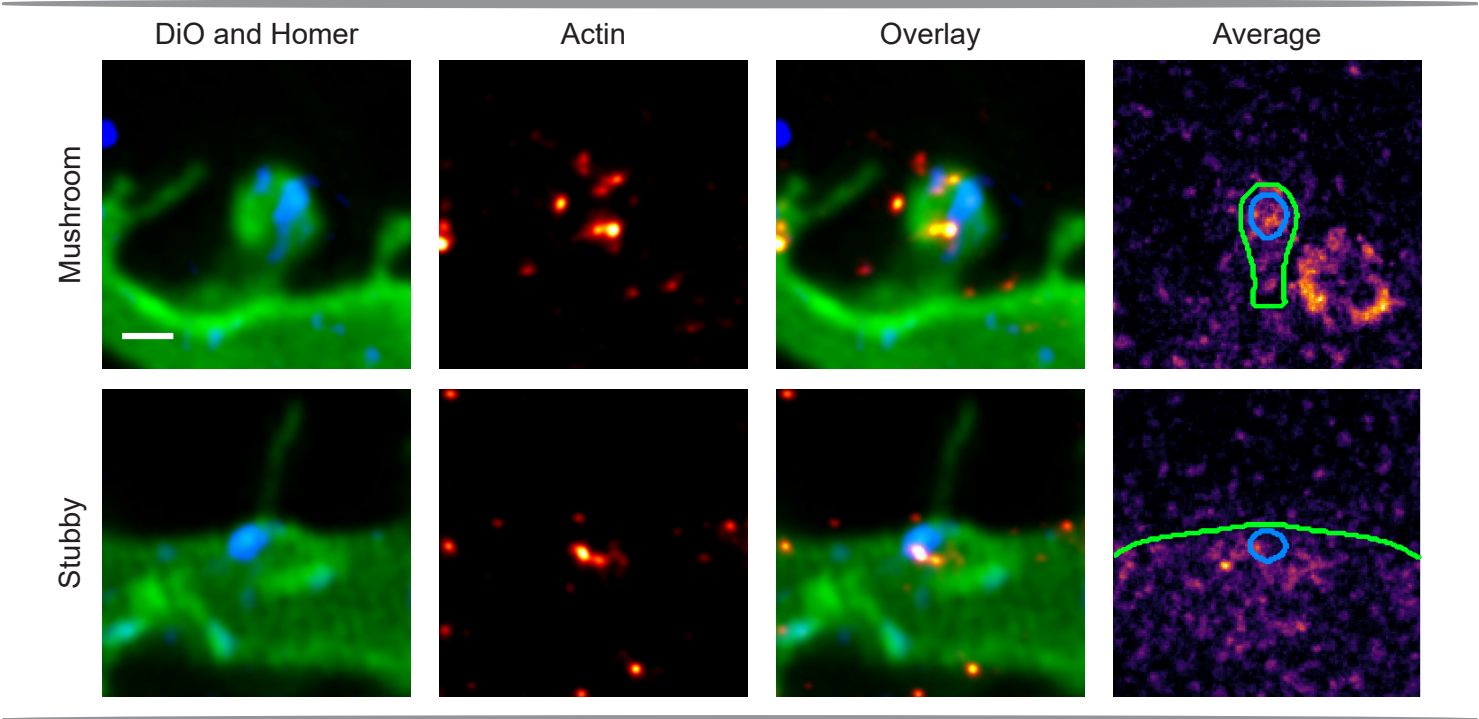
Shirane and Nakayama, 2006, Science

Rapsyn (Gene: Rapsn, Uniprot ID: D3ZPG2)

Known function: Binds and clusters nAChR to the PSD, E3 ligase activity

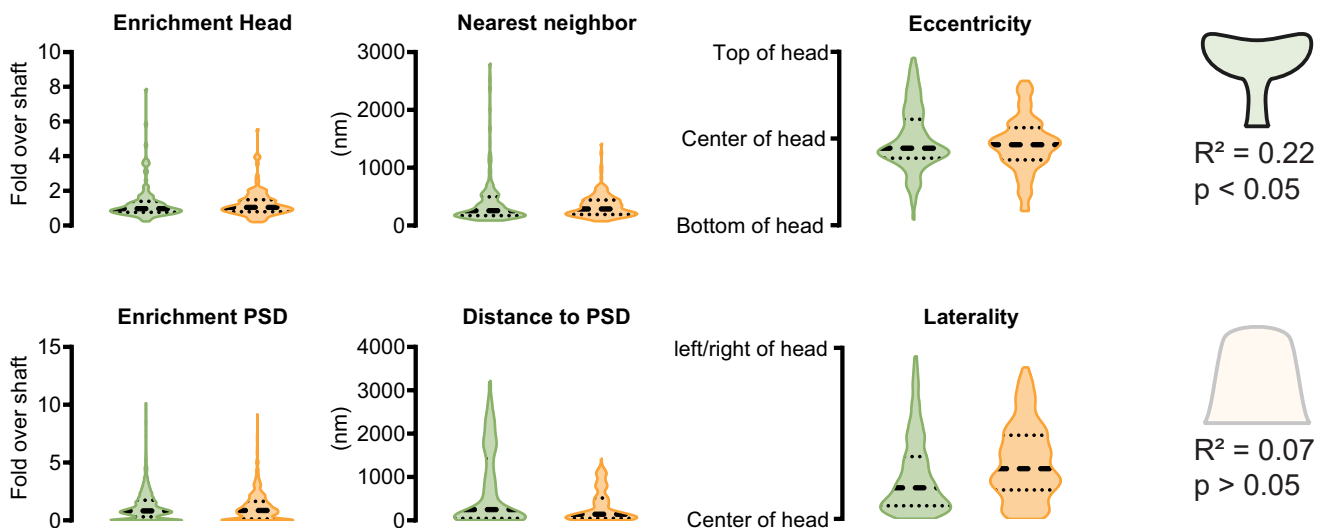
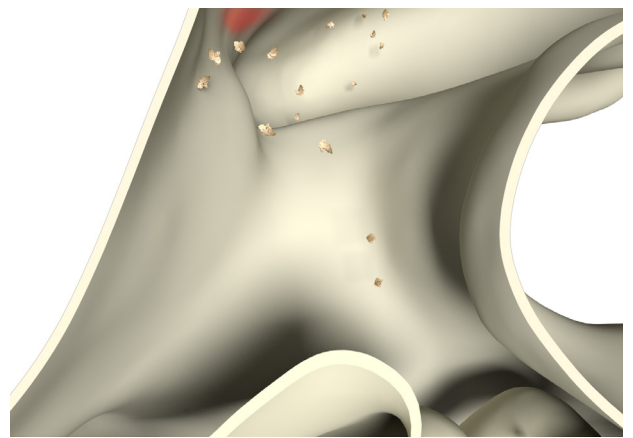
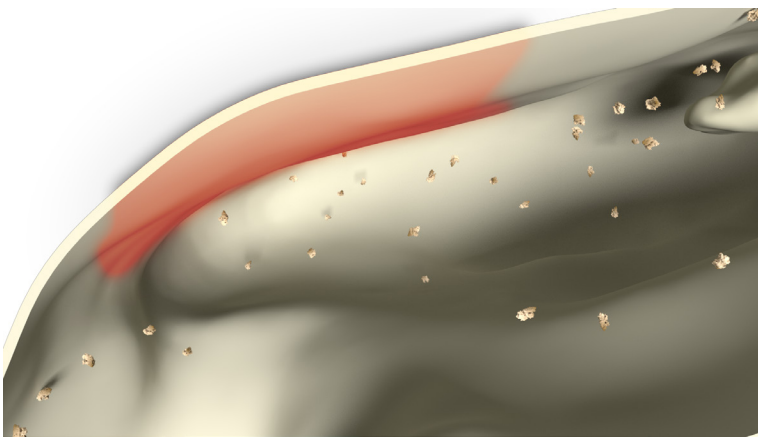
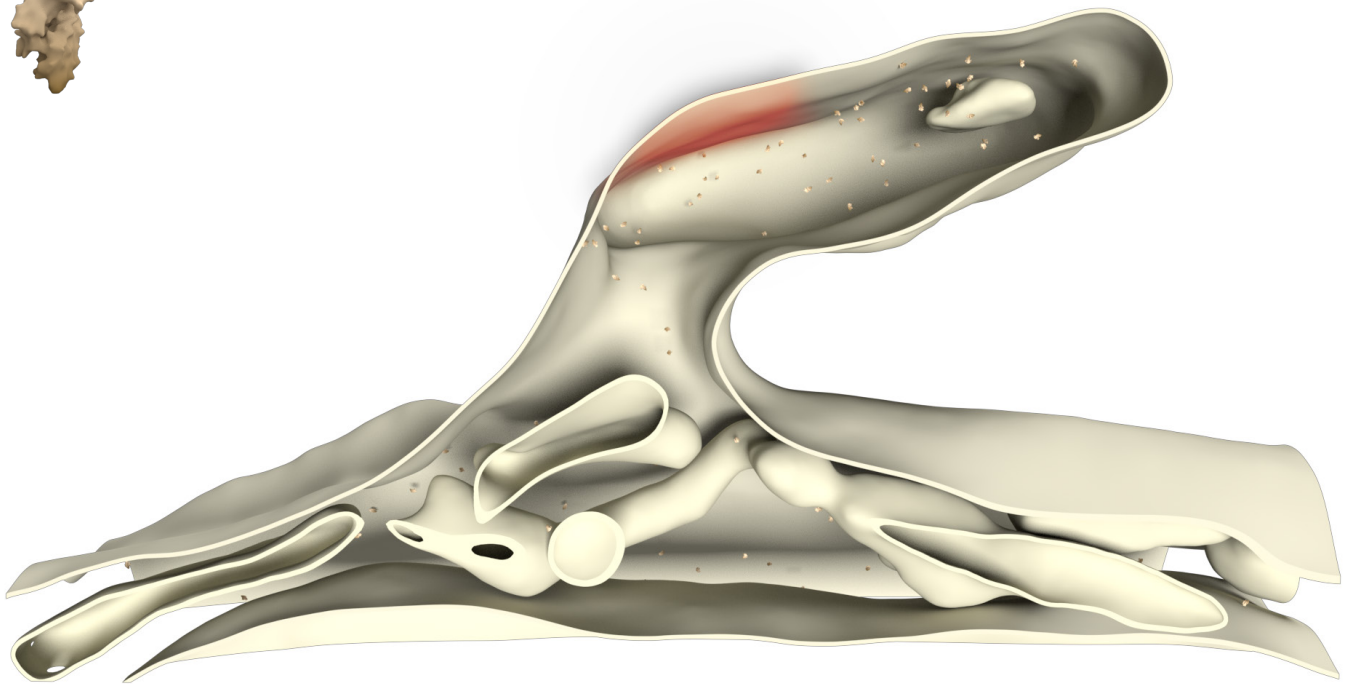
Known organization: In PSD, very dynamic

Known Interactions: None

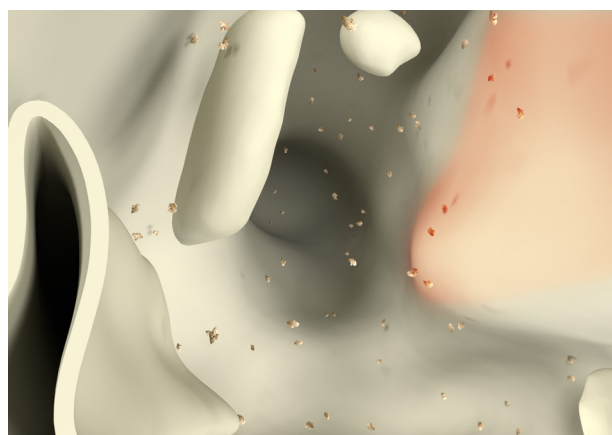
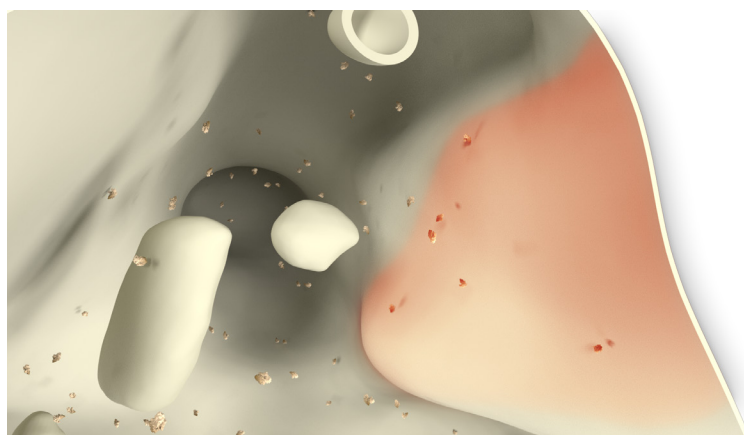
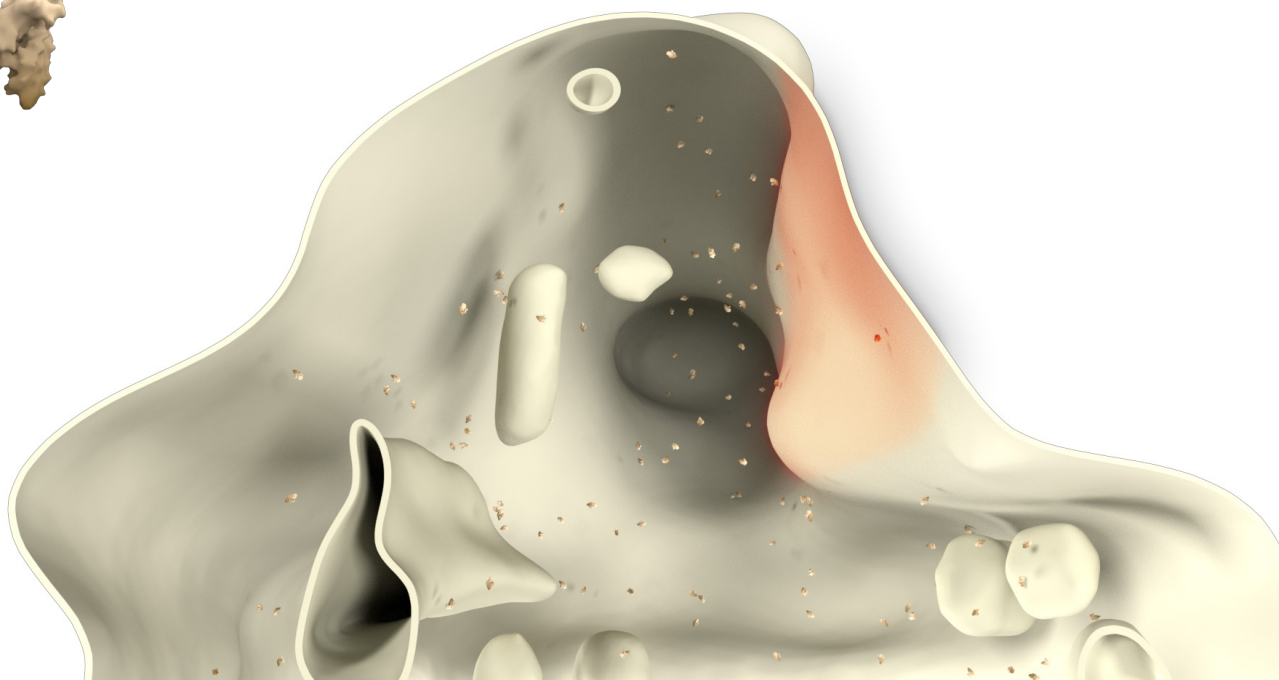
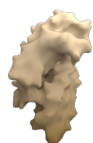


Whole cell copy number	3388460.4 ± 748084.5	
Spine copy number	206.5 ± 97.5	
Function	PSD Scaffold	
	Mushroom	Stubby
Spine copy number	207.1 ± 97.7	223.9 ± 105.7
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	2.6 ± 1.2	2.1 ± 1.0
PSD copy number	38 ± 17.9	27 ± 12.7
% in PSD	18.4 ± 8.7%	12.1 ± 5.7%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	207.1 ± 97.7	$0.0 \pm 0.0\%$	2.6 ± 1.2	38 ± 17.9
Stubby	223.9 ± 105.7	$0.0 \pm 0.0\%$	2.1 ± 1.0	27 ± 12.7



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	207.1 ± 97.7	$0.0 \pm 0.0\%$	2.6 ± 1.2	38 ± 17.9
Stubby	223.9 ± 105.7	$0.0 \pm 0.0\%$	2.1 ± 1.0	27 ± 12.7



References

Antibody: Atlas Antibodies HPA039475

PDB Identifier: 4bog

Literature:

Bruneau and Akaaboune, 2010, J. Neurosci.

Burden et al., 1983, Cell

Gautam et al., 1995, Nature

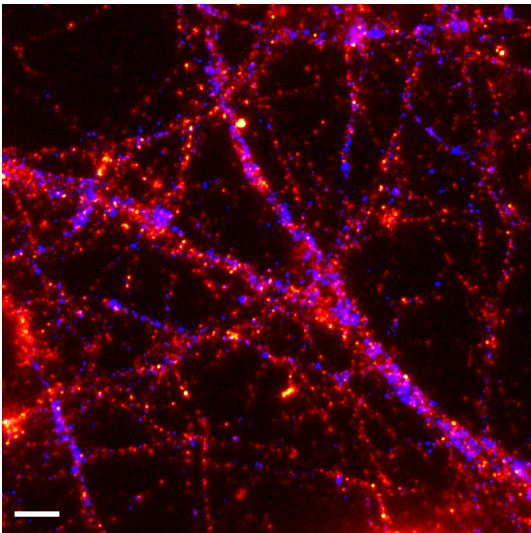
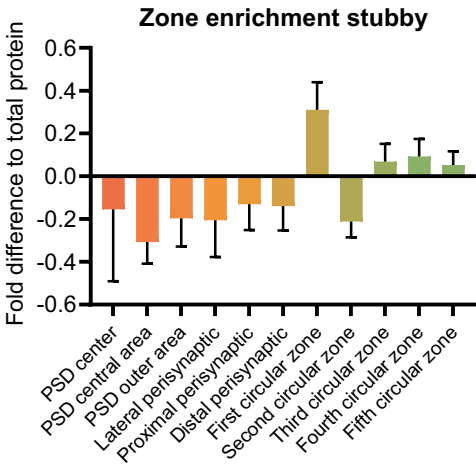
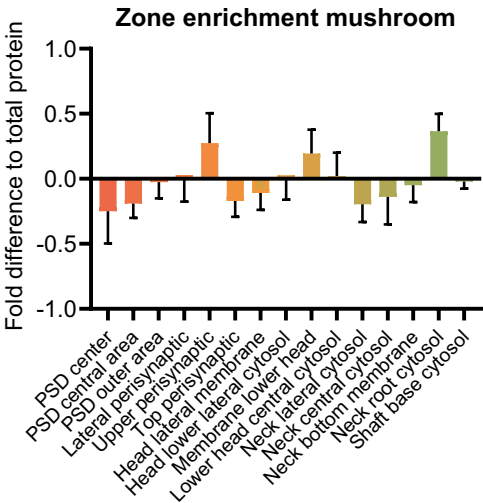
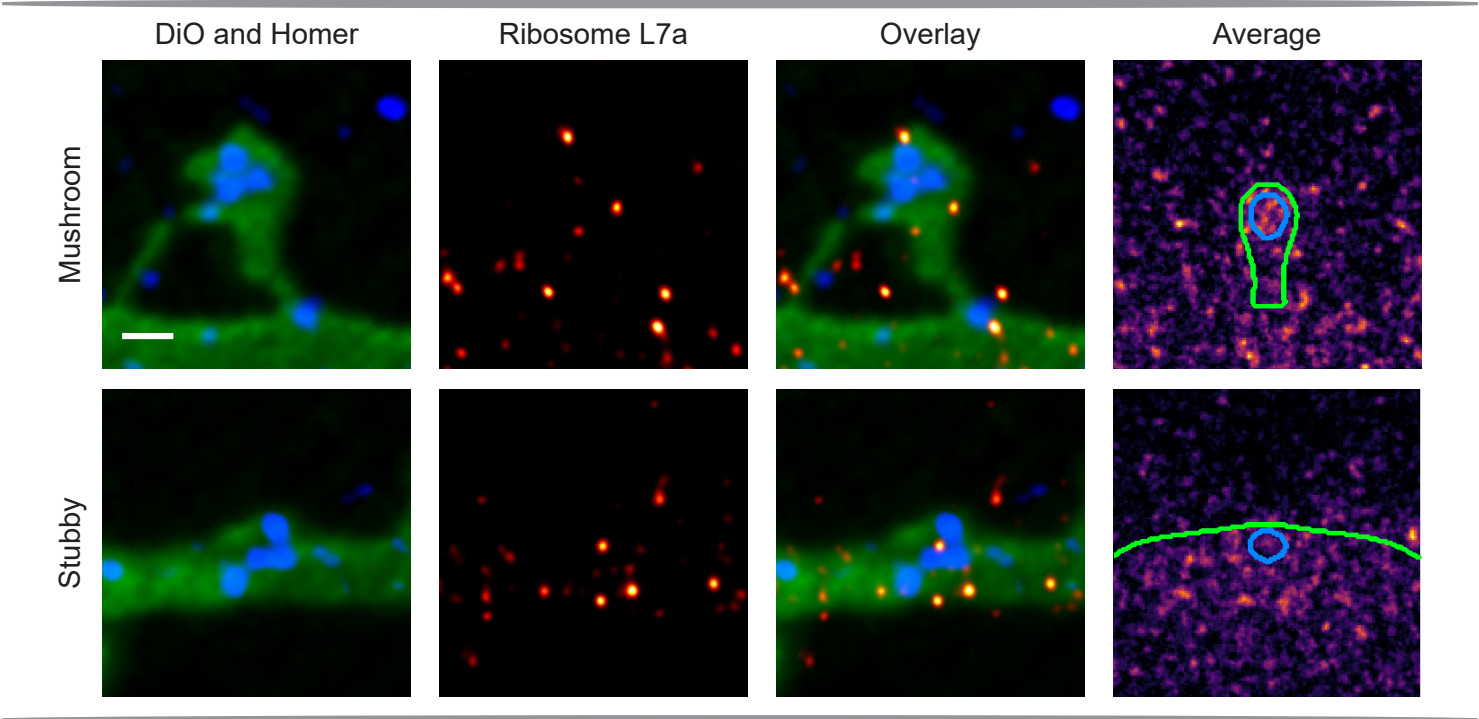
LaRoche and Froehner, 1986, J. Biol. Chem.

Li et al., 2016, Neuron

Walker et al., 1984, EMBO J.

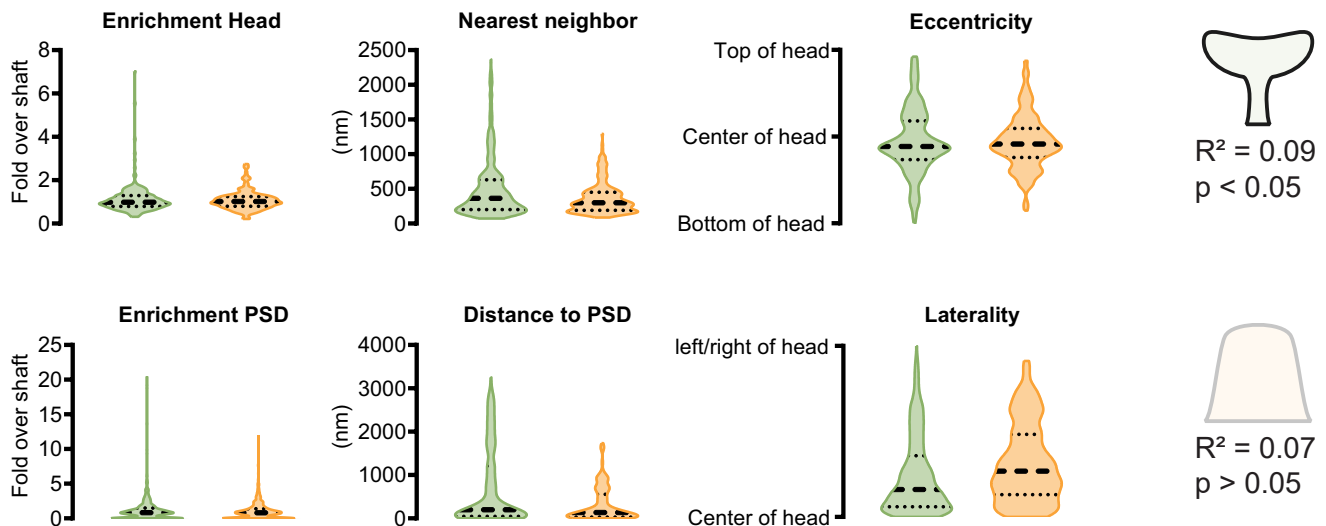
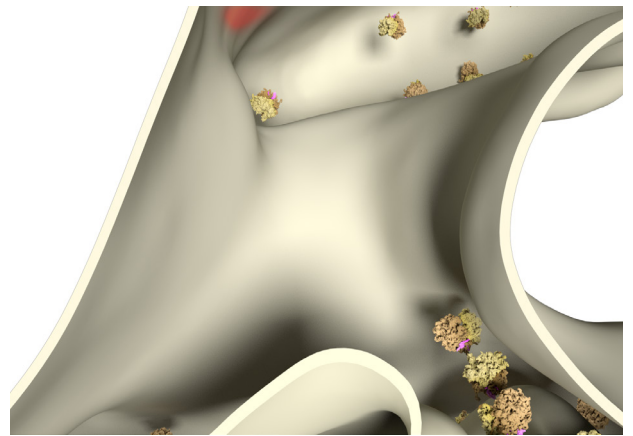
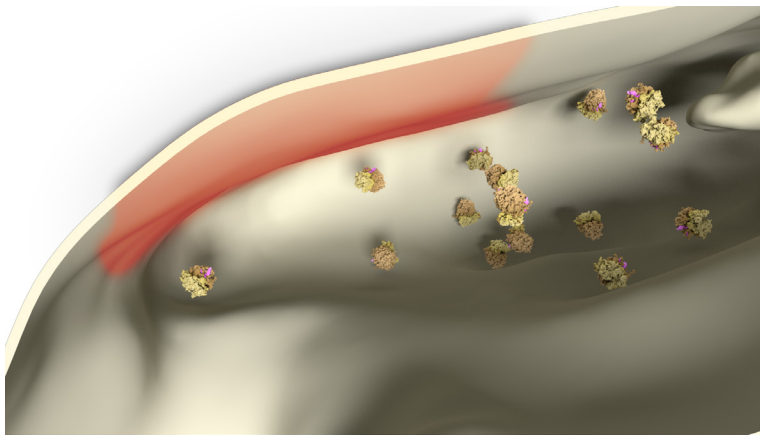
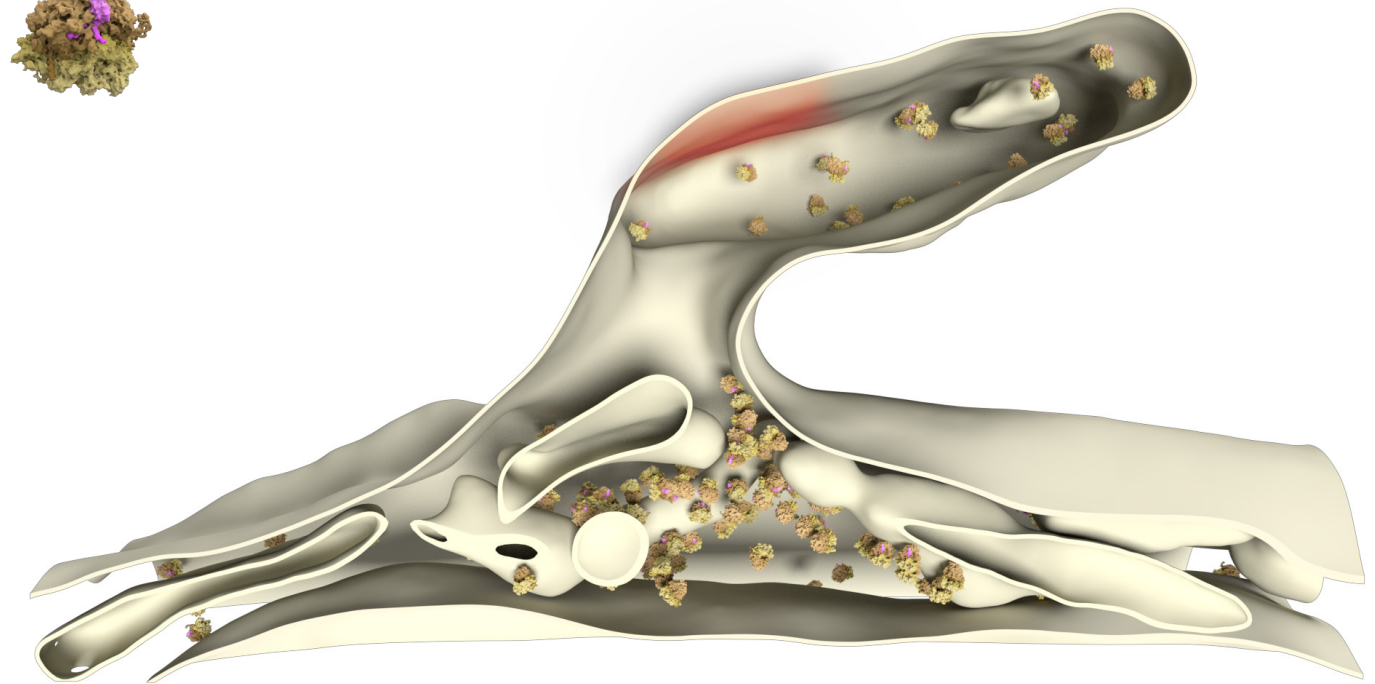
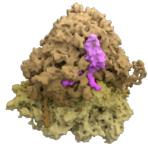
Ribosomal protein L7a (Gene: Rpl7a, Uniprot ID: P62425)

Known function: Translation
Known organization: Cytosolic, on 60S subunit
Known Interactions: 40S ribosomal subunit

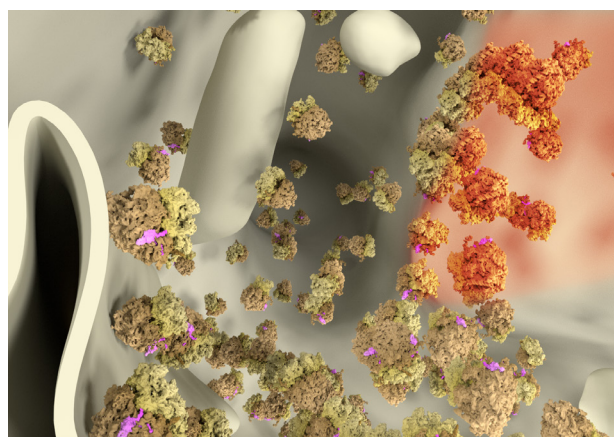
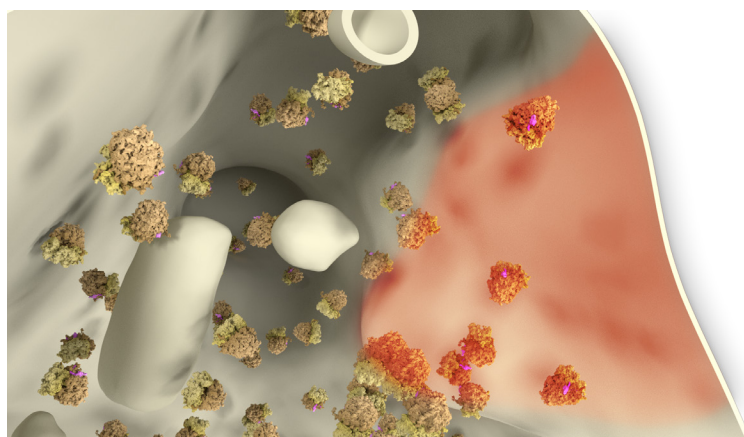
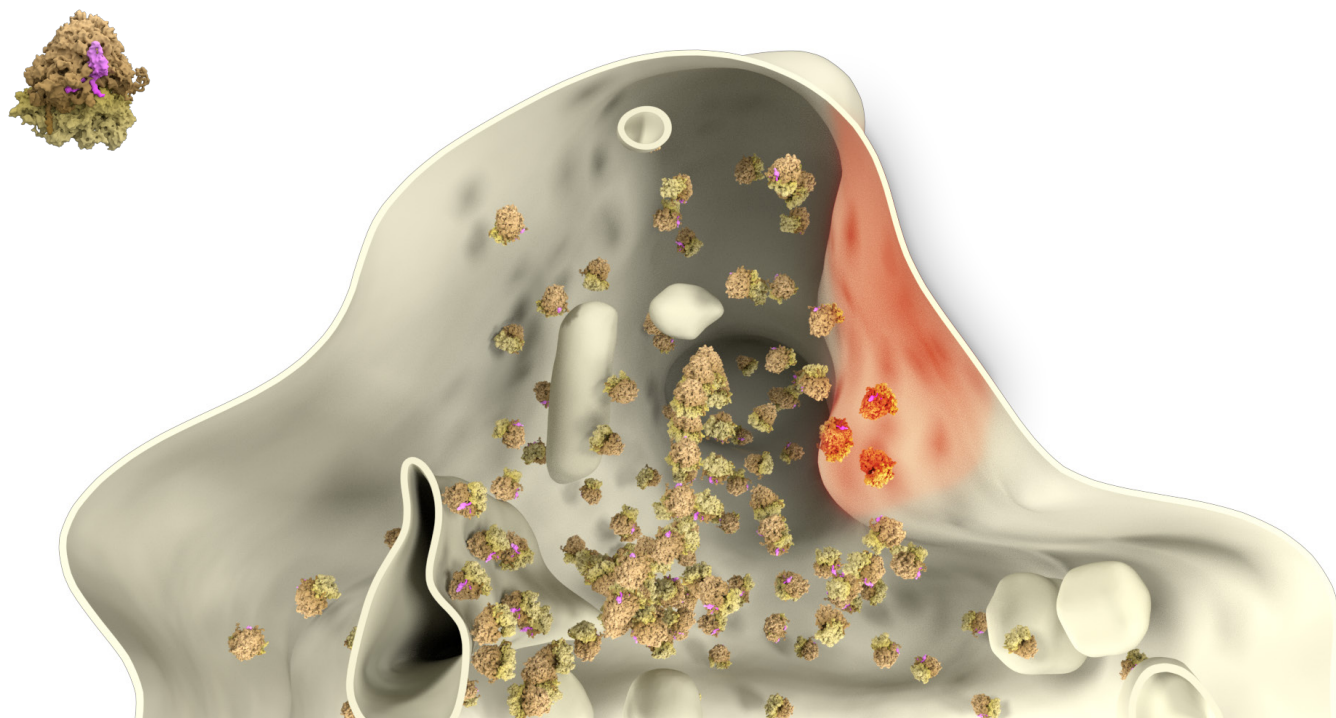


Whole cell copy number	18429434.9 ± 1939750.3	
Spine copy number	241.8 ± 290.7	
Function	Organelle	
	Mushroom	Stubby
Spine copy number	206.7 ± 248.5	292.9 ± 352.1
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (µM)	2.6 ± 3.2	2.8 ± 3.3
PSD copy number	28 ± 33.7	20 ± 24.0
% in PSD	13.5 ± 16.3%	6.8 ± 8.2%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	206.7 ± 248.5	$0.0 \pm 0.0\%$	2.6 ± 3.2	28 ± 33.7
Stubby	292.9 ± 352.1	$0.0 \pm 0.0\%$	2.8 ± 3.3	20 ± 24.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	206.7 ± 248.5	$0.0 \pm 0.0\%$	2.6 ± 3.2	28 ± 33.7
Stubby	292.9 ± 352.1	$0.0 \pm 0.0\%$	2.8 ± 3.3	20 ± 24.0



References

Antibody: Cell Signaling 2403

PDB Identifier: 4ugo

Literature:

Ban et al., 2014, Curr. Opin. Struct. Biol.

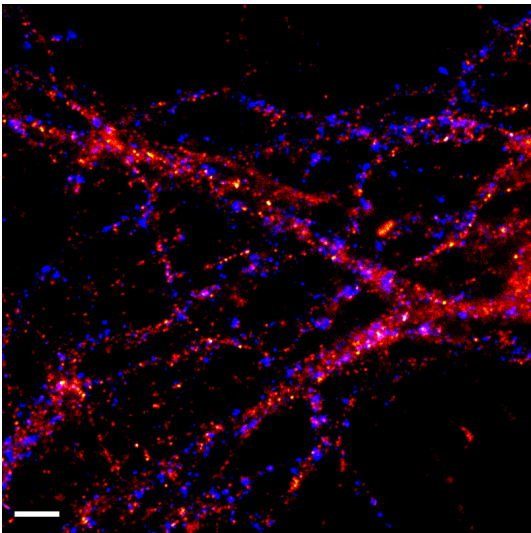
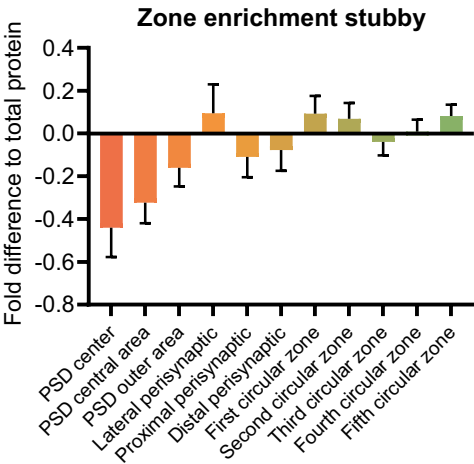
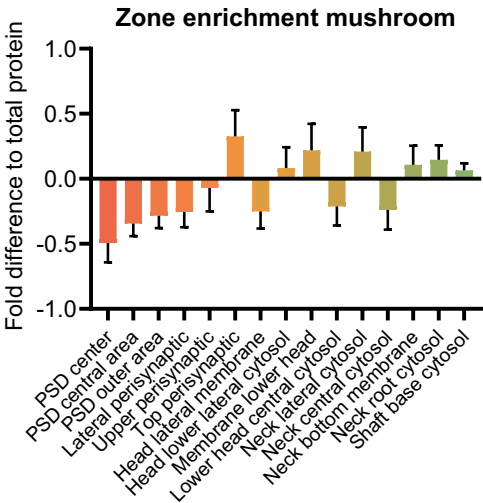
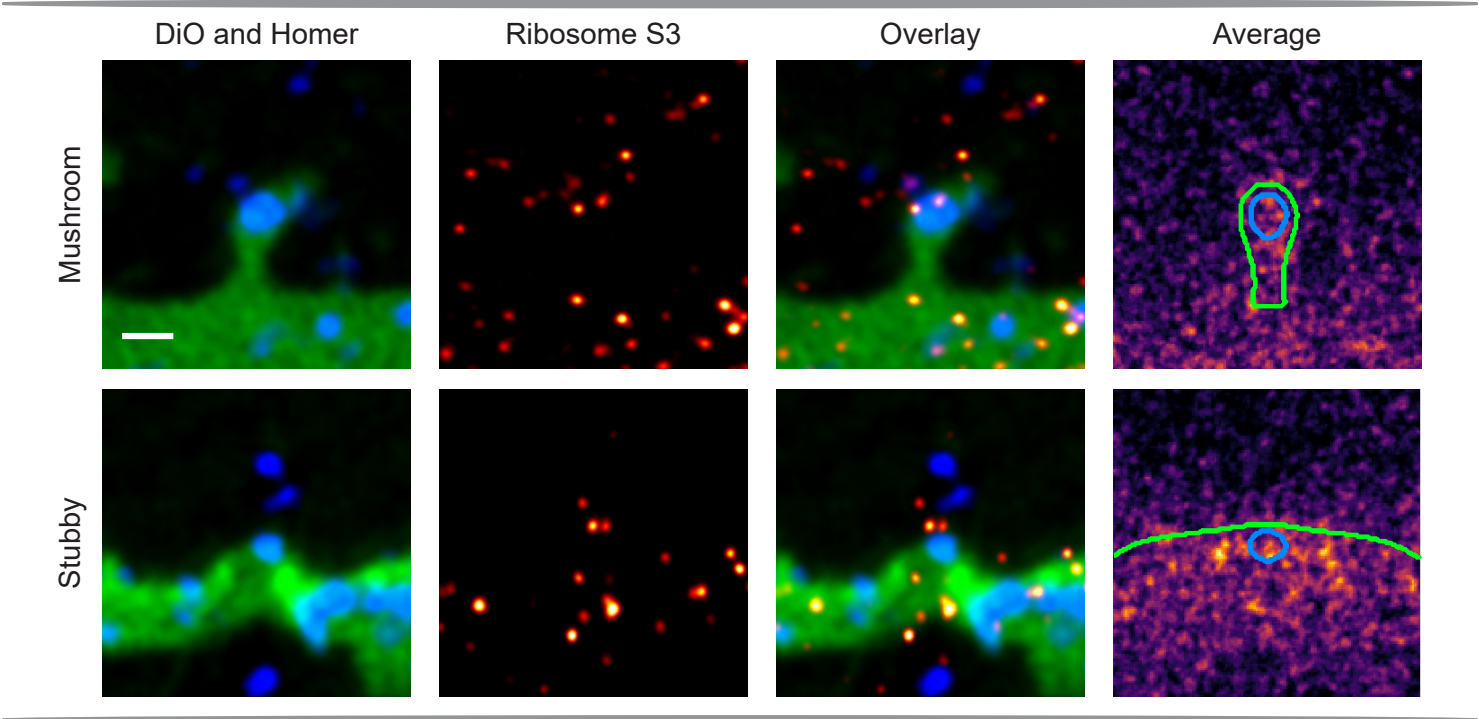
de la Cruz et al., 2015, Annu. Rev. Biochem.

Ribosomal protein S3 (Gene: Rps3, Uniprot ID: P62909)

Known function: Translation

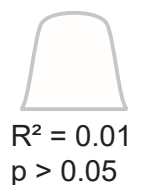
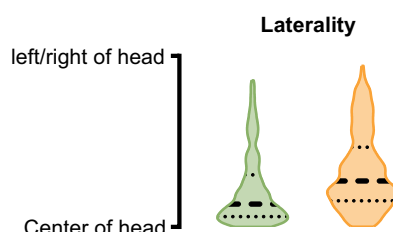
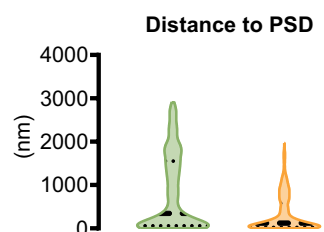
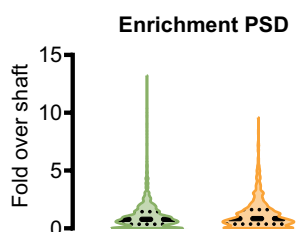
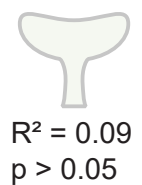
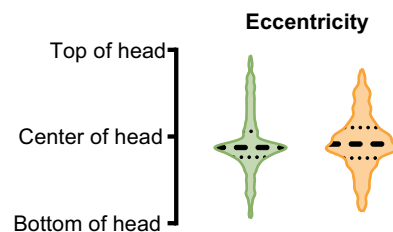
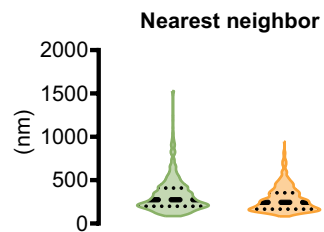
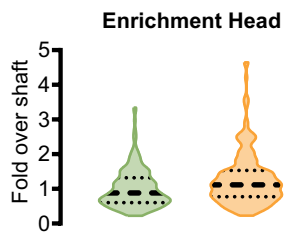
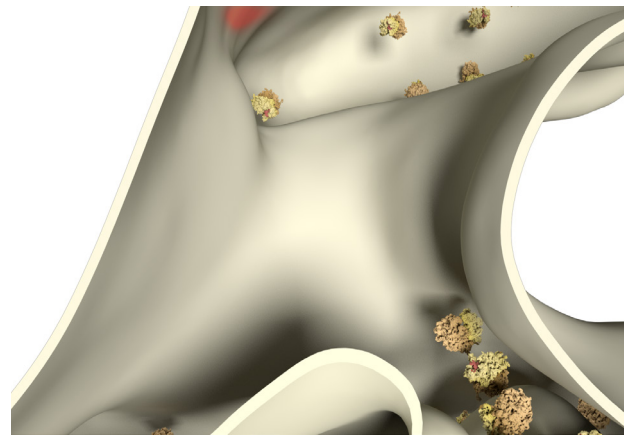
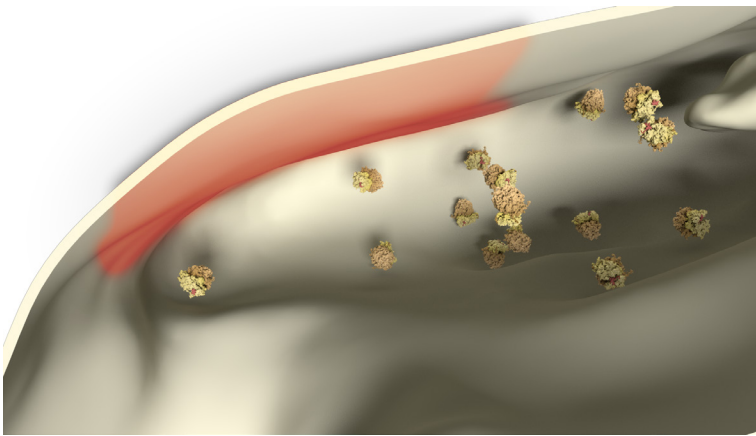
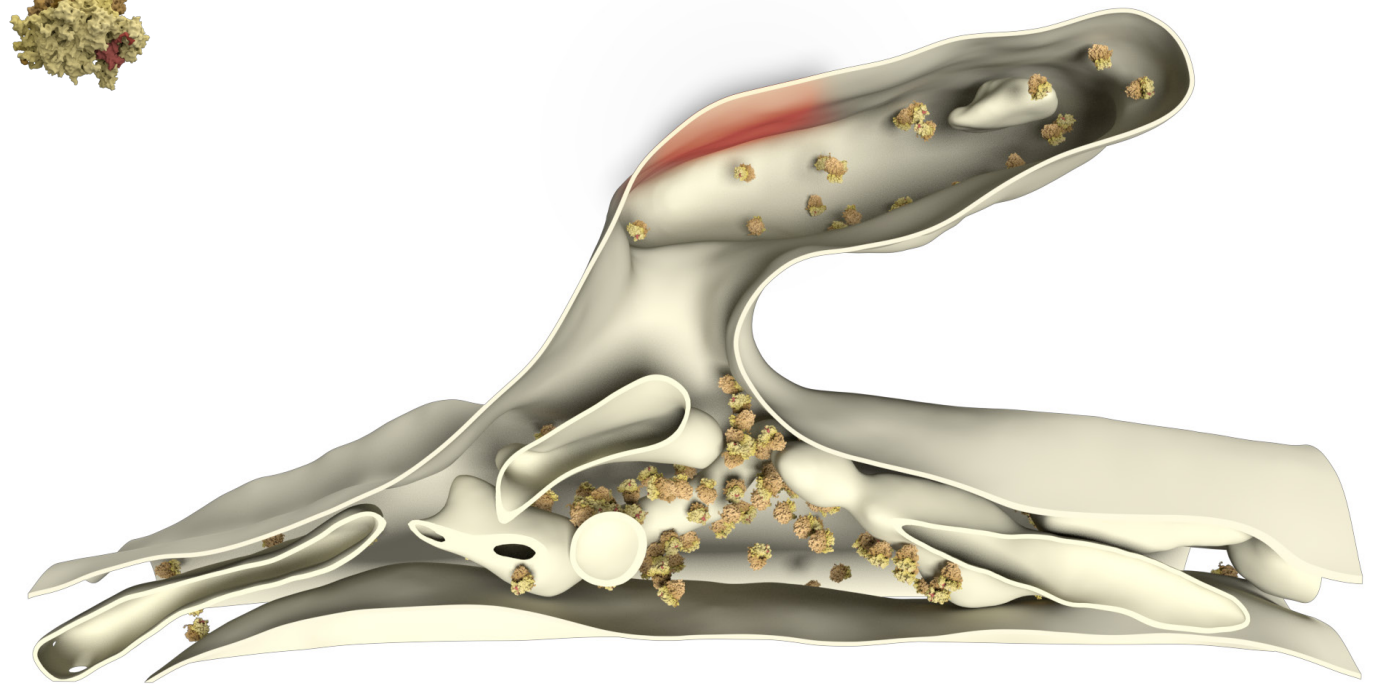
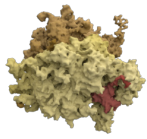
Known organization: Cytosolic, on 40S subunit

Known Interactions: 60S ribosomal subunit

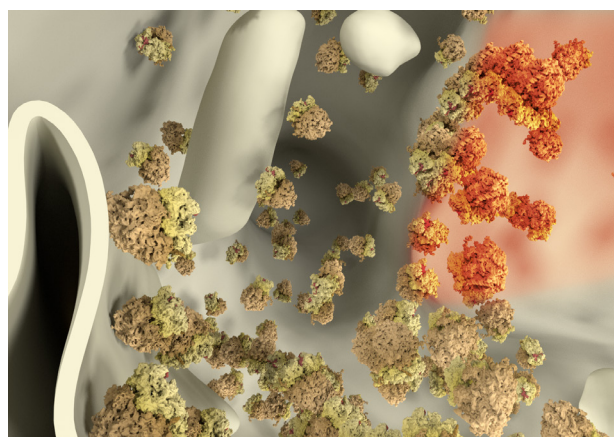
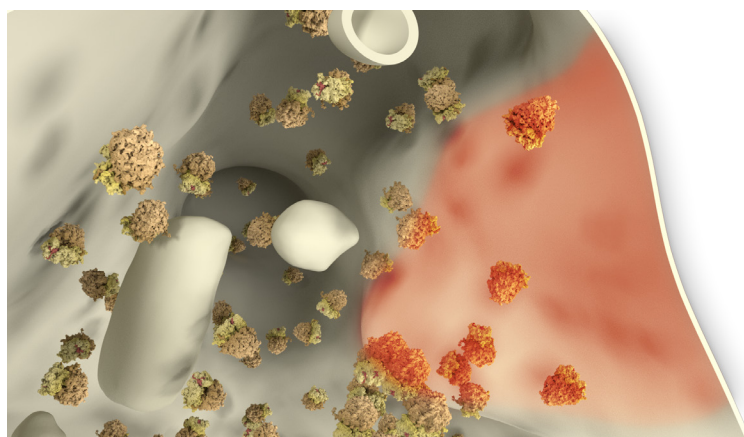
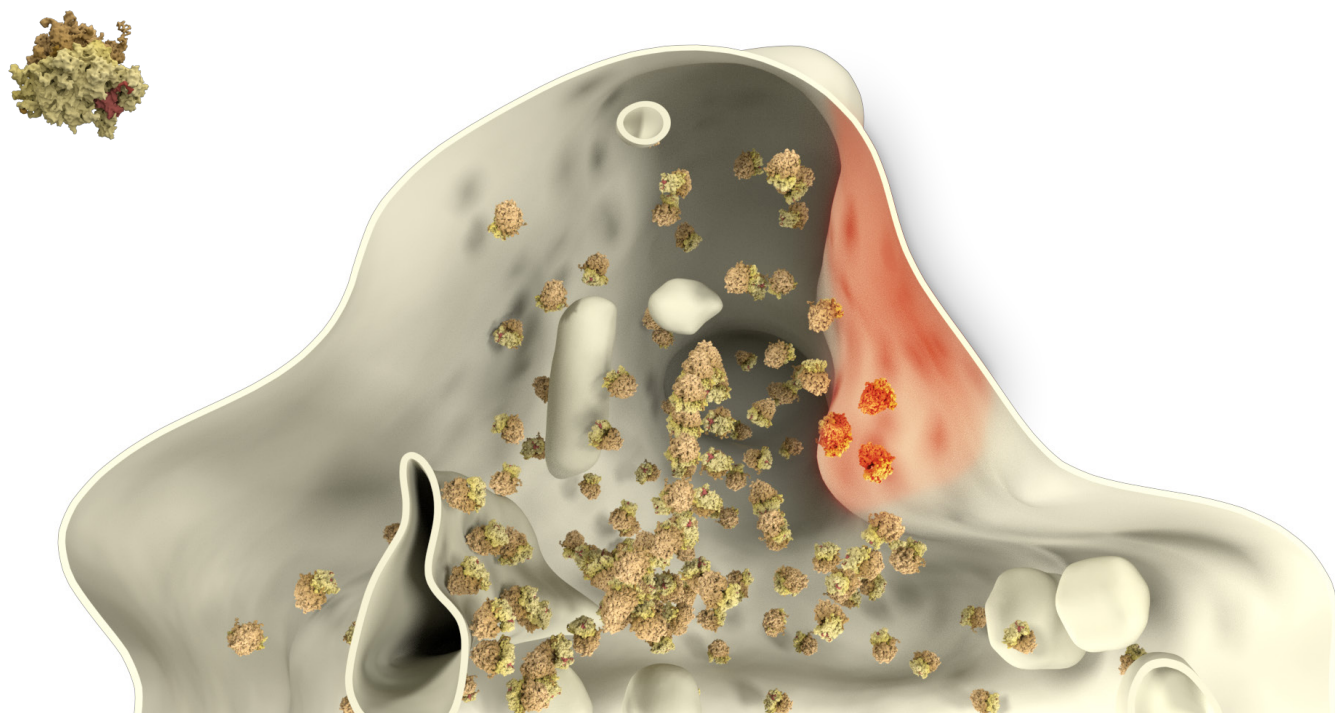


Whole cell copy number	22971897.3 ± 2234796.0	
Spine copy number	1675.1 ± 618.7	
Function	Organelle	
	Mushroom	Stubby
Spine copy number	1272.8 ± 470.2	2221.6 ± 820.6
% of total protein	0.2 ± 0.1%	0.2 ± 0.1%
Molarity (μM)	16.2 ± 6.0	21.0 ± 7.8
PSD copy number	140 ± 51.7	235 ± 86.8
% in PSD	11.0 ± 4.1%	10.6 ± 3.9%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1272.8 ± 470.2	$0.2 \pm 0.1\%$	16.2 ± 6.0	140 ± 51.7
Stubby	2221.6 ± 820.6	$0.2 \pm 0.1\%$	21.0 ± 7.8	235 ± 86.8



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1272.8 ± 470.2	$0.2 \pm 0.1\%$	16.2 ± 6.0	140 ± 51.7
Stubby	2221.6 ± 820.6	$0.2 \pm 0.1\%$	21.0 ± 7.8	235 ± 86.8



References

Antibody: Cell Signaling 9538

PDB Identifier: 4ugo

Literature:

Ban et al., 2014, Curr. Opin. Struct. Biol.

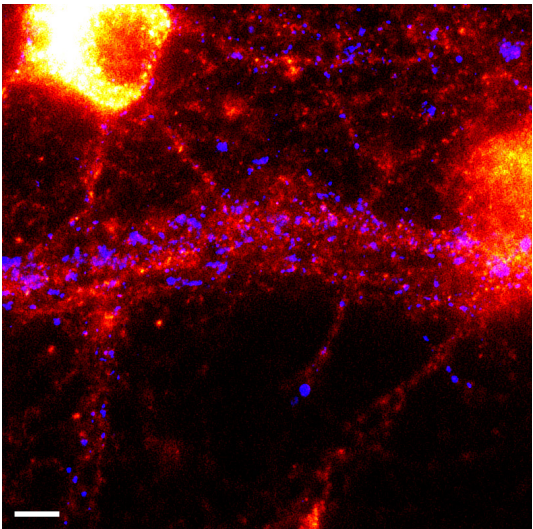
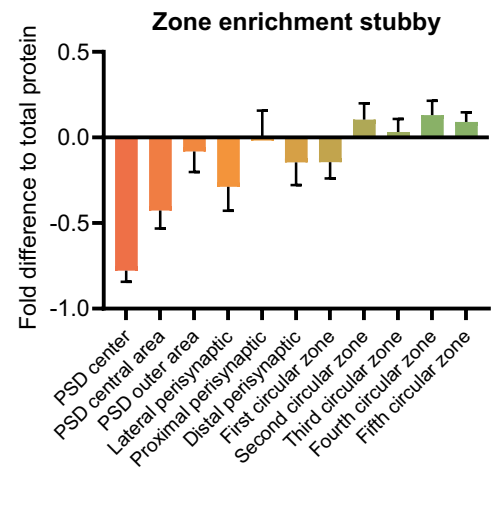
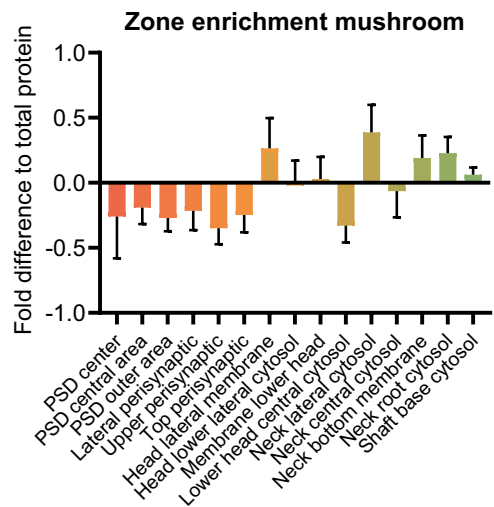
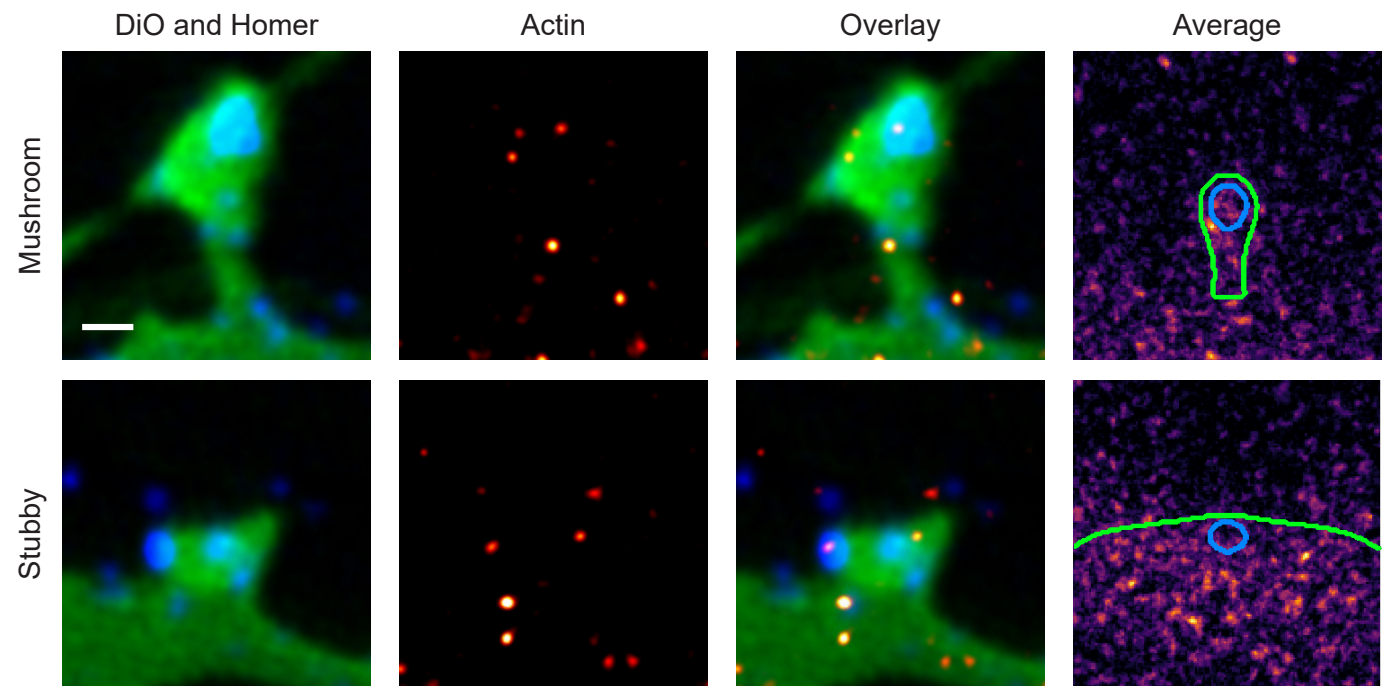
de la Cruz et al., 2015, Annu. Rev. Biochem.

Ribosomal protein S6 (Gene: Rps6, Uniprot ID: P62755)

Known function: Translation

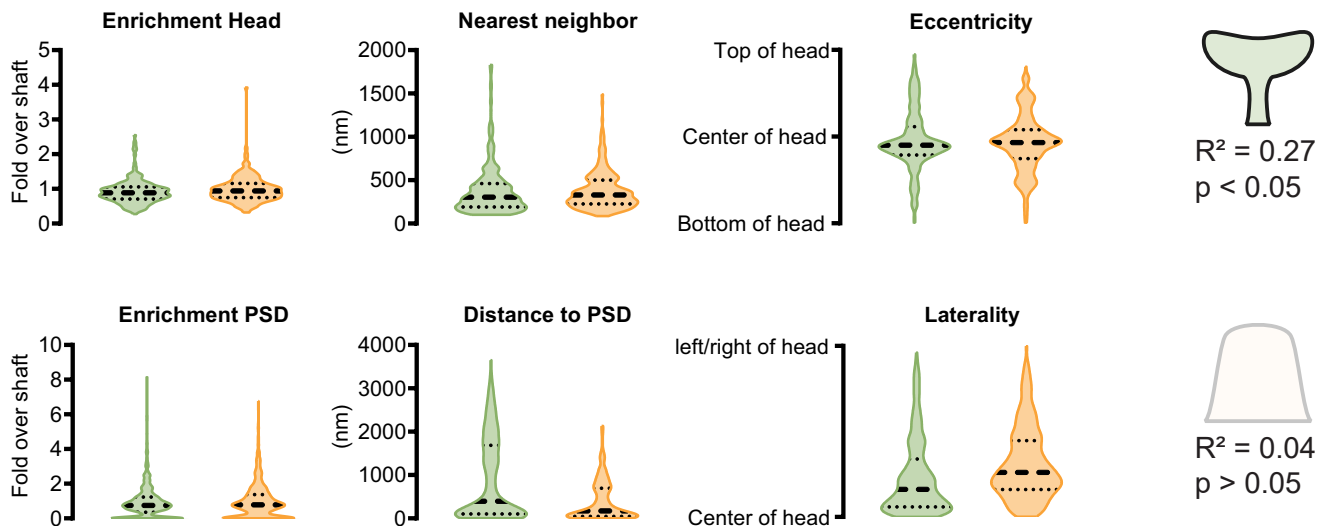
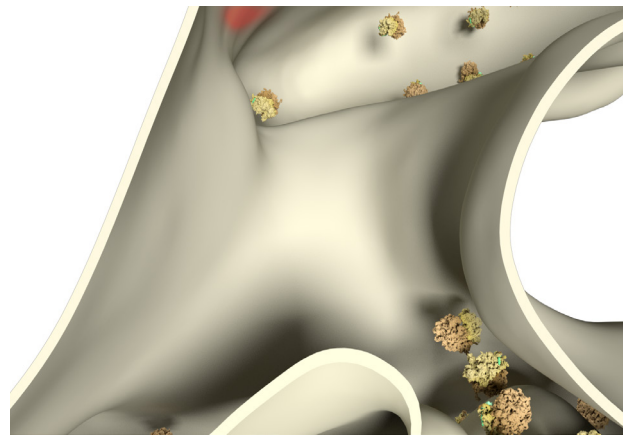
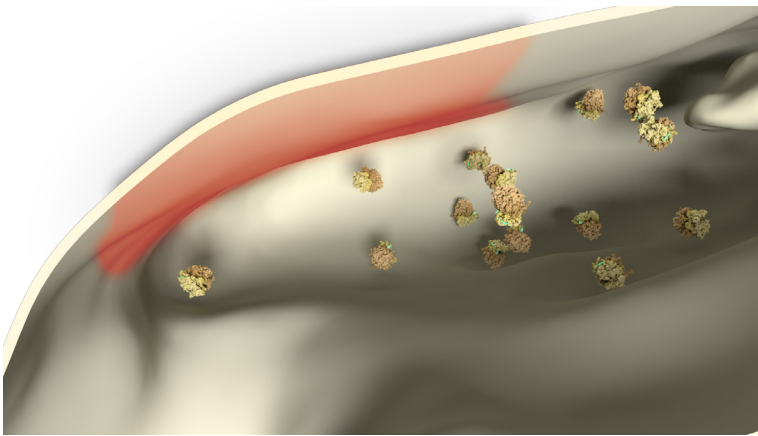
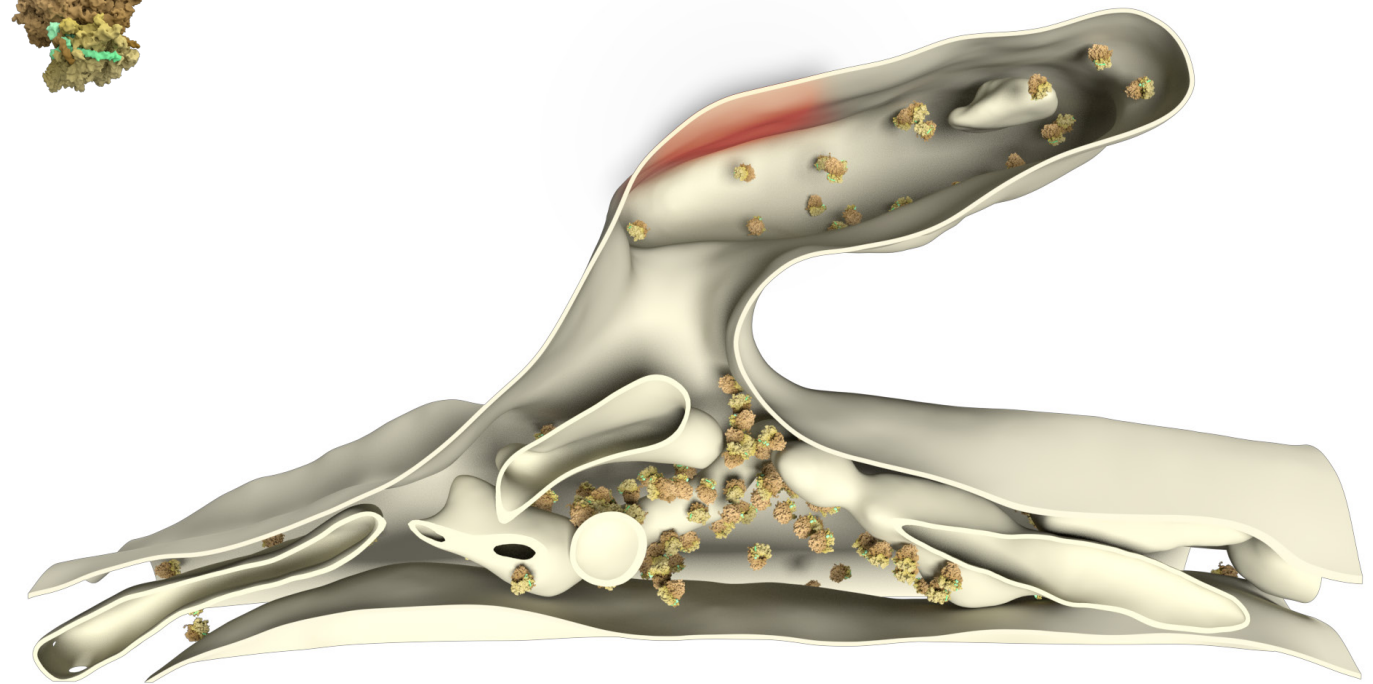
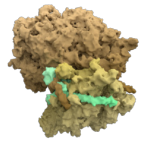
Known organization: Cytosolic, on 40S subunit

Known Interactions: 60S ribosomal subunit

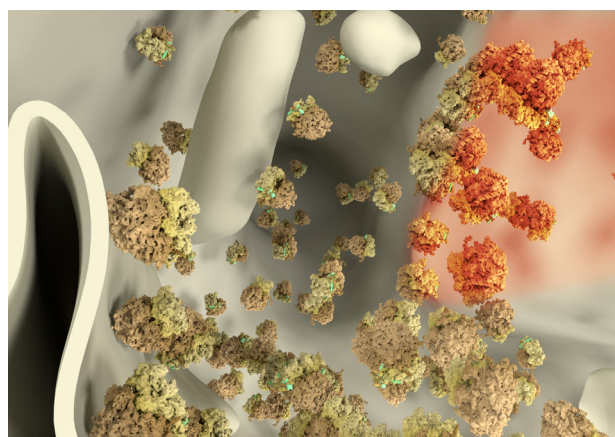
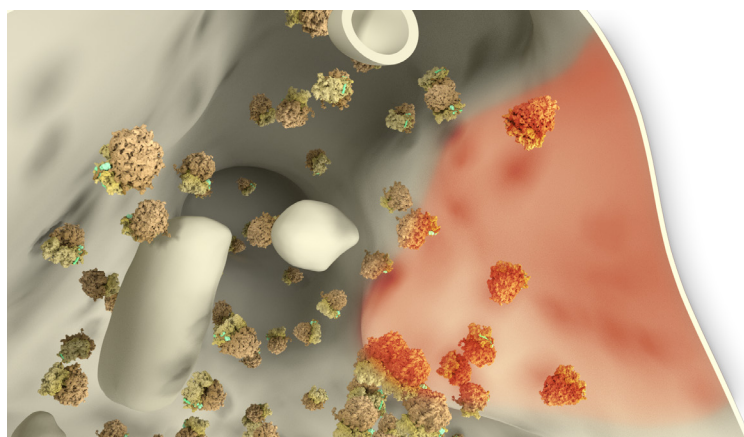
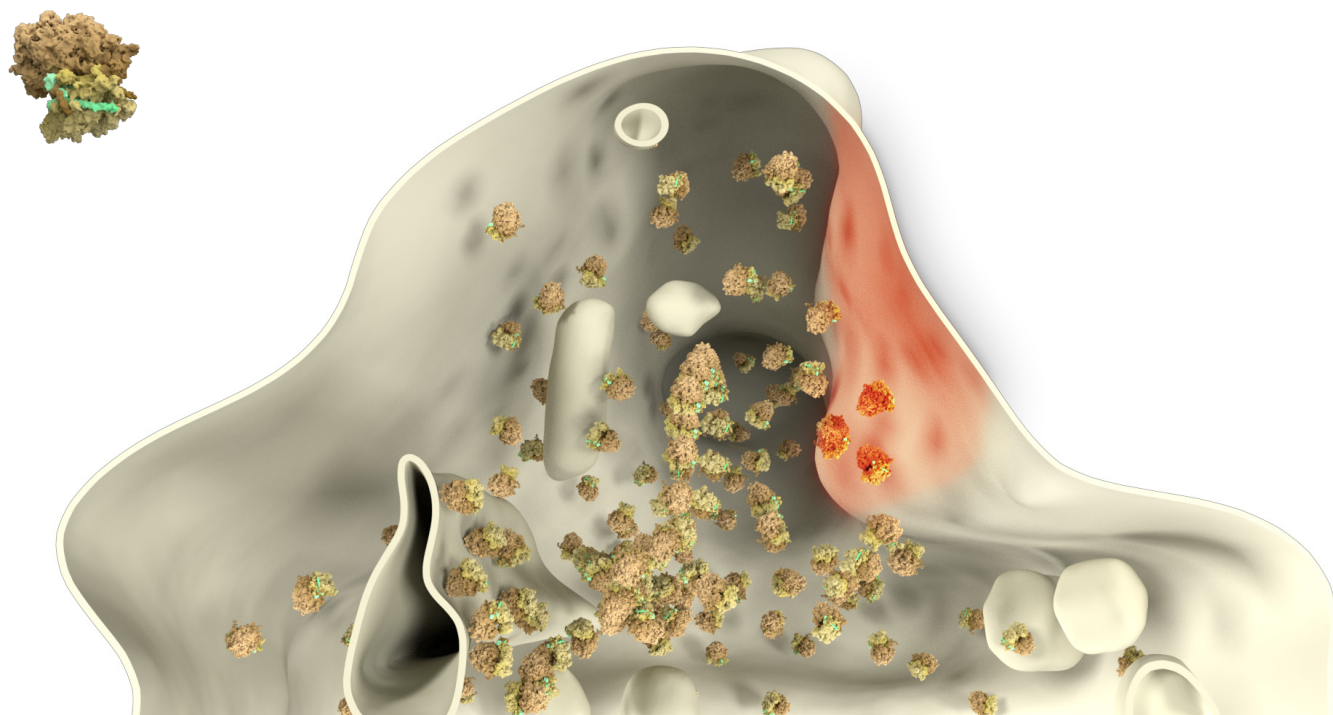


Whole cell copy number	23885770.5 ± 2685969.5	
Spine copy number	not detected	
Function	Organelle	
	Mushroom	Stubby
Spine copy number	not detected	not detected
% of total protein	not detected	not detected
Molarity (µM)	not detected	not detected
PSD copy number	not detected	not detected
% in PSD	not detected	not detected

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	not detected	not detected	not detected	not detected
Stubby	not detected	not detected	not detected	not detected



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	not detected	not detected	not detected	not detected
Stubby	not detected	not detected	not detected	not detected



References

Antibody: Cell Signaling 2217

PDB Identifier: 4ugo

Literature:

Ban et al., 2014, Curr. Opin. Struct. Biol.

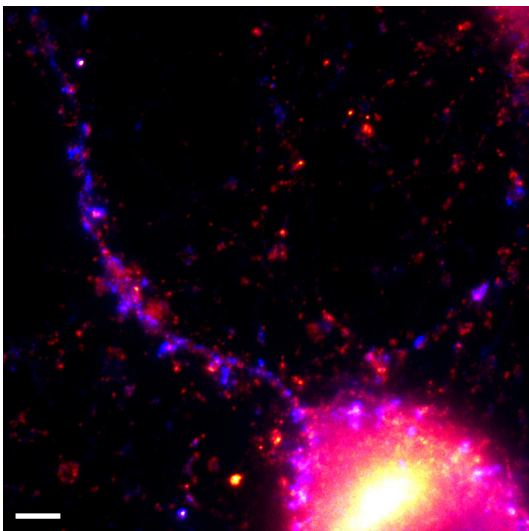
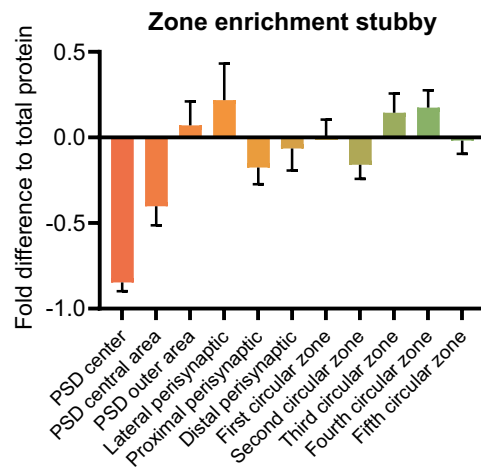
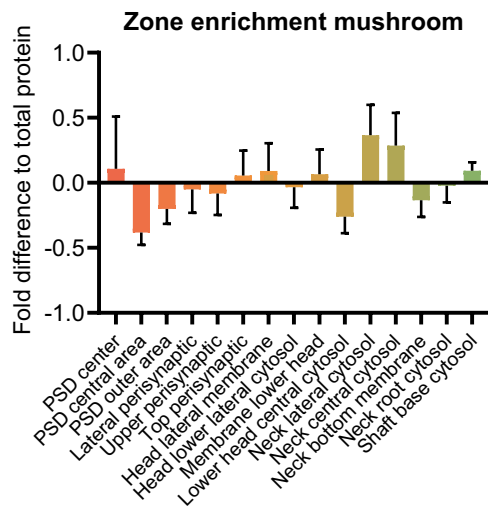
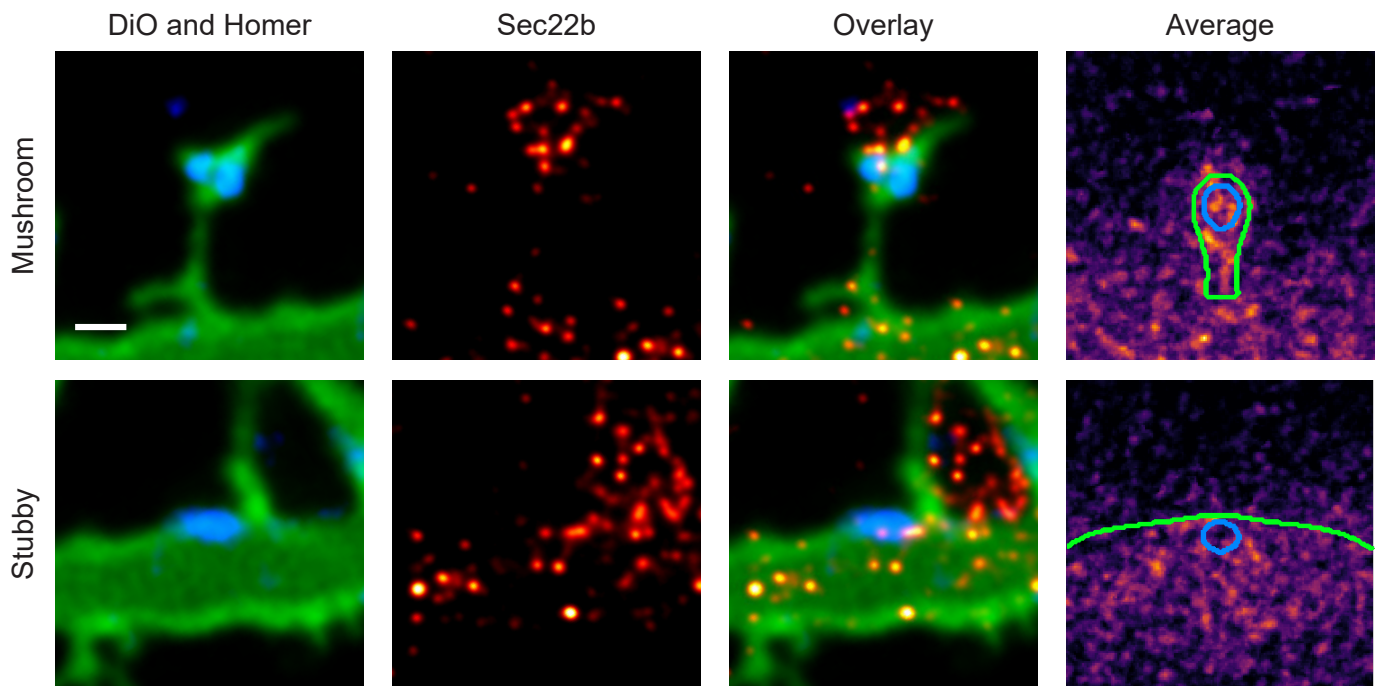
de la Cruz et al., 2015, Annu. Rev. Biochem.

Sec22b (ERS24, Gene: Sec22b, Uniprot ID: Q4KM74)

Known function: R-SNARE, Antero- and retrograde ER-Golgi transport, Homotypic COPII vesicle fusion, Delivery of NMDAR and GABAAR to PM

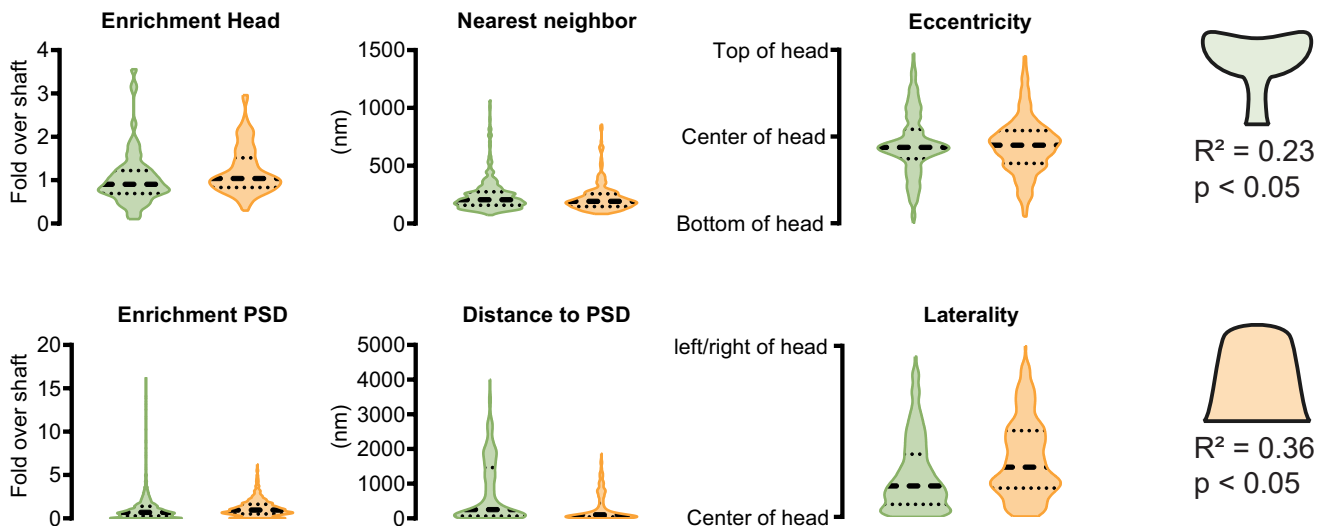
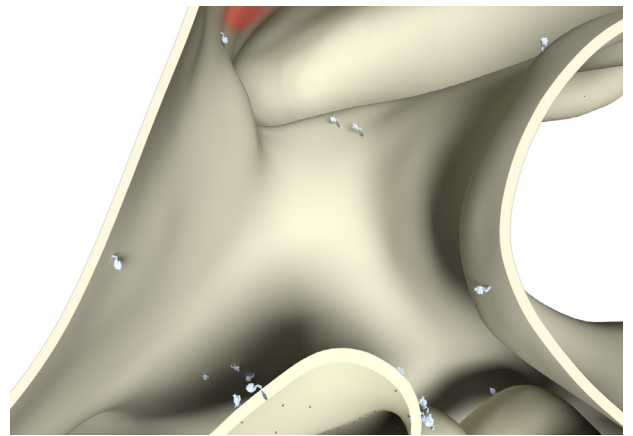
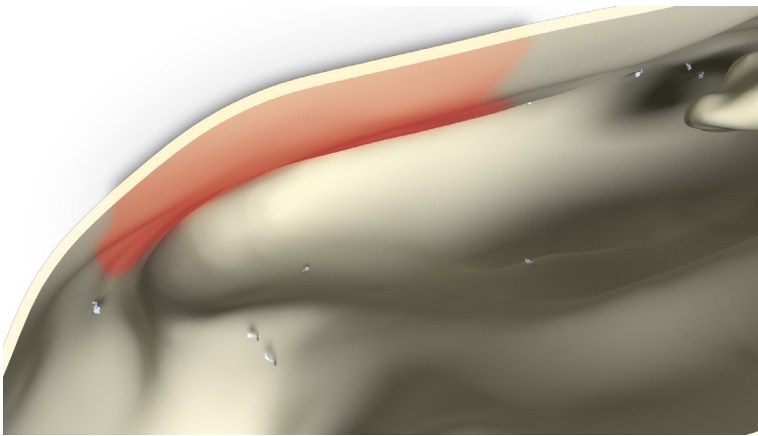
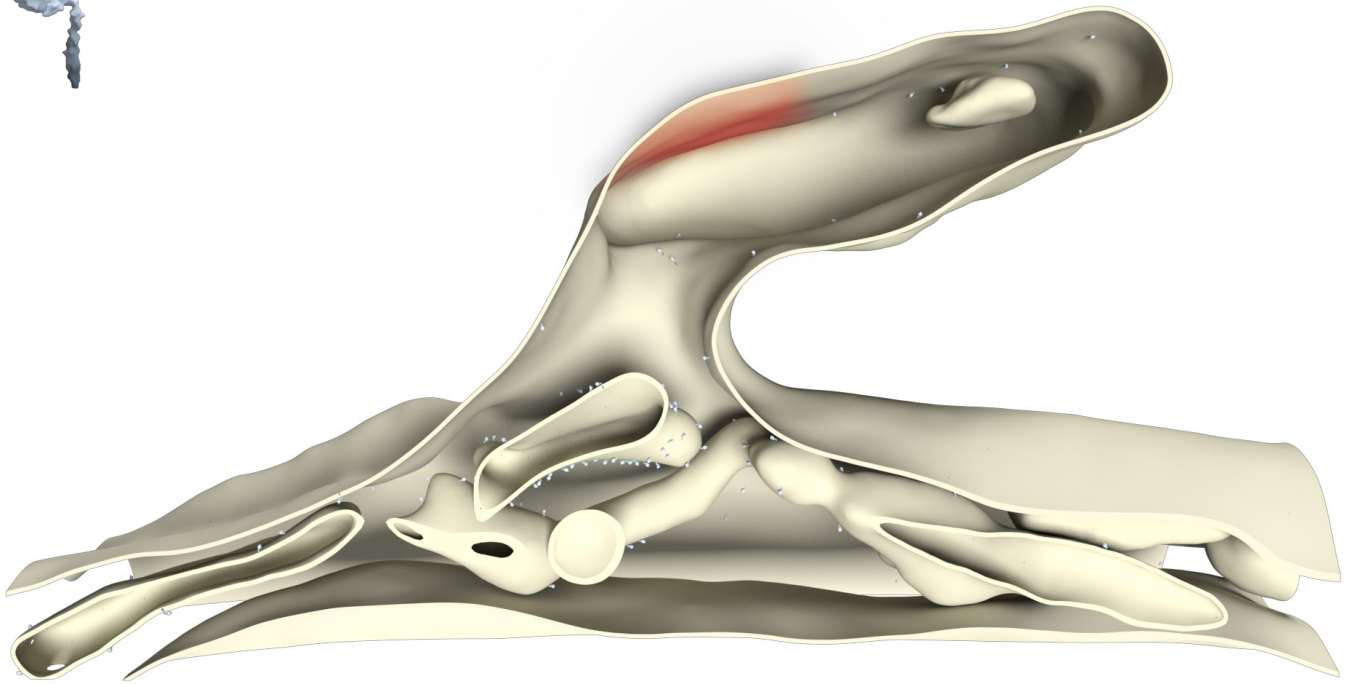
Known organization: Transmembrane proteine, ER, Golgi and ERGIC

Known Interactions: Syntaxin1, Syntaxin5

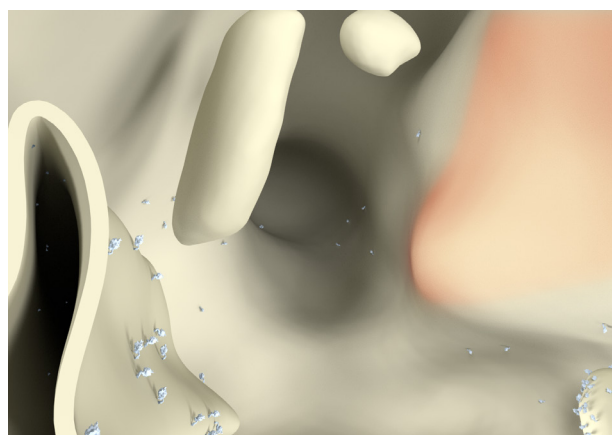
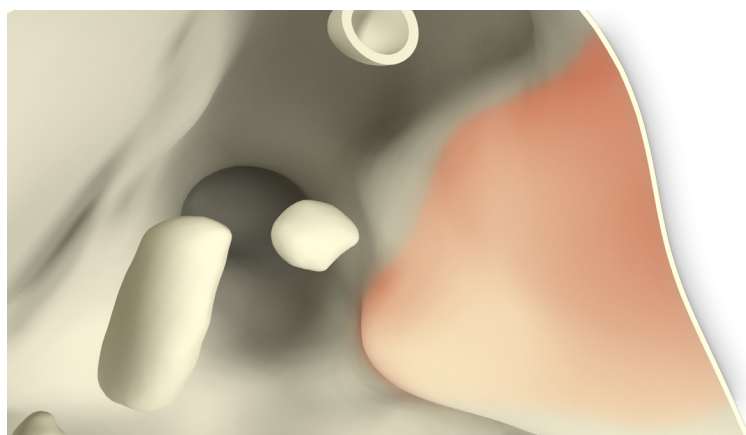
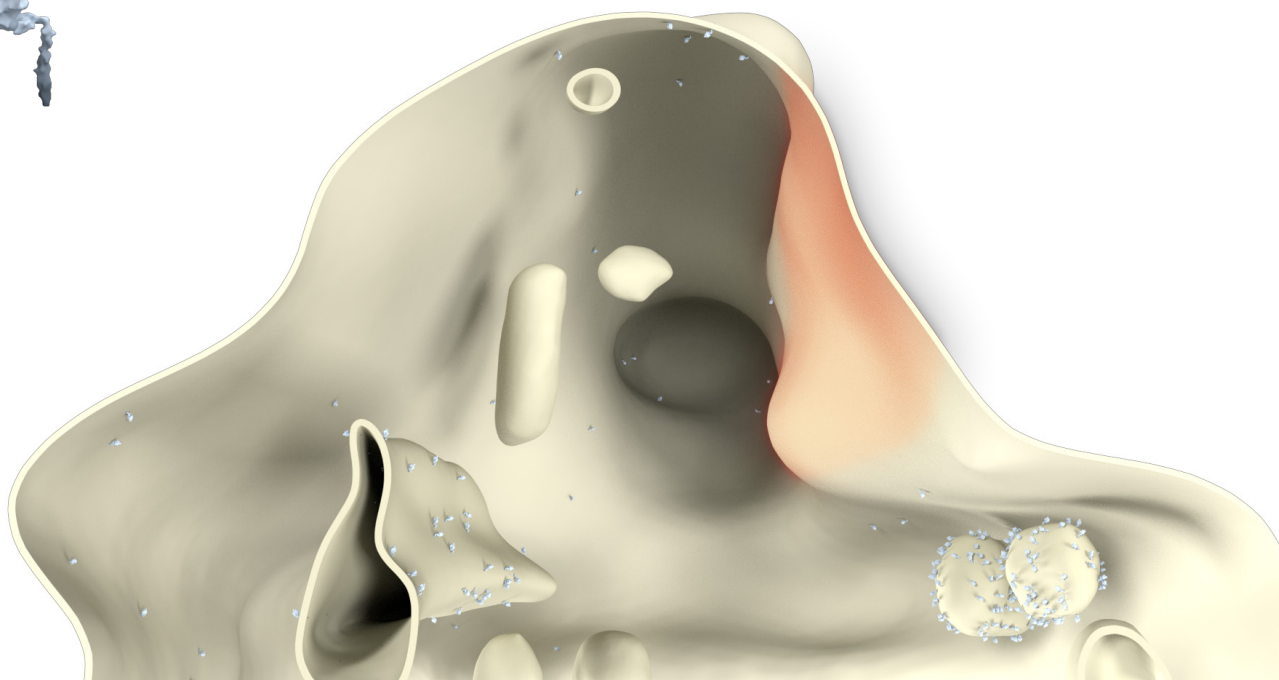


Whole cell copy number	8033640.6 ± 672775.5	
Spine copy number	321.1 ± 214.8	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	304.7 ± 203.9	371.1 ± 248.3
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	3.9 ± 2.6	3.5 ± 2.3
PSD copy number	8 ± 5.4	10 ± 6.7
% in PSD	2.6 ± 1.8%	2.7 ± 1.8%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	304.7 ± 203.9	$0.0 \pm 0.0\%$	3.9 ± 2.6	8 ± 5.4
Stubby	371.1 ± 248.3	$0.0 \pm 0.0\%$	3.5 ± 2.3	10 ± 6.7



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	304.7 ± 203.9	$0.0 \pm 0.0\%$	3.9 ± 2.6	8 ± 5.4
Stubby	371.1 ± 248.3	$0.0 \pm 0.0\%$	3.5 ± 2.3	10 ± 6.7



References

Antibody: Synaptic Systems 186 003

PDB Identifier: 5vno

Literature:

Burri et al., 2003, Proc. Natl. Acad. Sci. U S A

Gu et al., 2016, Proc. Natl. Acad. Sci. U S A

Hay et al., 1997, Cell

Lewis et al., 1997, EMBO J.

McNew et al., 2000, Nature

Washbourne, 2004, J. Neurosci.

Zhang et al., 1997, J. Cell. Biol.

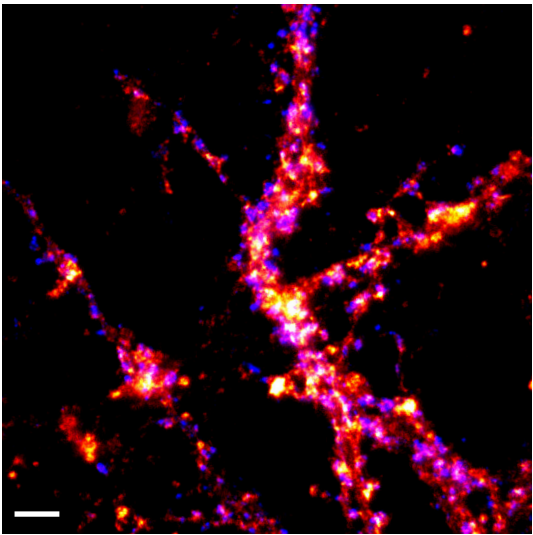
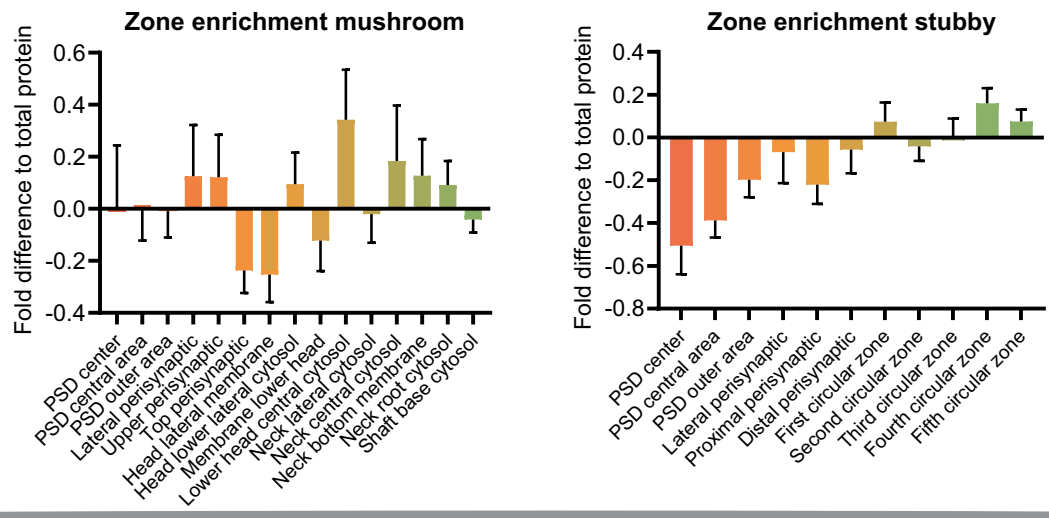
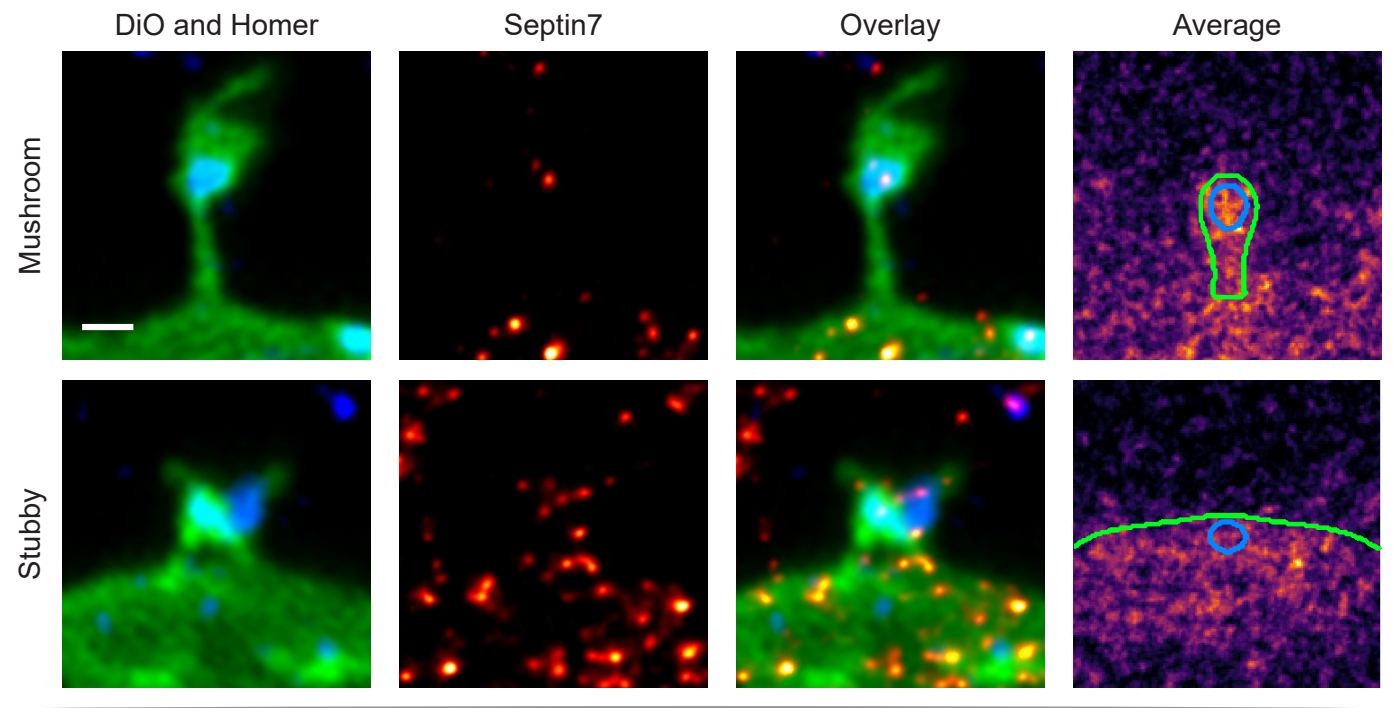
Zhang et al., 1999, Mol. Biol. Cell.

Septin7 (Gene: Sept7, Uniprot ID: Q9WVC0)

Known function: Restricts diffusion at spine neck, Regulates spine morphology, Stabilizes PSD95 in spines

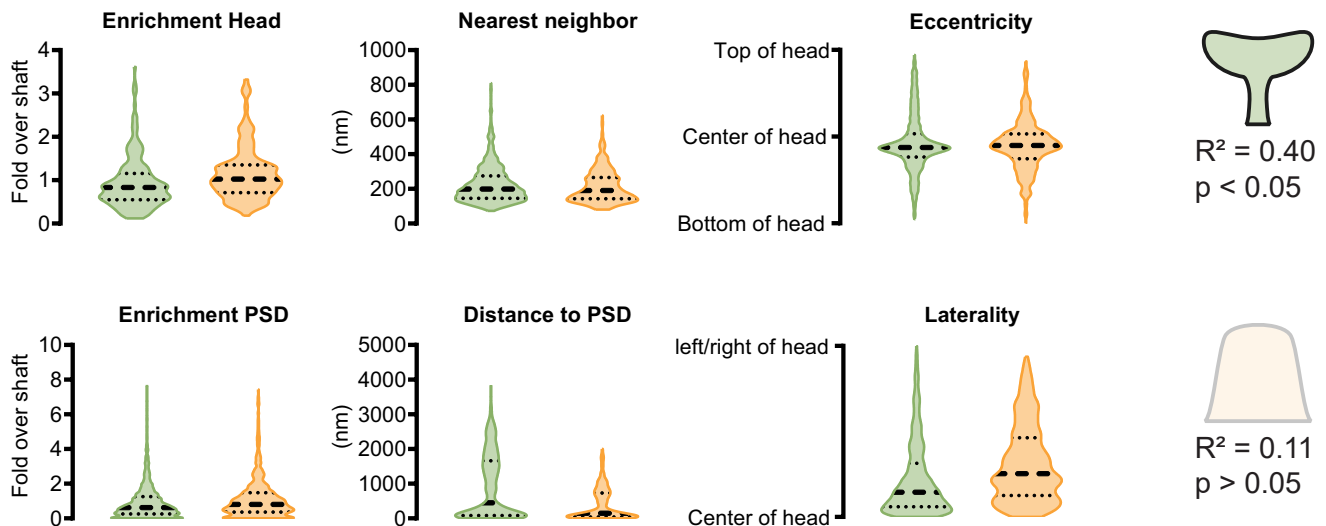
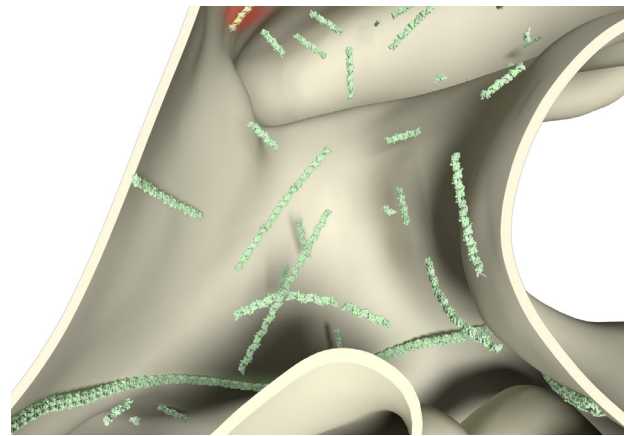
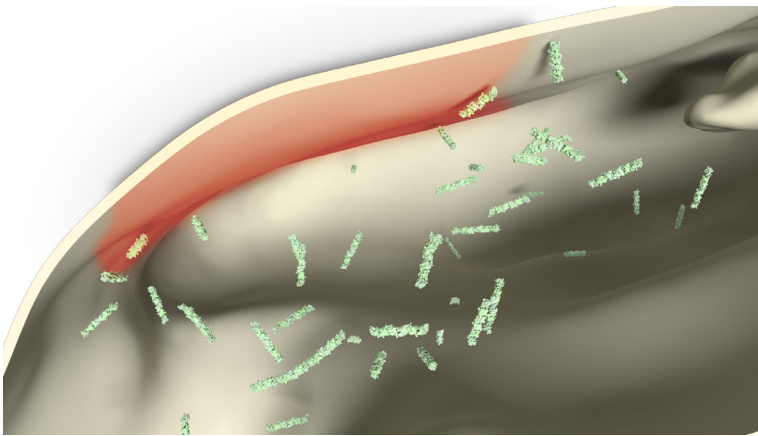
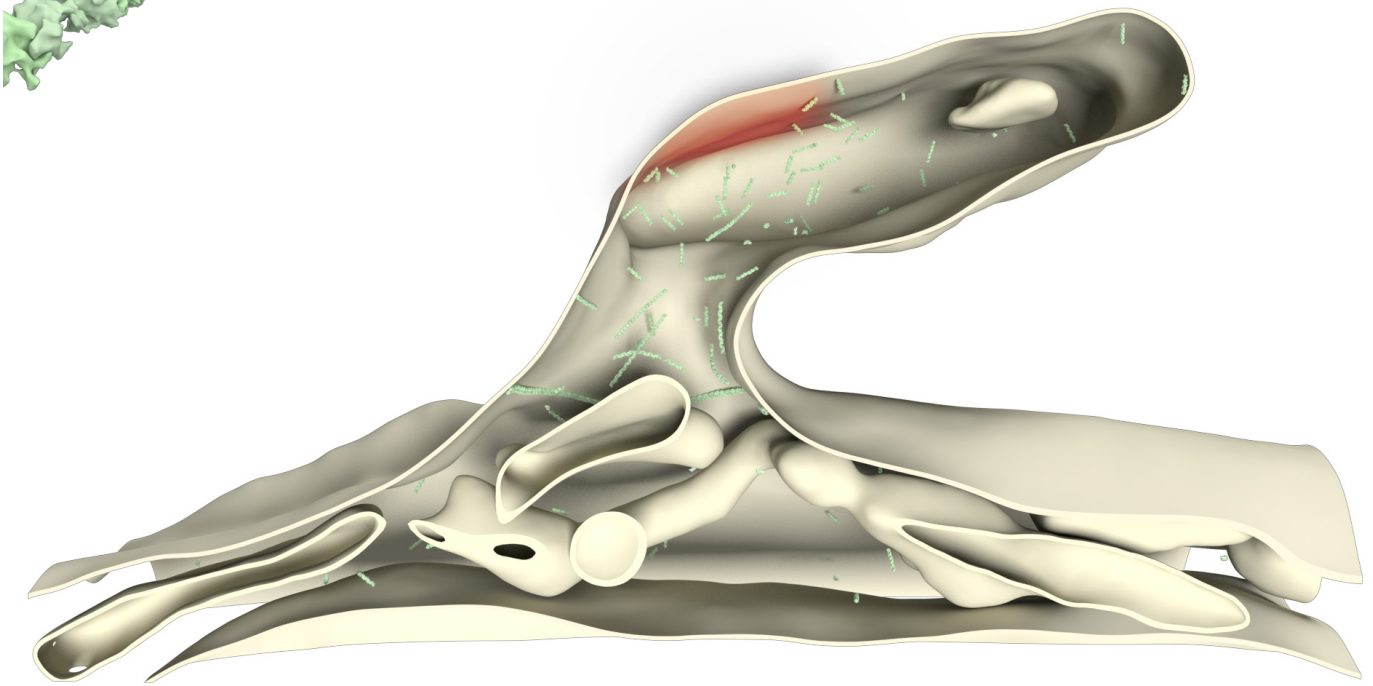
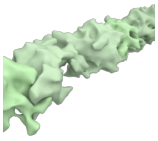
Known organization: Cytosolic, Forms arc or ring-like structures

Known Interactions: None

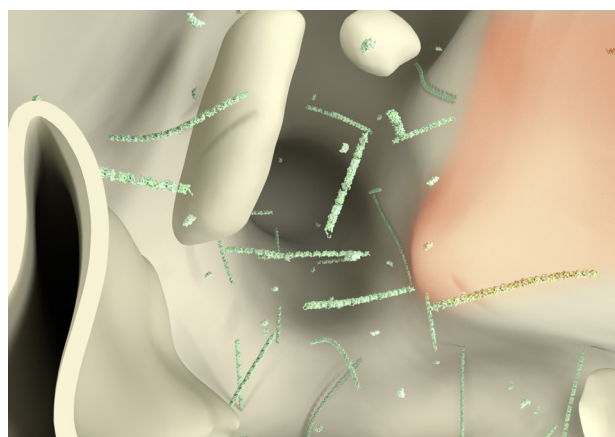
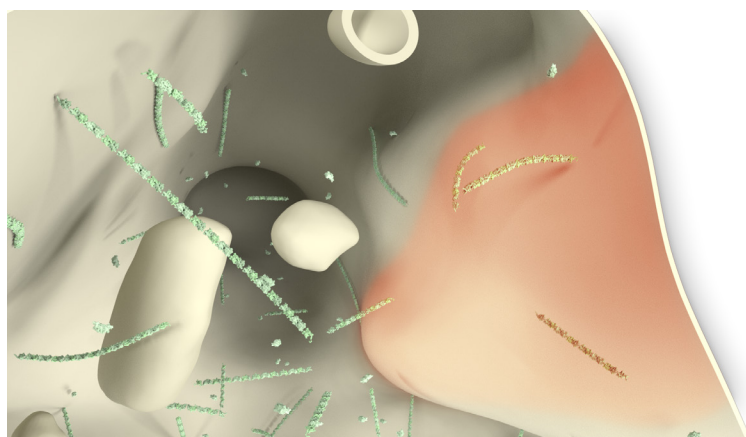
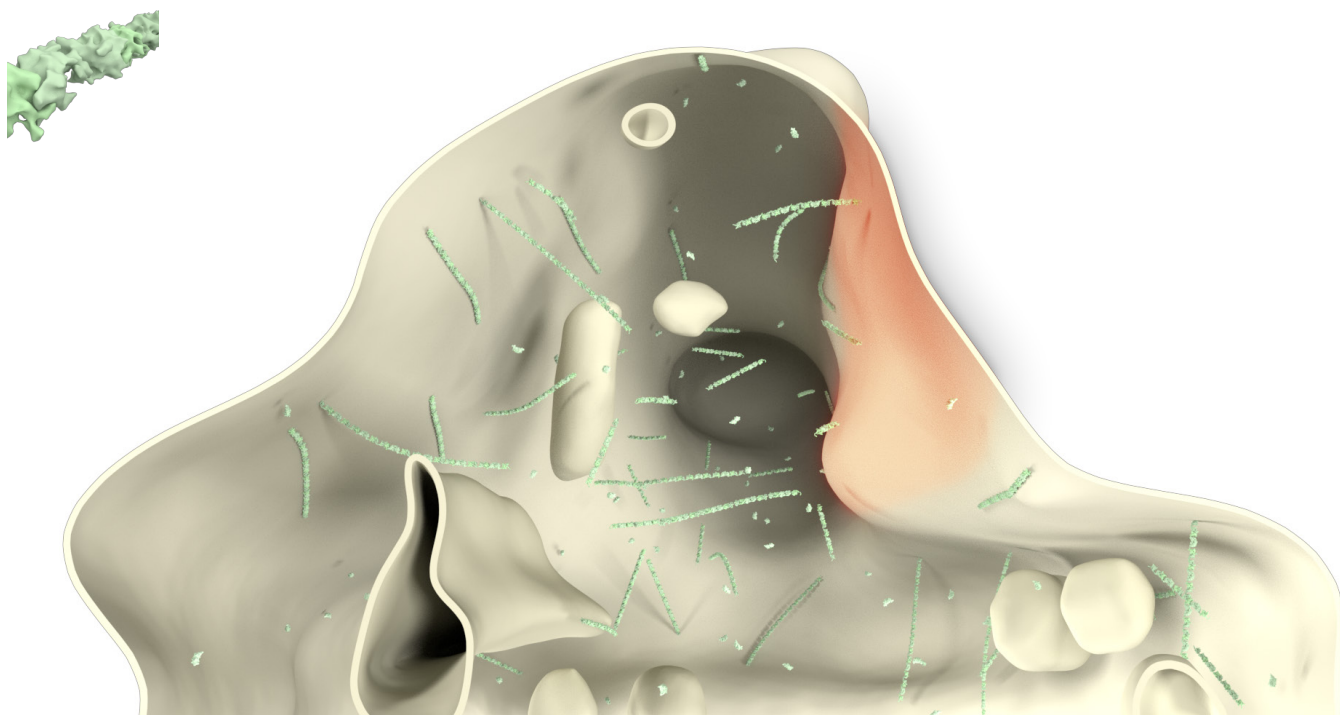


Whole cell copy number	4149665.7 ± 474108.6	
Spine copy number	838.2 ± 231.6	
Function	Cytoskeleton	
	Mushroom	Stubby
Spine copy number	666.1 ± 184.1	986.2 ± 272.6
% of total protein	0.2 ± 0.0%	0.2 ± 0.1%
Molarity (µM)	8.5 ± 2.3	9.3 ± 2.6
PSD copy number	109 ± 30.1	83 ± 22.9
% in PSD	16.4 ± 4.5%	8.4 ± 2.3%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	666.1 ± 184.1	$0.2 \pm 0.0\%$	8.5 ± 2.3	109 ± 30.1
Stubby	986.2 ± 272.6	$0.2 \pm 0.1\%$	9.3 ± 2.6	83 ± 22.9



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	666.1 ± 184.1	$0.2 \pm 0.0\%$	8.5 ± 2.3	109 ± 30.1
Stubby	986.2 ± 272.6	$0.2 \pm 0.1\%$	9.3 ± 2.6	83 ± 22.9



References

Antibody: Atlas Antibodies HPA029524

PDB Identifier: 2qag

Literature:

Brand et al., 2012, Mol. Cell. Biol.

Ewers et al., 2014, PLoS One

Kinoshita et al., 2002, Dev. Cell

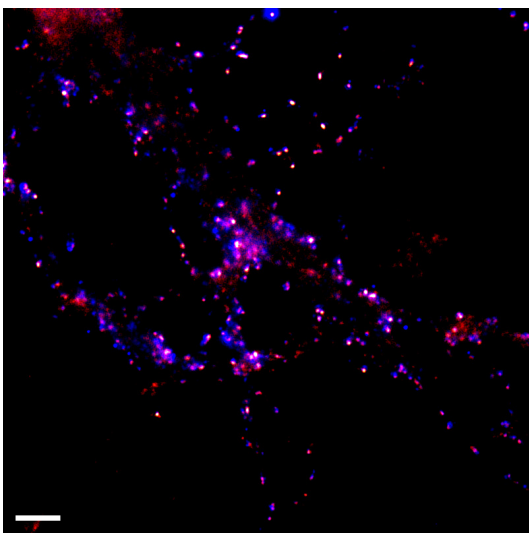
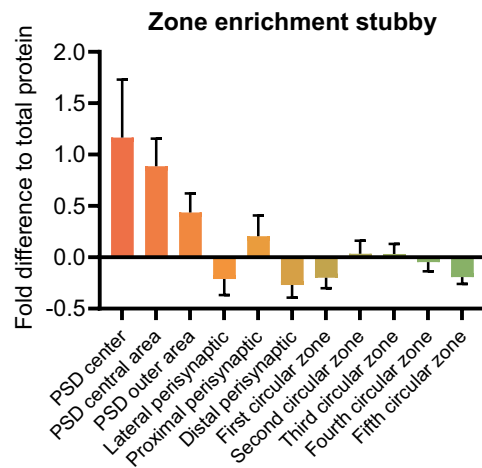
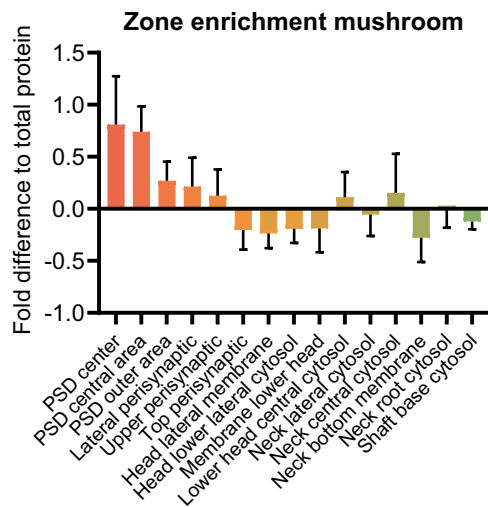
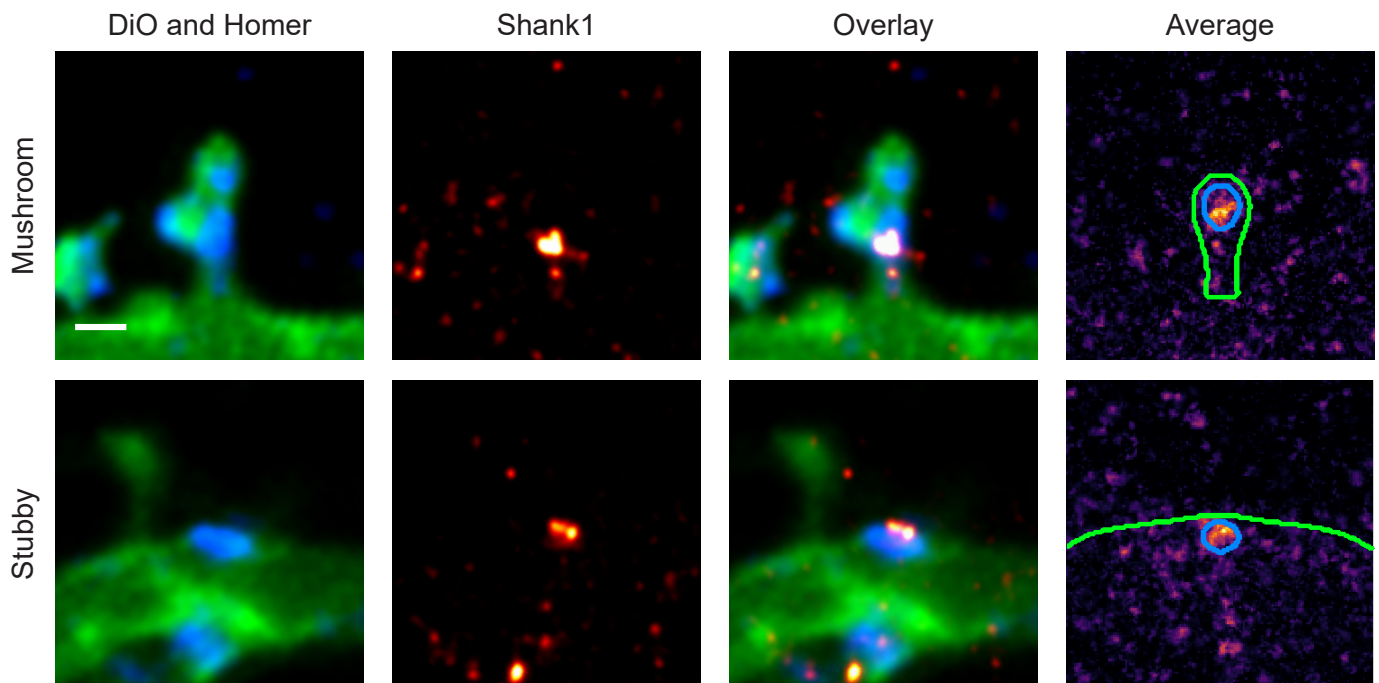
Yadav et al., 2017, Neuron

Shank1 (Synamon, Gene Shank1, Uniprot ID: Q9WV48)

Known function: Links the PSD to the cytoskeleton

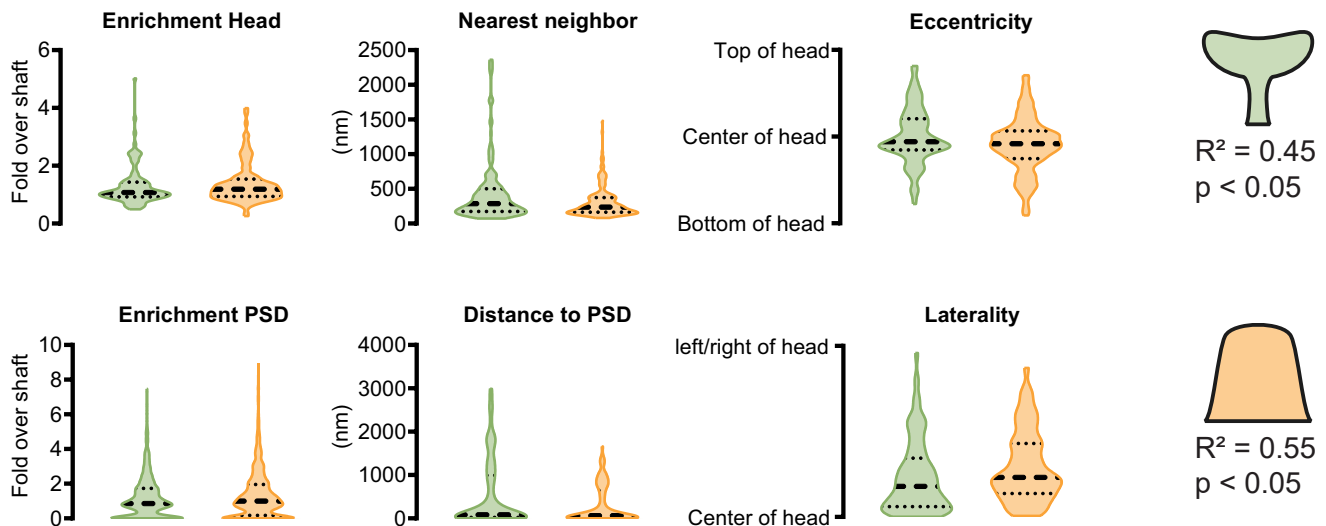
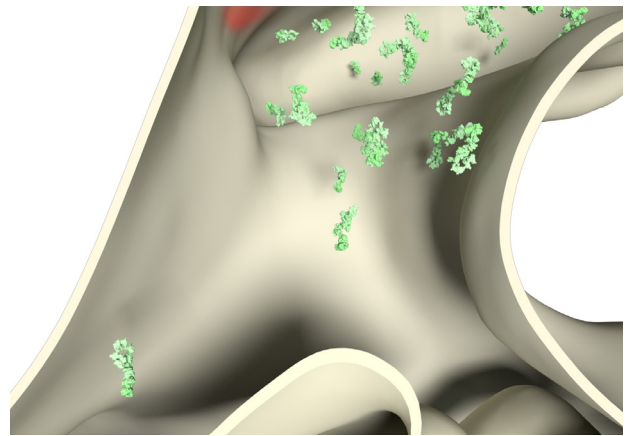
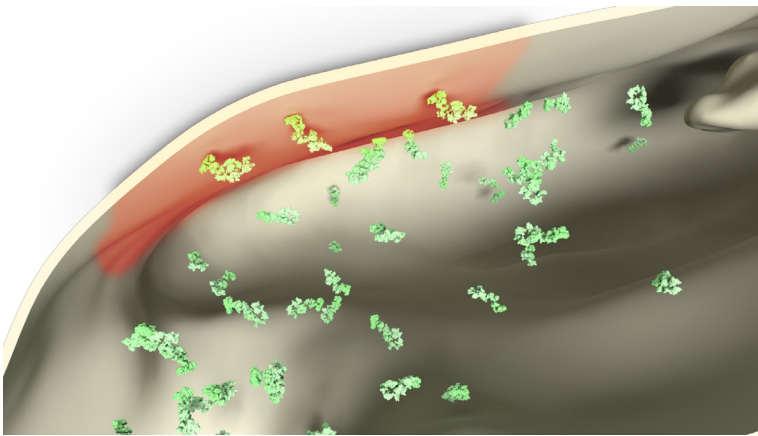
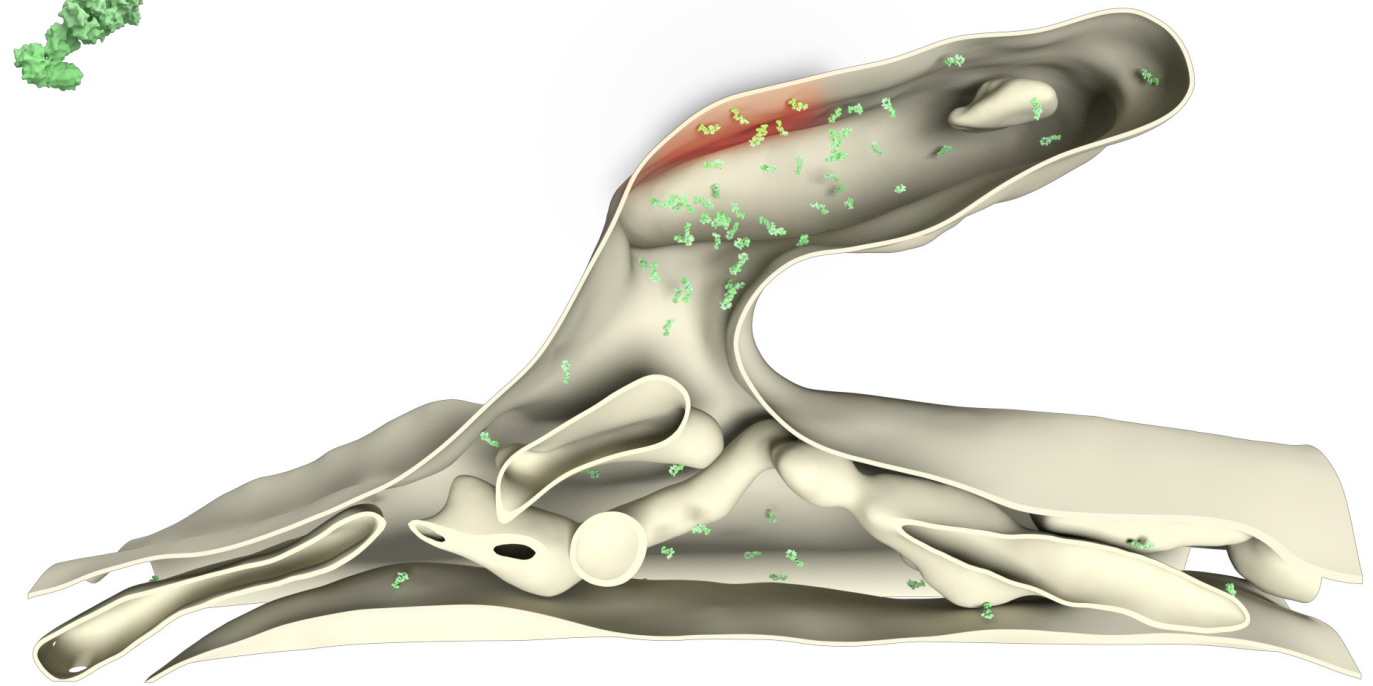
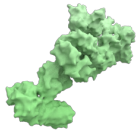
Known organization: Cytosolic, Selfmultimerizes, Forms mesh like structure with Homer proteins, Axially more distal to PSD than PSD95, Forms clusters

Known Interactions: Homer proteins, DLGAP1, GluR1

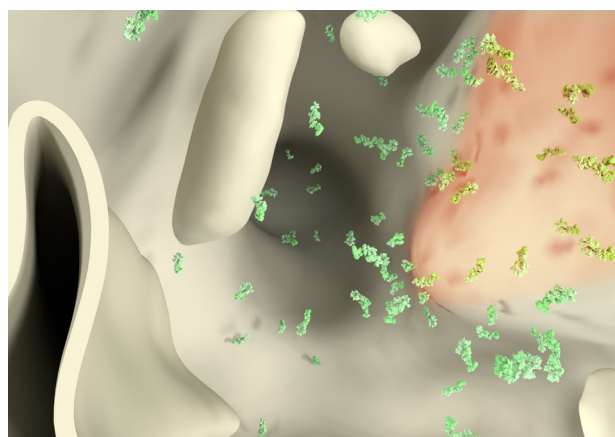
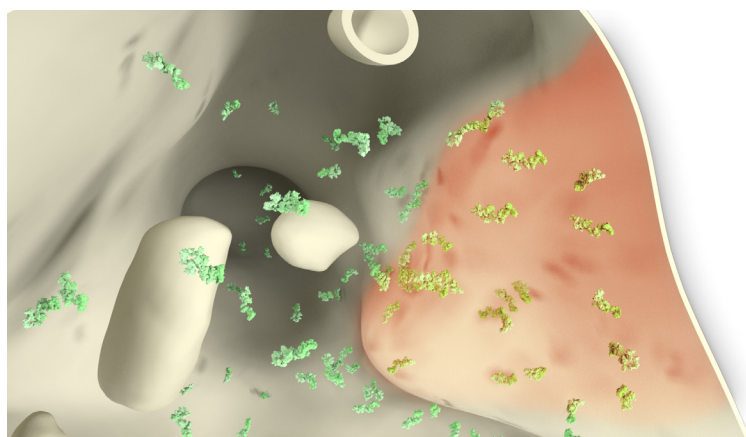
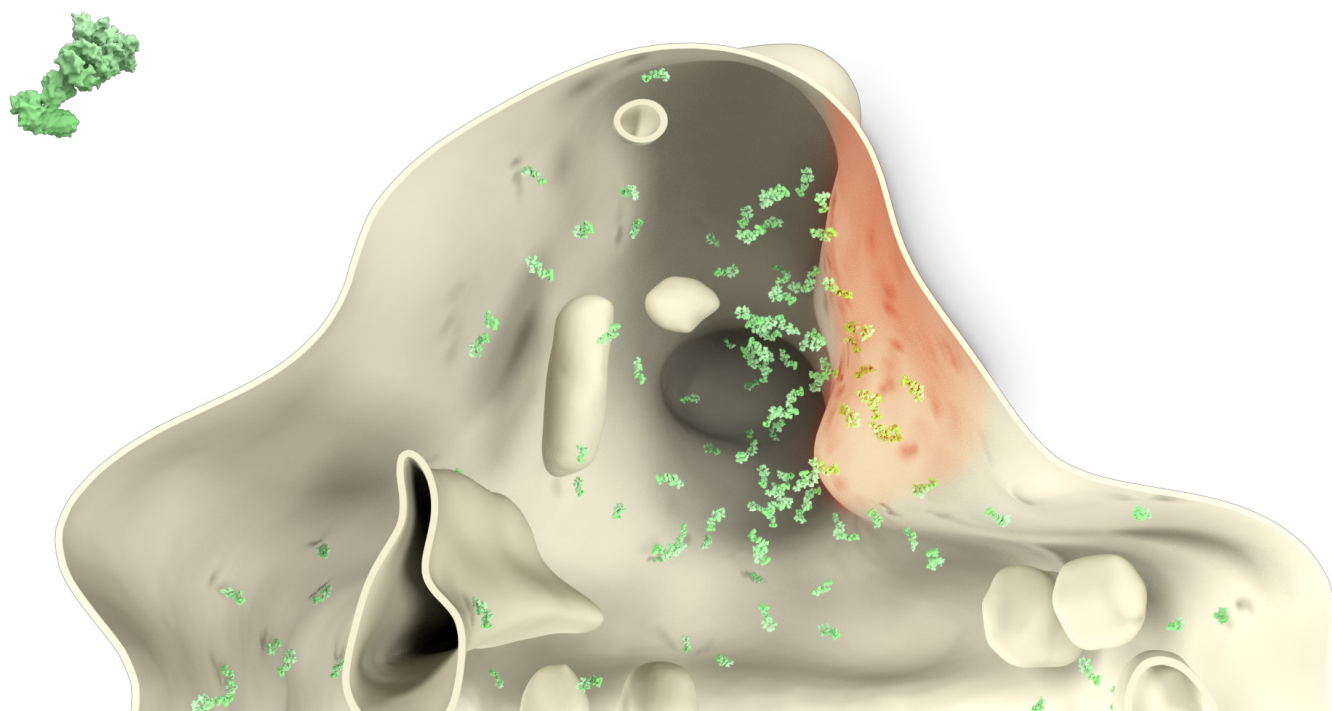


Whole cell copy number	923695.9 ± 190227.6 (extrapolated)	
Spine copy number	178.8 ± 27.1	
Function	PSD Scaffold	
	Mushroom	Stubby
Spine copy number	149.3 ± 22.6	214.5 ± 32.5
% of total protein	0.2 ± 0.0%	0.2 ± 0.0%
Molarity (μM)	1.9 ± 0.3	2.0 ± 0.3
PSD copy number	49 ± 7.4	80 ± 12.1
% in PSD	32.8 ± 5.0%	37.3 ± 5.7%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	149.3 ± 22.6	$0.2 \pm 0.0\%$	1.9 ± 0.3	49 ± 7.4
Stubby	214.5 ± 32.5	$0.2 \pm 0.0\%$	2.0 ± 0.3	80 ± 12.1



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	149.3 ± 22.6	$0.2 \pm 0.0\%$	1.9 ± 0.3	49 ± 7.4
Stubby	214.5 ± 32.5	$0.2 \pm 0.0\%$	2.0 ± 0.3	80 ± 12.1



References

Antibody: Synaptic Systems 162 013

PDB Identifier: 1q3o, 1wsx, 2f3n

Literature:

Boeckers et al., 1999b, Biochem. Biophys. Res. Commun.

Dani et al., 2010, Neuron

Hayashi et al., 2006, J. Neurosci.

Hayashi et al., 2009, Cell

MacGillavry et al., 2013, Neuron

Naisbitt et al., 1999, Neuron

Tao-Cheng et al., 2015, PLoS One

Tu et al., 1998, Neuron

Uchino et al., 2006, J. Neurochem.

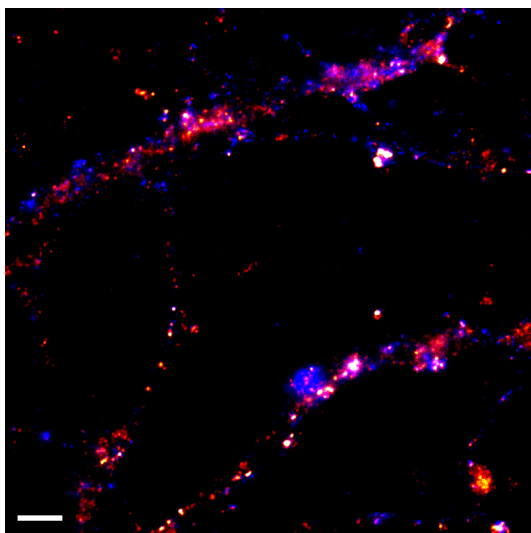
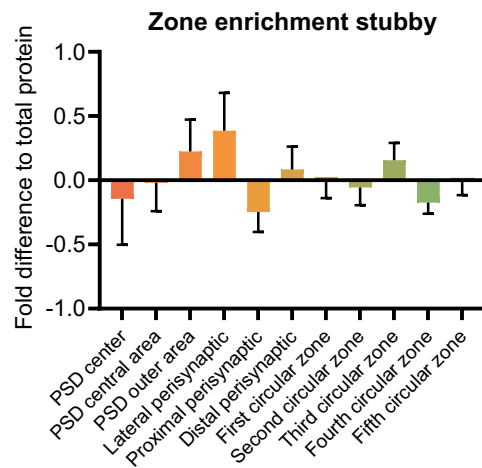
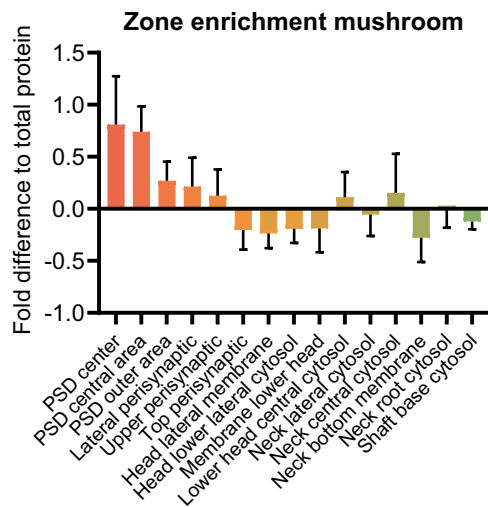
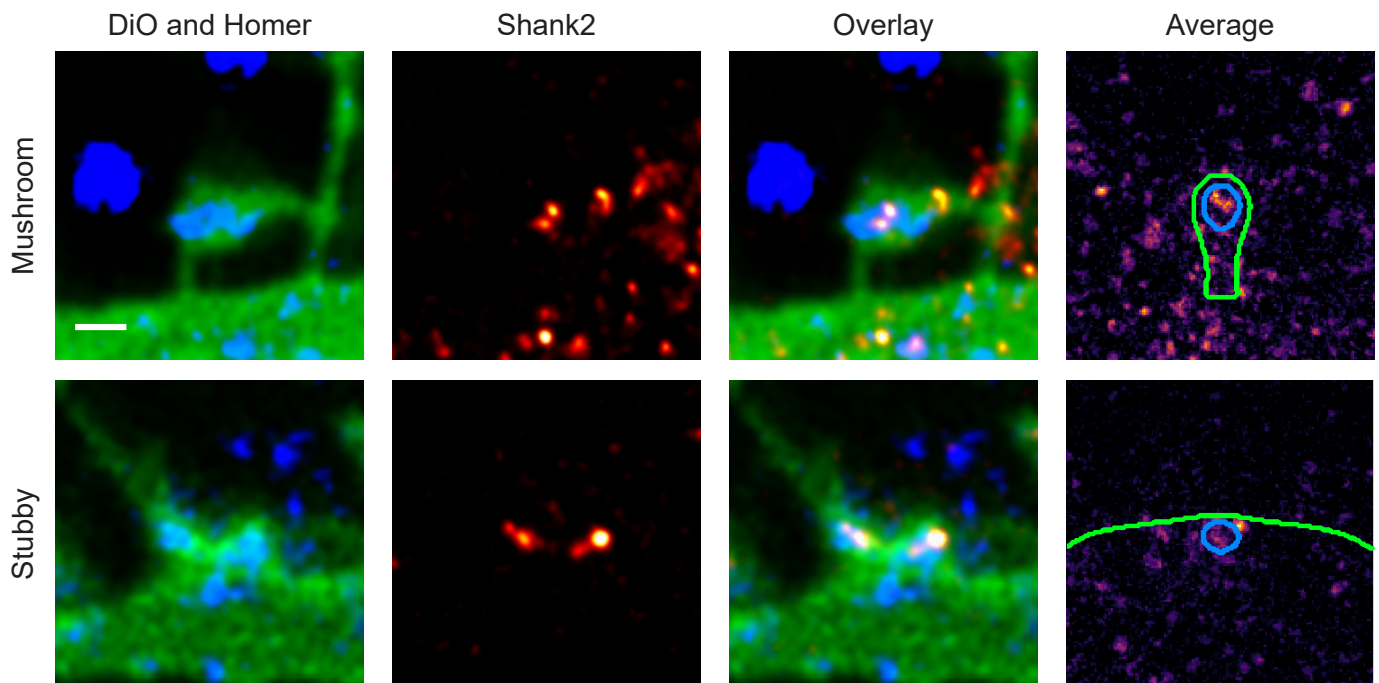
Valtschanoff and Weinberg, 2001, J. Neurosci.

Shank2 (ProSAP1, CortBP1, Gene: Shank2, Uniprot ID: Q9QX74)

Known function: Links the PSD to the cytoskeleton

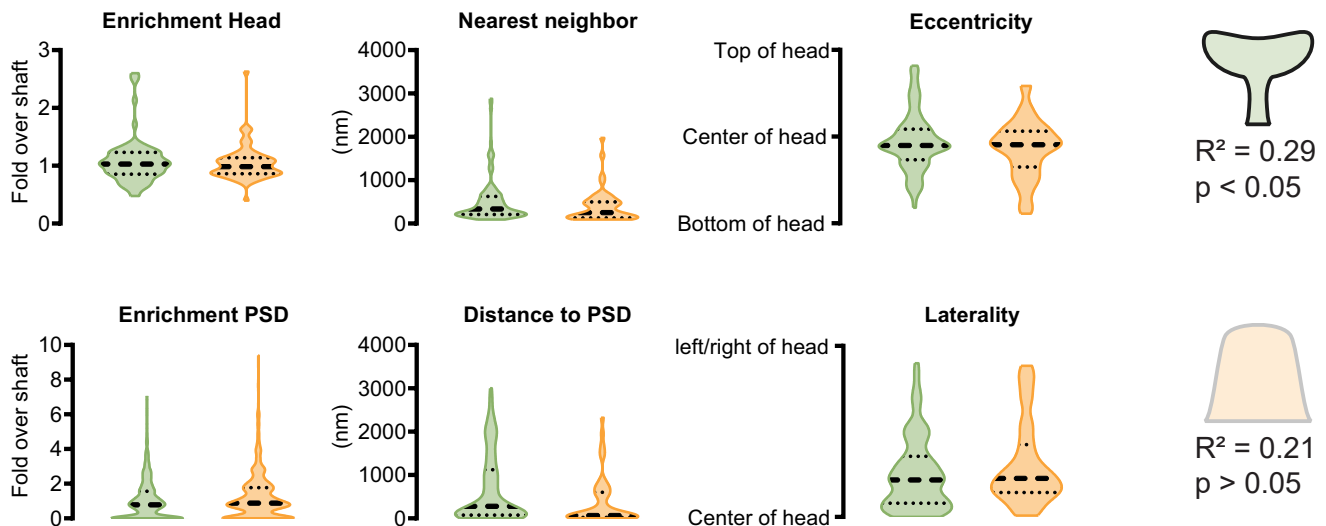
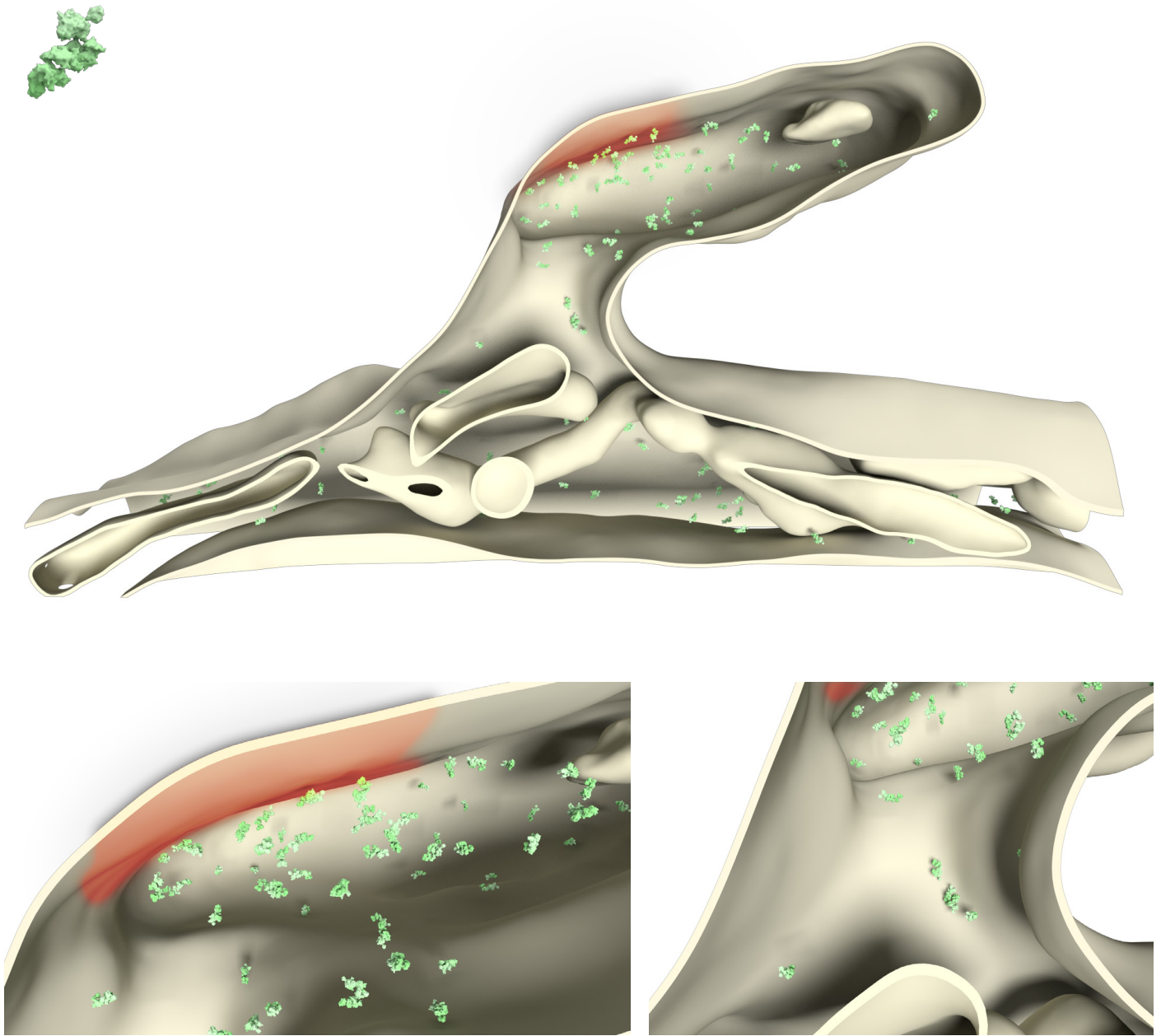
Known organization: Cytosolic, Selfmultimerizes, Forms mesh like structure with Homer proteins, Axially more distal to PSD than PSD95, Forms clusters

Known Interactions: Homer proteins, DLGAP1, Cortactin, GluR1

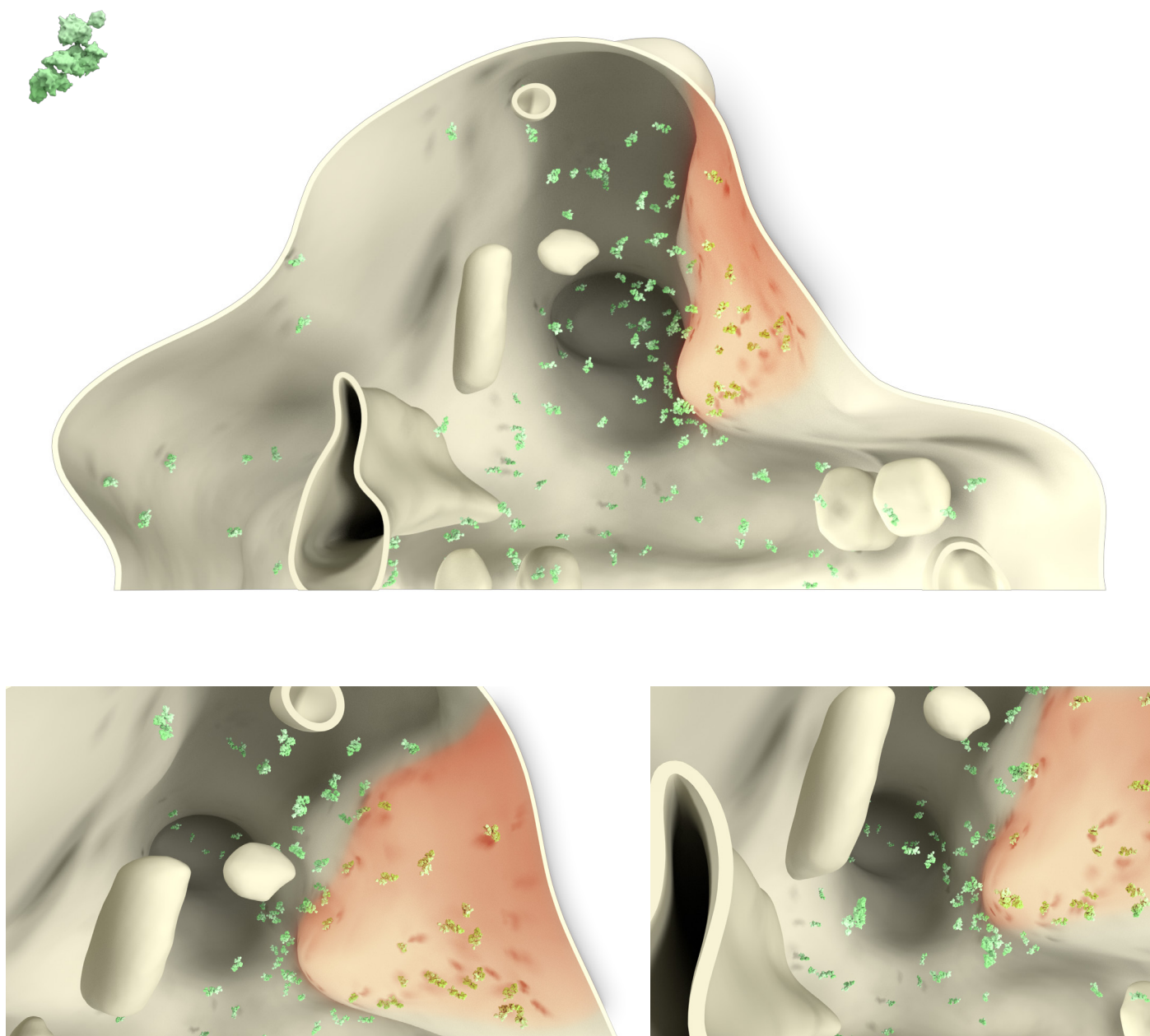


Whole cell copy number	10834453.7 ± 7438062.5 (extrapolated)	
Spine copy number	238.1 ± 79.9	
Function	PSD Scaffold	
	Mushroom	Stubby
Spine copy number	255.0 ± 85.6	231.6 ± 77.7
% of total protein	0.2 ± 0.1%	0.2 ± 0.1%
Molarity (μM)	3.2 ± 1.1	2.2 ± 0.7
PSD copy number	50 ± 16.8	61 ± 20.5
% in PSD	19.6 ± 6.6%	26.3 ± 8.8%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	255.0 ± 85.6	$0.2 \pm 0.1\%$	3.2 ± 1.1	50 ± 16.8
Stubby	231.6 ± 77.7	$0.2 \pm 0.1\%$	2.2 ± 0.7	61 ± 20.5



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	255.0 ± 85.6	$0.2 \pm 0.1\%$	3.2 ± 1.1	50 ± 16.8
Stubby	231.6 ± 77.7	$0.2 \pm 0.1\%$	2.2 ± 0.7	61 ± 20.5



References

Antibody: Synaptic Systems 162 202

PDB Identifier: modified Shank1

Literature:

Boeckers et al., 1999b, Biochem. Biophys. Res. Commun.

Dani et al., 2010, Neuron

Du et al., 1998, Mol. Cell. Biol.

Hayashi et al., 2006, J. Neurosci.

Hayashi et al., 2009, Cell

MacGillavry et al., 2013, Neuron

Naisbitt et al., 1999, Neuron

Tao-Cheng et al., 2015, PLoS One

Tu et al., 1998, Neuron

Uchino et al., 2006, J. Neurochem.

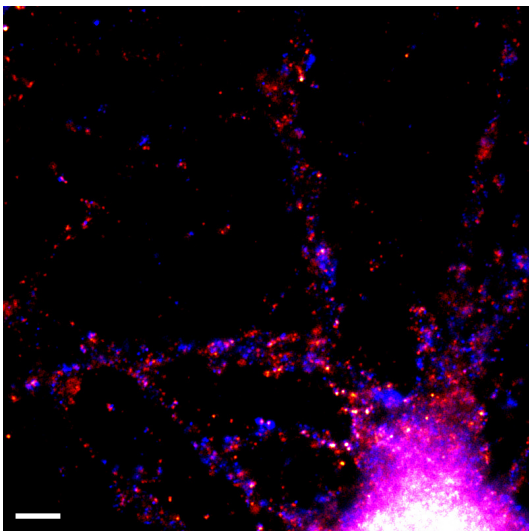
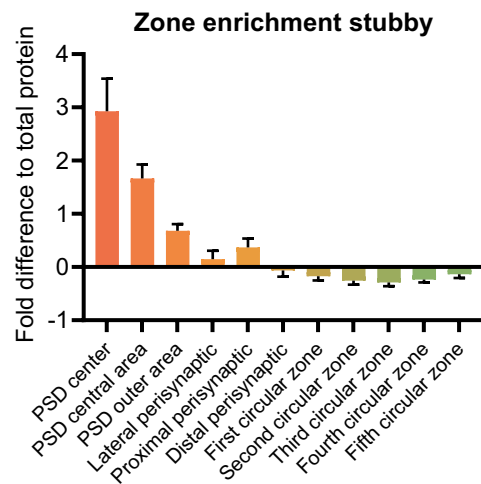
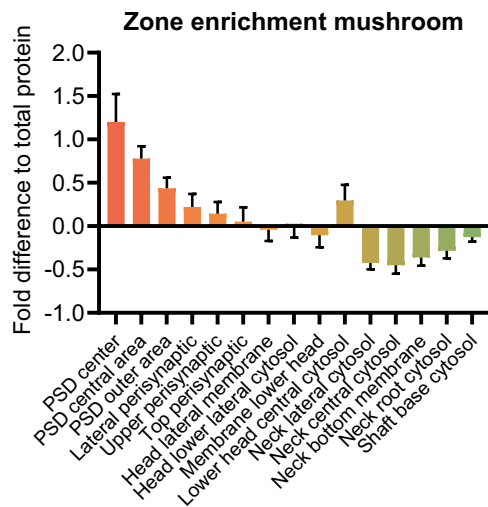
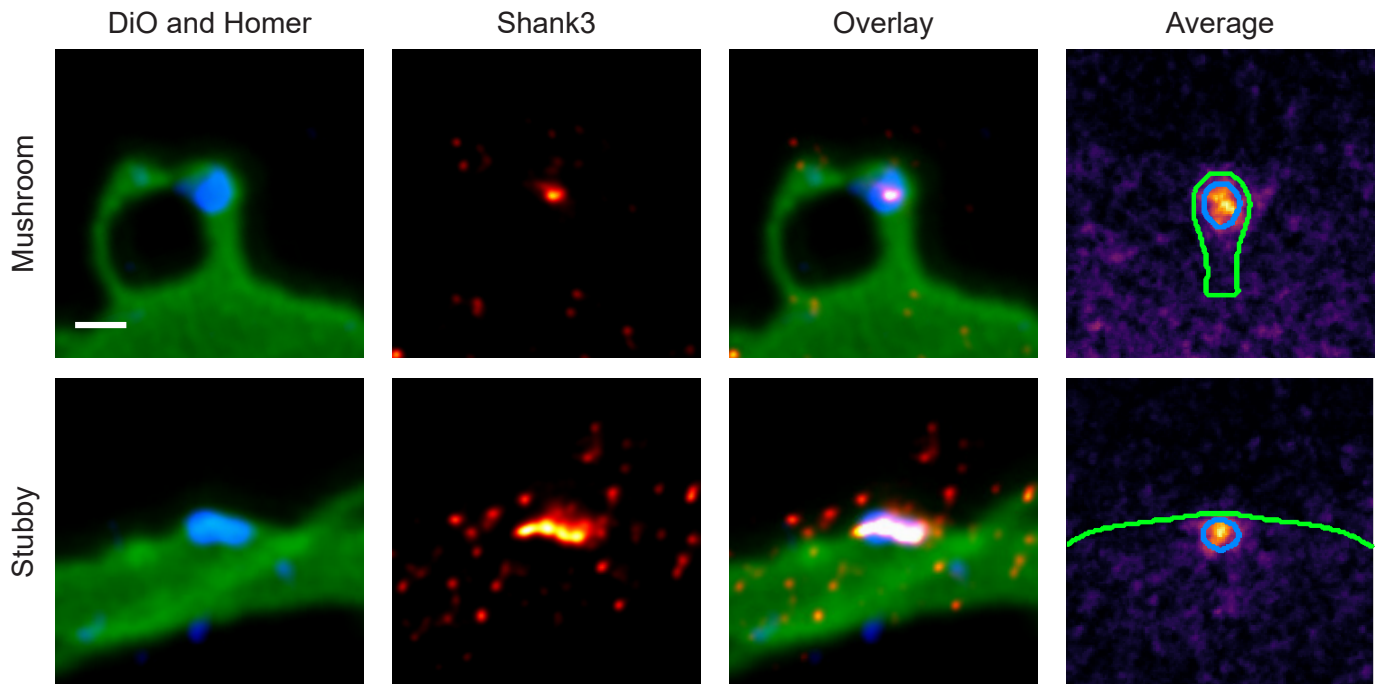
Valtschanoff and Weinberg, 2001, J. Neurosci.

Shank3 (ProSAP2 Gene: Shank2, Uniprot ID: Q9JLU4)

Known function: Links the PSD to the cytoskeleton

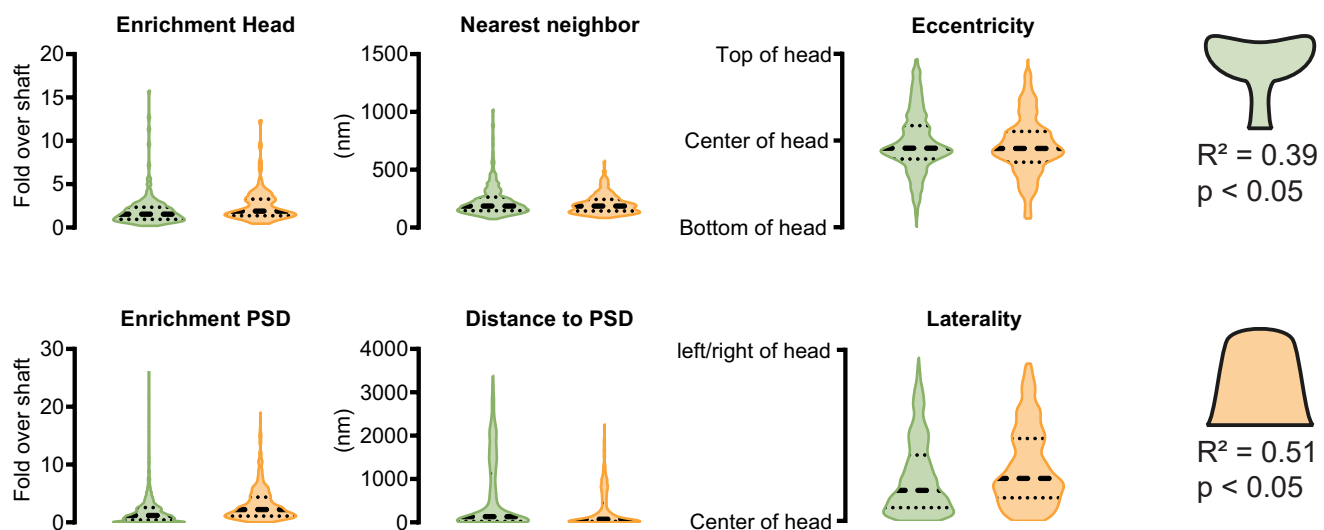
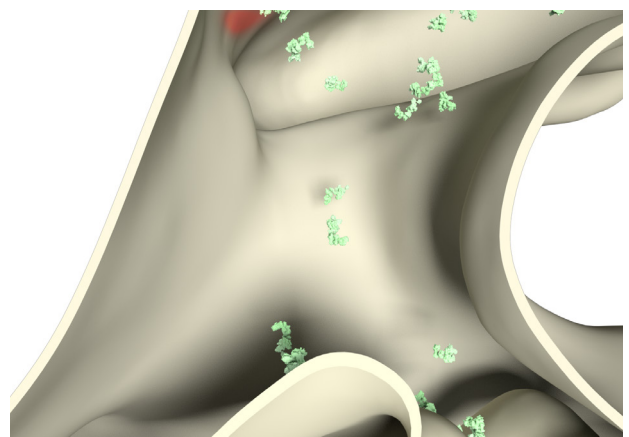
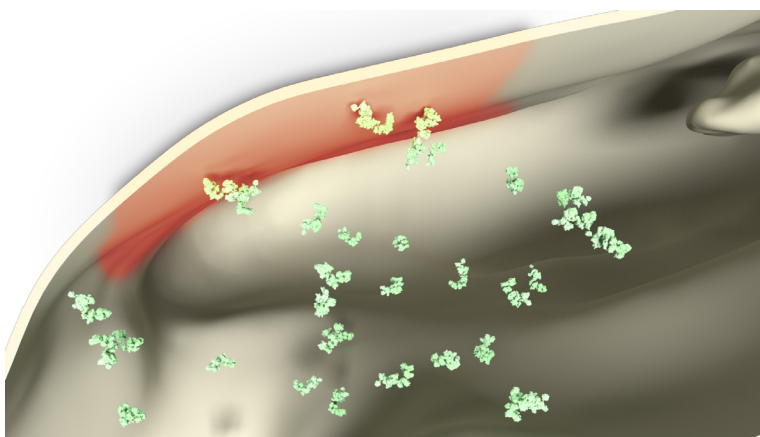
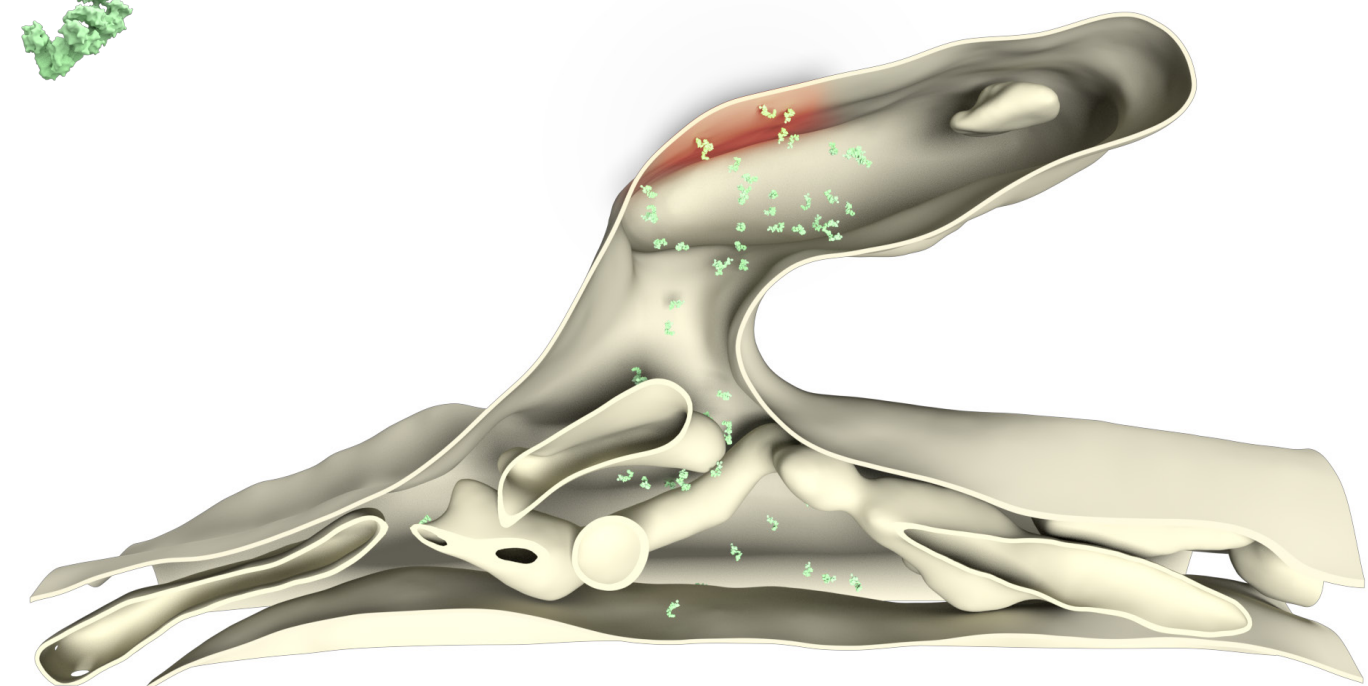
Known organization: Cytosolic, Selfmultimerizes, Forms mesh like structure with Homer proteins, Axially more distal to PSD than PSD95, Forms clusters

Known Interactions: Homer proteins, DLGAP1, Cortactin, GluR1

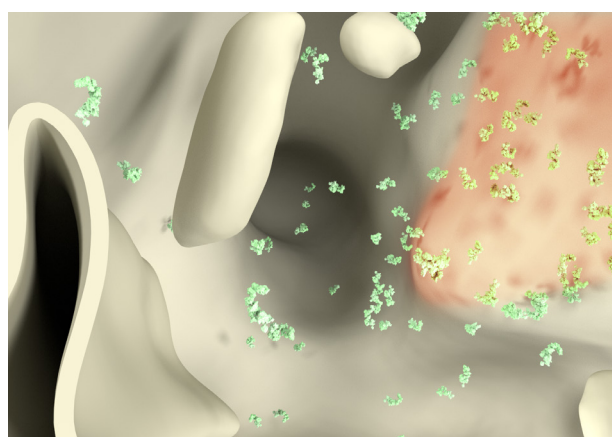
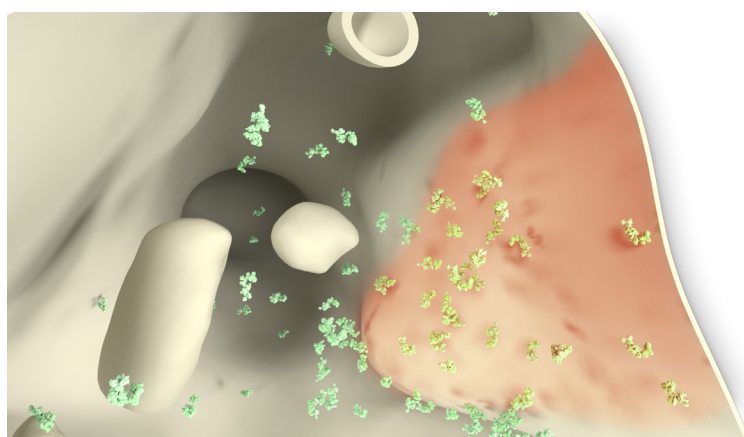
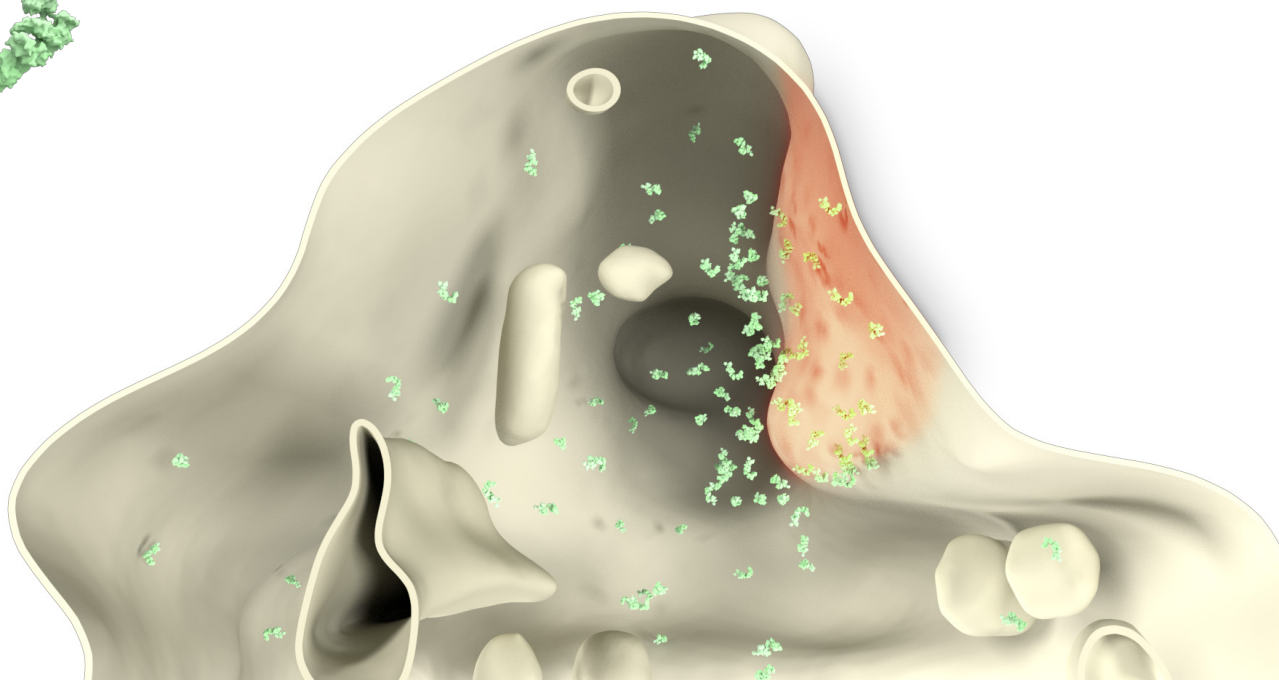
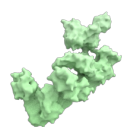


Whole cell copy number	283141.9 ± 49736.9 (extrapolated)	
Spine copy number	124.4 ± 20.1	
Function	PSD Scaffold	
	Mushroom	Stubby
Spine copy number	95.8 ± 15.5	173.8 ± 28.1
% of total protein	0.1 ± 0.0%	0.1 ± 0.0%
Molarity (μM)	1.2 ± 0.2	1.6 ± 0.3
PSD copy number	51 ± 8.2	105 ± 17.0
% in PSD	53.2 ± 8.6%	60.4 ± 9.8%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	95.8 \pm 15.5	0.1 \pm 0.0%	1.2 \pm 0.2	51 \pm 8.2
Stubby	173.8 \pm 28.1	0.1 \pm 0.0%	1.6 \pm 0.3	105 \pm 17.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	95.8 ± 15.5	$0.1 \pm 0.0\%$	1.2 ± 0.2	51 ± 8.2
Stubby	173.8 ± 28.1	$0.1 \pm 0.0\%$	1.6 ± 0.3	105 ± 17.0



References

Antibody: Synaptic Systems 162 302

PDB Identifier: 5q4x

Literature:

Boeckers et al., 1999b, Biochem. Biophys. Res. Commun.

Dani et al., 2010, Neuron

Du et al., 1998, Mol. Cell. Biol.

Hayashi et al., 2006, J. Neurosci.

Hayashi et al., 2009, Cell

MacGillavry et al., 2013, Neuron

Naisbitt et al., 1999, Neuron

Tao-Cheng et al., 2015, PLoS One

Tu et al., 1998, Neuron

Uchino et al., 2006, J. Neurochem.

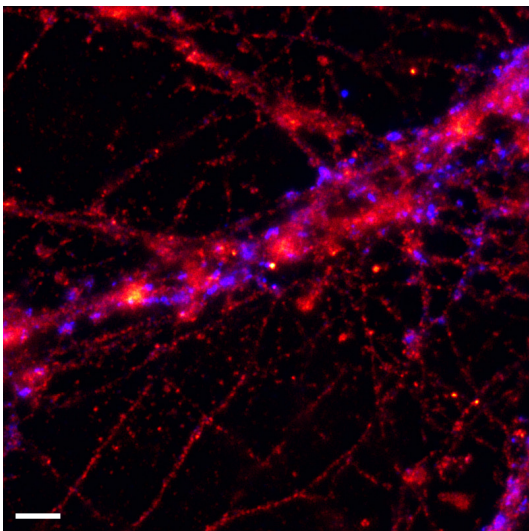
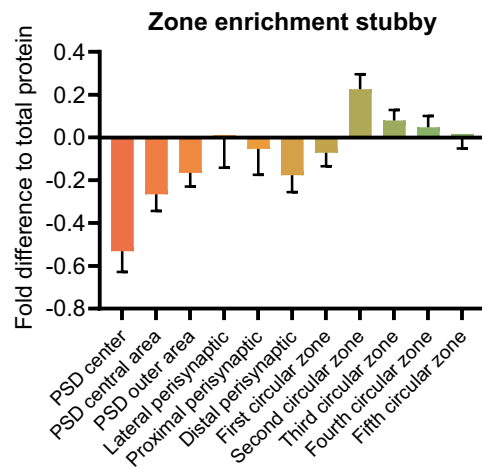
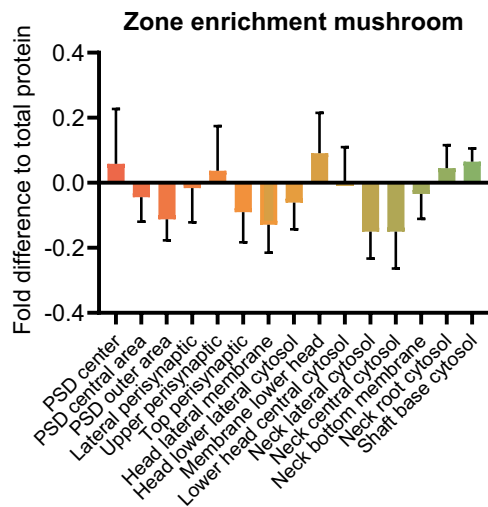
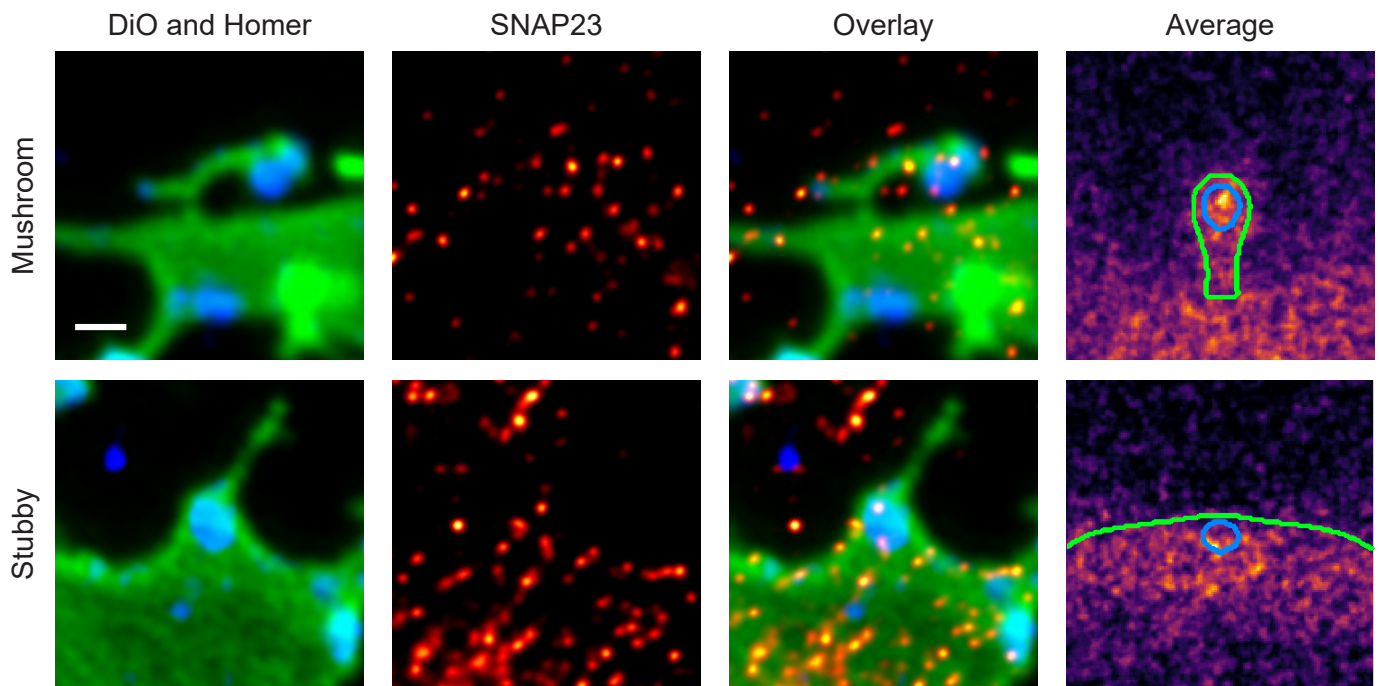
Valtschanoff and Weinberg, 2001, J. Neurosci.

SNAP23 (Gene: Snap23, Uniprot ID: O70377)

Known function: Qbc SNARE, Lysosome and granule secretion, Asynchronous SV release, Delivery of NMDAR to PM

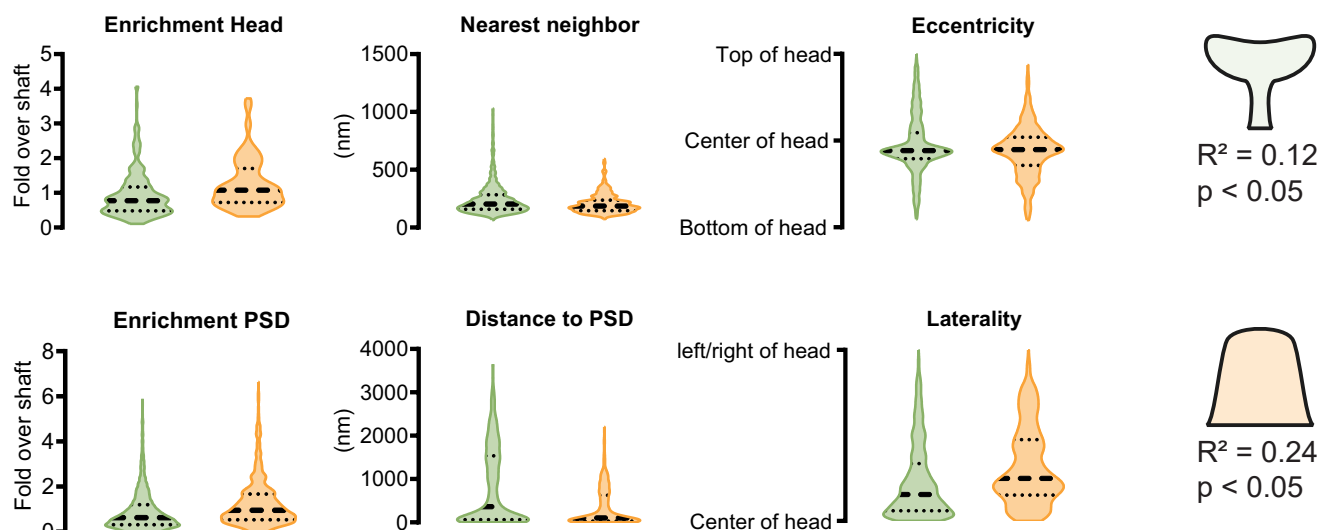
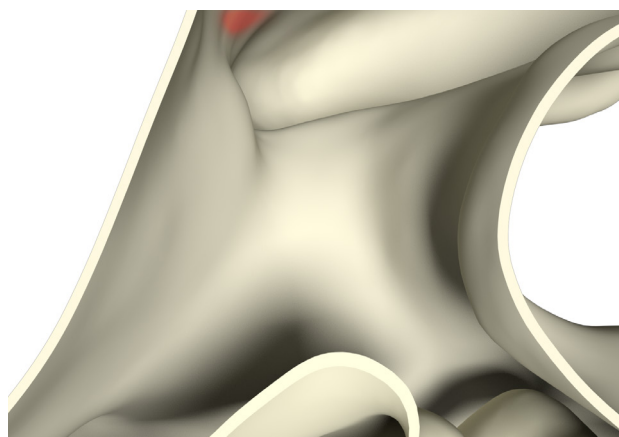
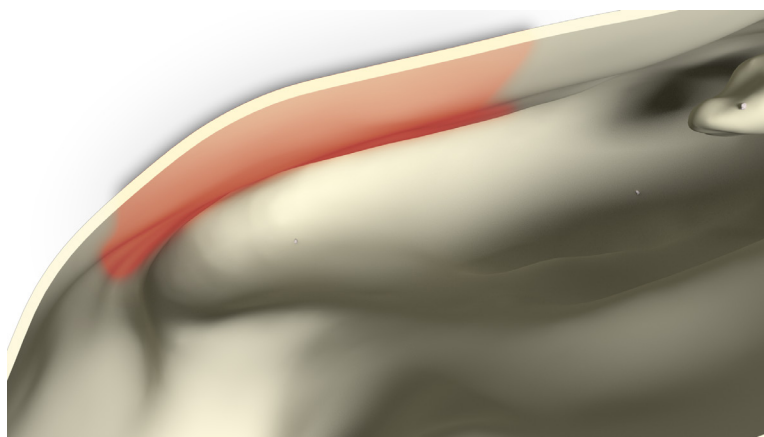
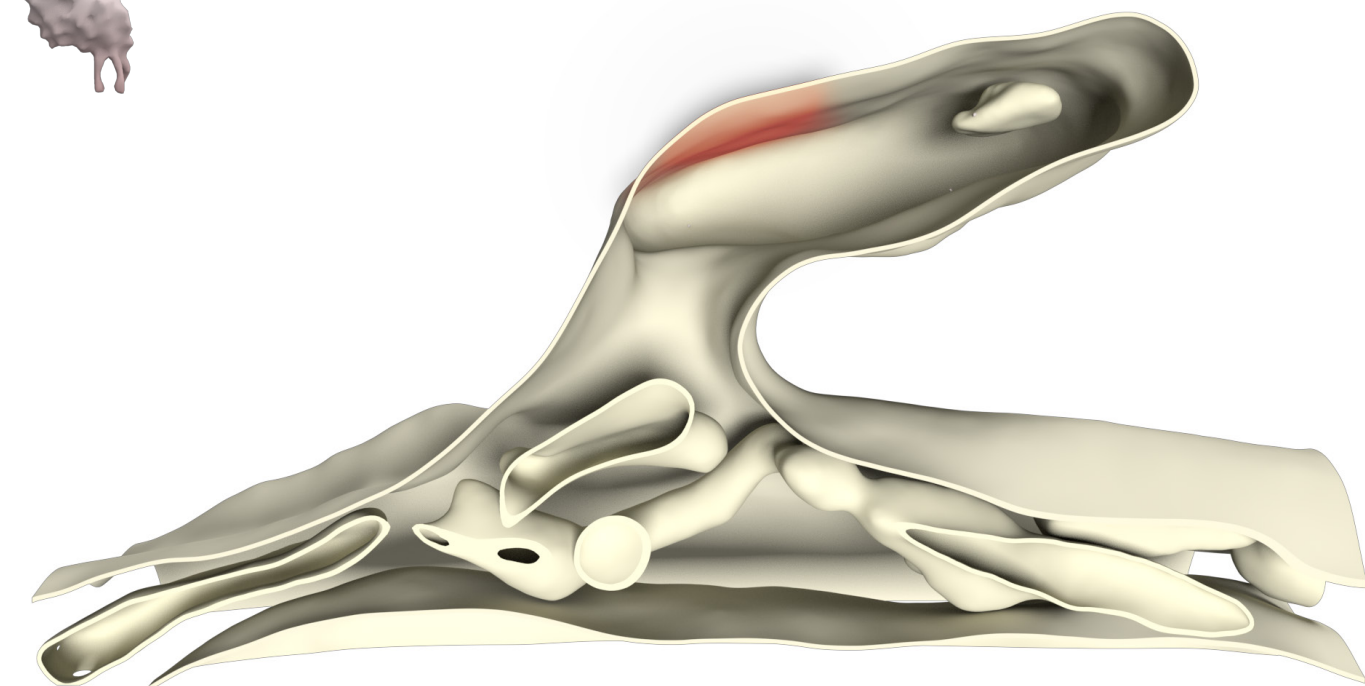
Known organization: Membrane associated, On PM, Enriched in spines, Perisynaptic

Known Interactions: Syntaxin2, Syntaxin4, VAMP2, VAMP7, Synaptotagmin 7

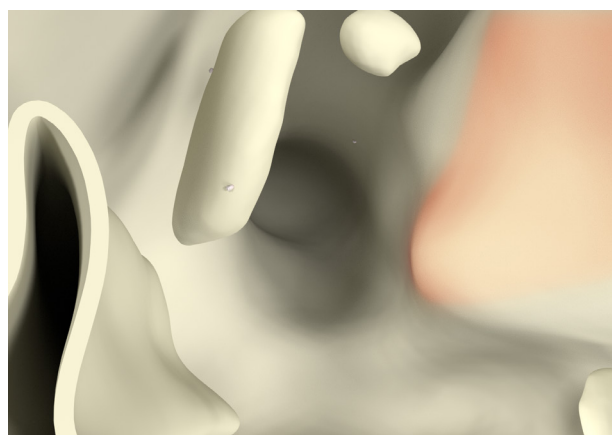
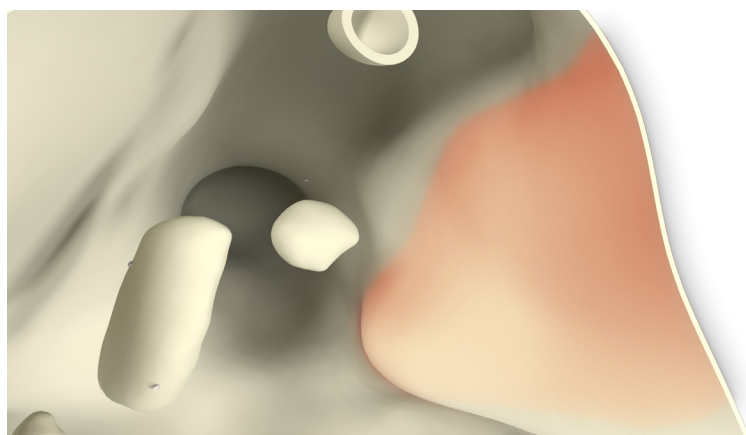
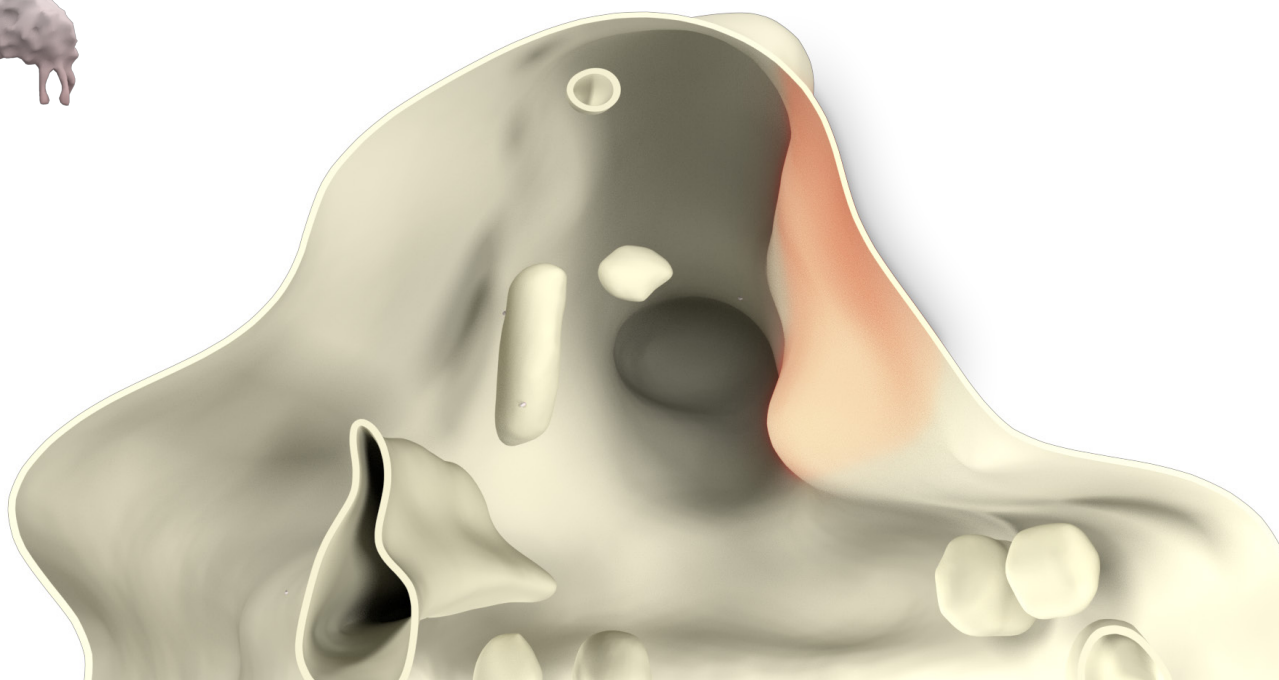


Whole cell copy number	22632.7 (detected in only 1 replicate)	
Spine copy number	6 ± 0.9	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	4.9 ± 0.7	7.7 ± 1.2
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.1 ± 0.0	0.1 ± 0.0
PSD copy number	1 ± 0.0	0 ± 0.0
% in PSD	20.5 ± 0.0%	0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	4.9 ± 0.7	$0.0 \pm 0.0\%$	0.1 ± 0.0	$20.5 \pm 0.0\%$
Stubby	7.7 ± 1.2	$0.0 \pm 0.0\%$	0.1 ± 0.0	$0 \pm 0.0\%$



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	4.9 ± 0.7	$0.0 \pm 0.0\%$	0.1 ± 0.0	$20.5 \pm 0.0\%$
Stubby	7.7 ± 1.2	$0.0 \pm 0.0\%$	0.1 ± 0.0	$0 \pm 0.0\%$



References

Antibody: Synaptic Systems 111 202

PDB Identifier: modified SNAP25

Literature:

Flaumenhaft et al., 1999, J. Biol. Chem.

Rao et al., 2004, J. Biol. Chem.

Suh et al., 2010, Na. Neurosci.

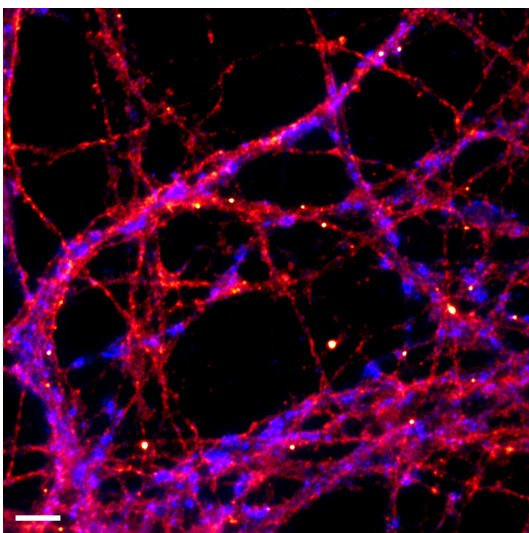
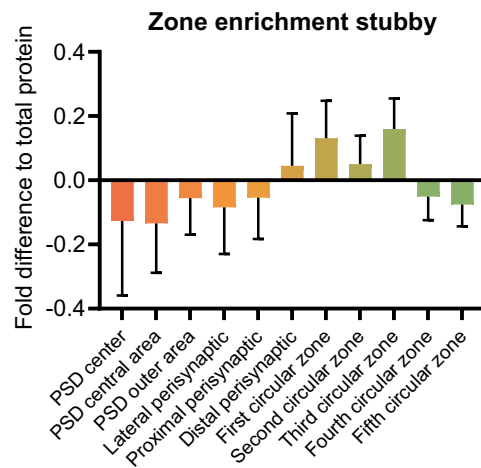
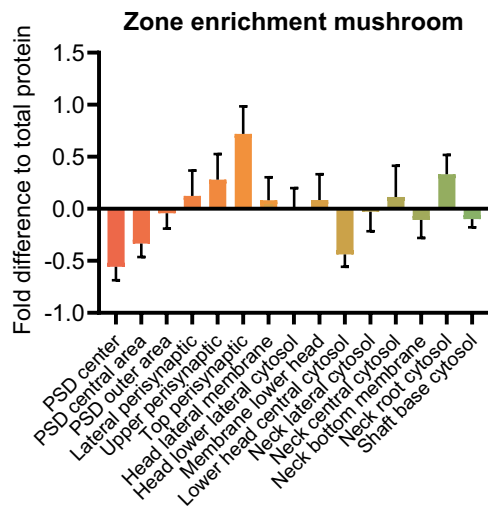
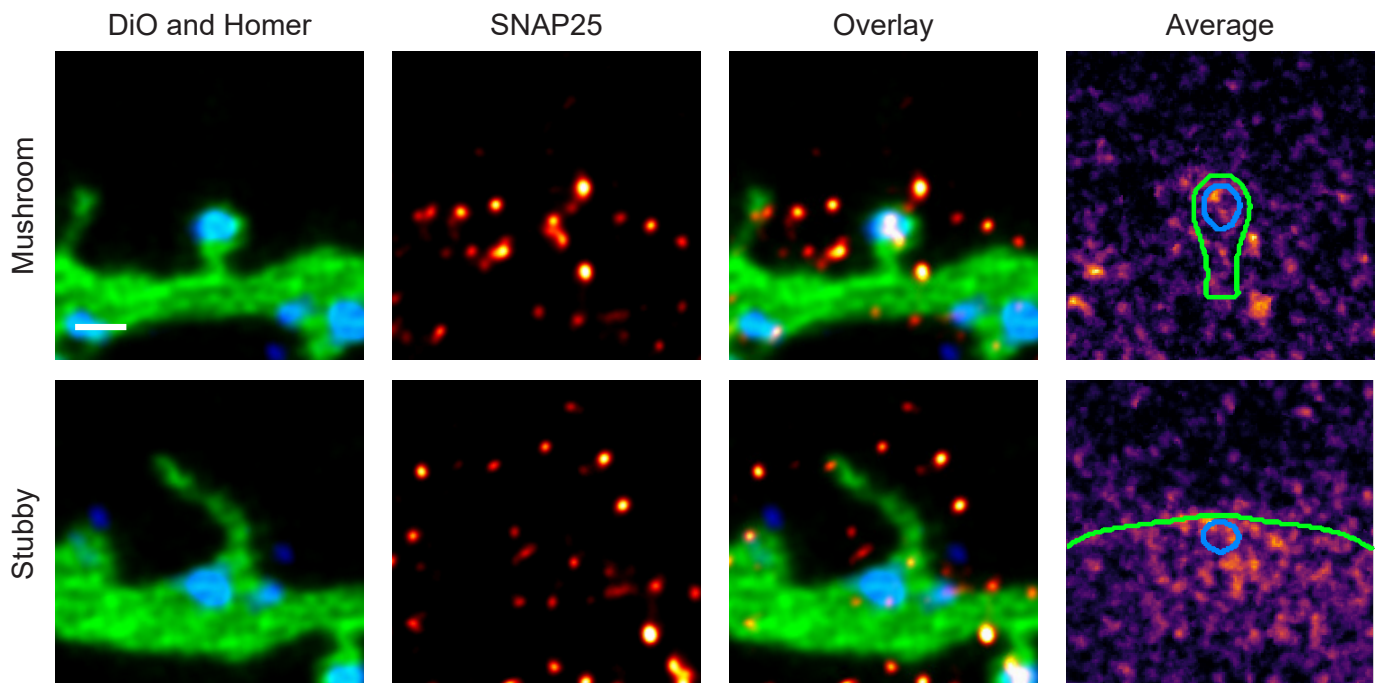
Weber et al., 2014, PLoS One

SNAP25 (Gene: Snap25 , Uniprot ID: P60881)

Known function: Qbc SNARE, SV release, regulates PSD95 mobility, Delivery of AMPAR and NMDAR to PM

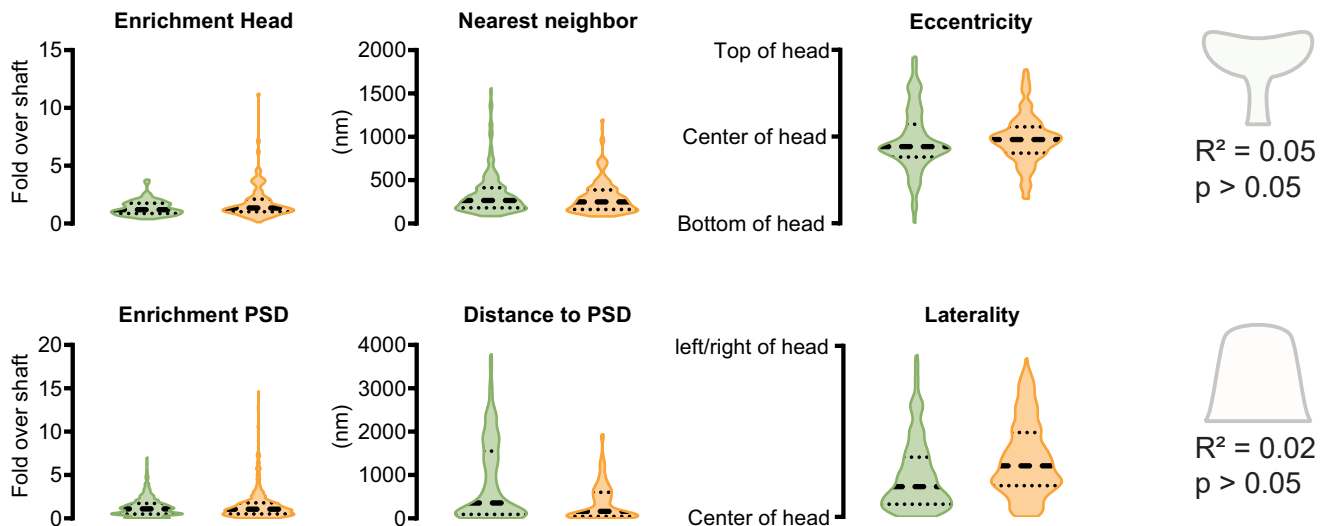
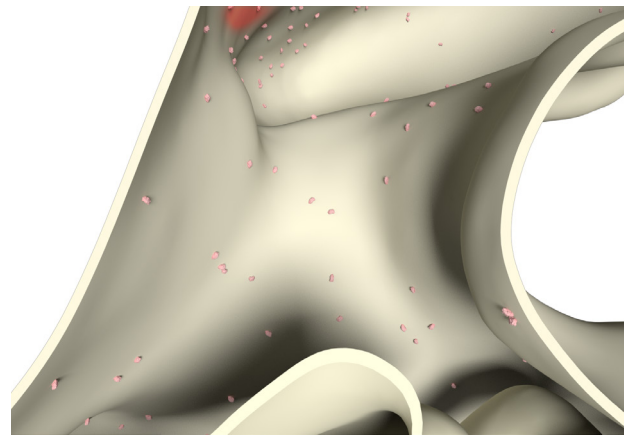
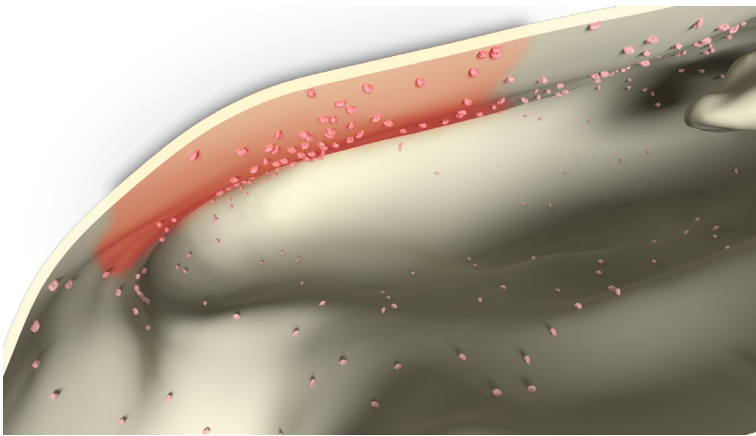
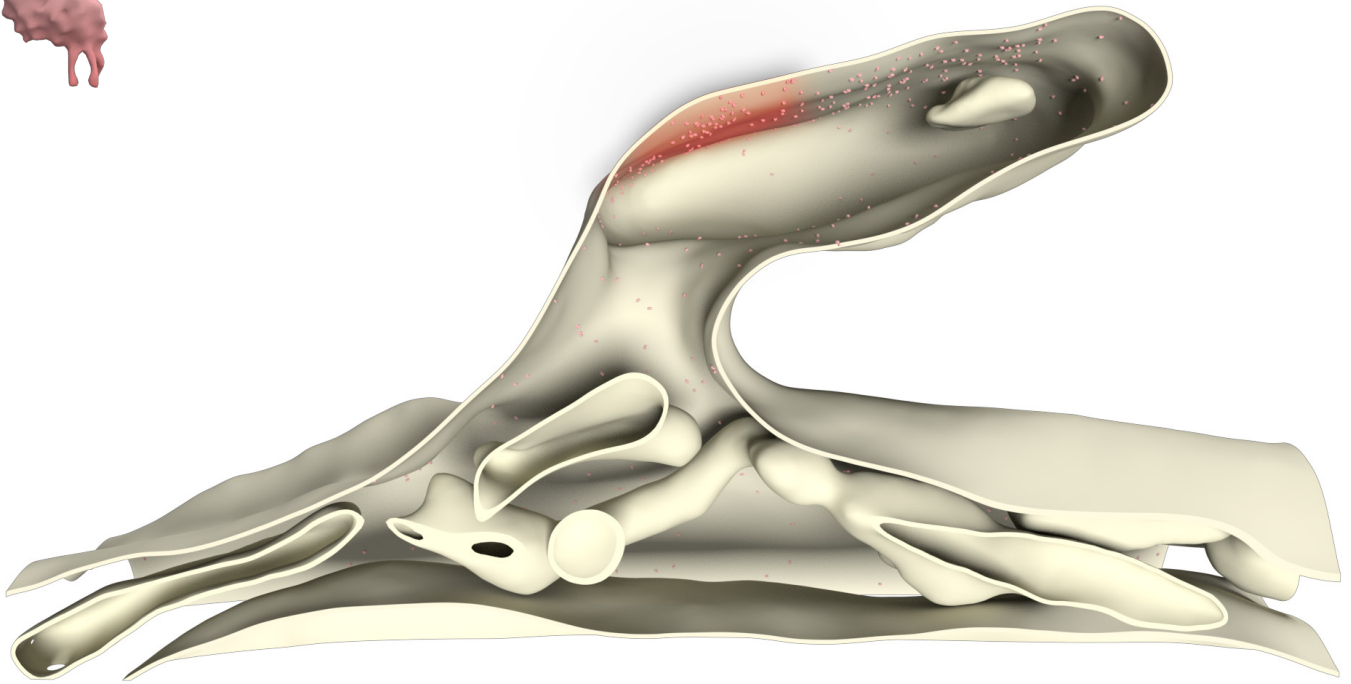
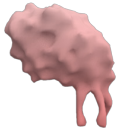
Known organization: Membrane-associated, On PM, Slightly on endosomes and TGN

Known Interactions: Syntaxin1, Syntaxin 4, Syntaxin 13, VAMP1, VAMP2, GRIP1

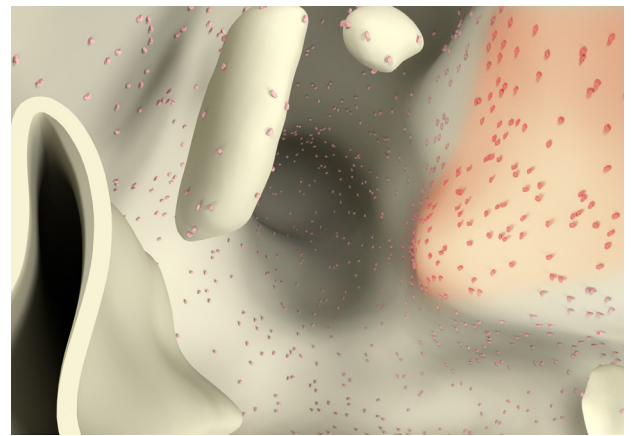
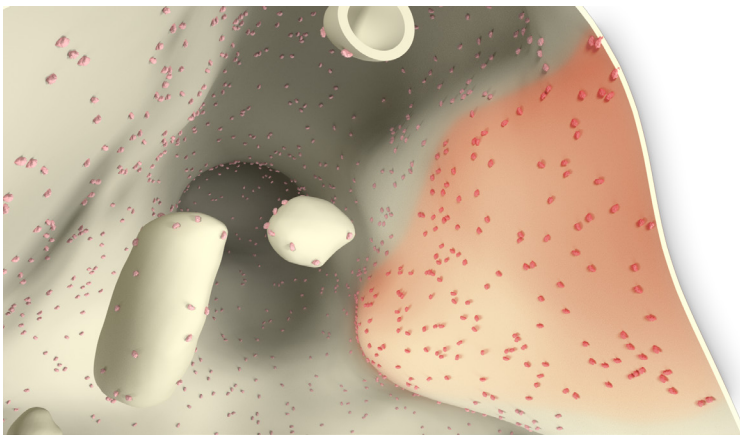
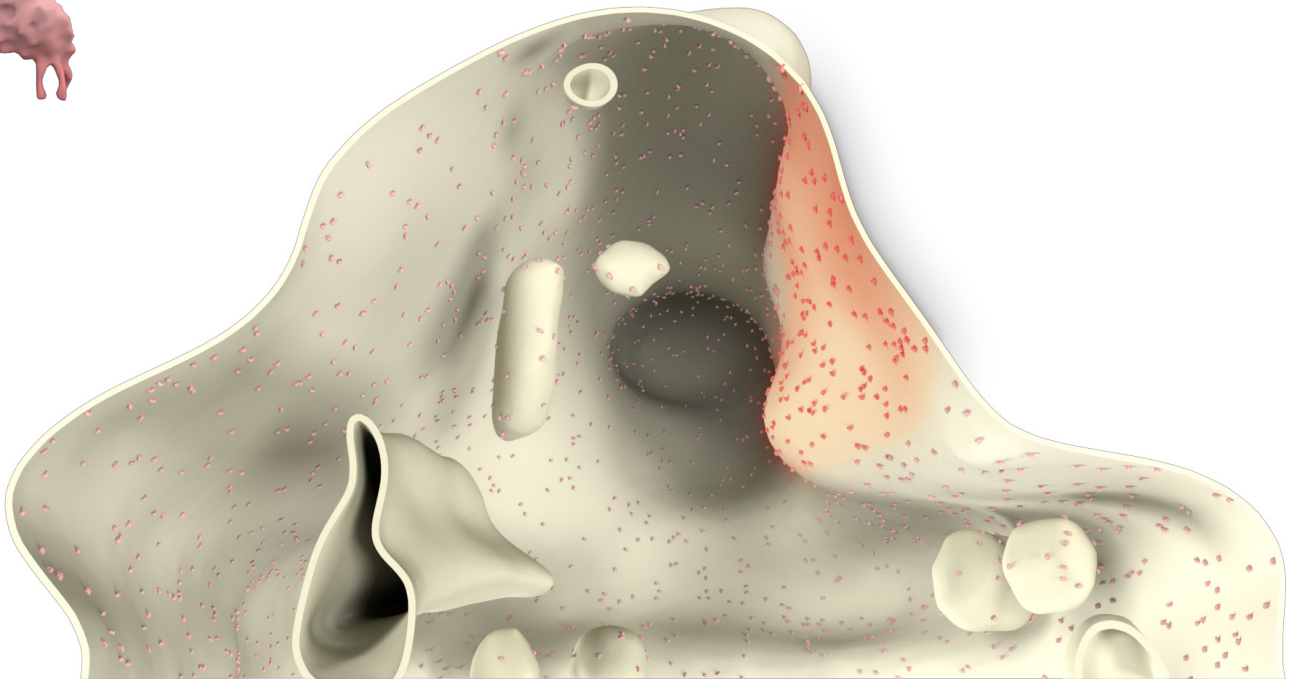
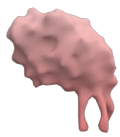


Whole cell copy number	76270019.6 ± 3296093.2	
Spine copy number	1966.1 ± 3626.0	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	1362.8 ± 2513.3	2922.1 ± 5389.1
% of total protein	0.2 ± 0.3%	0.3 ± 0.5%
Molarity (μM)	17.3 ± 31.9	27.6 ± 50.9
PSD copy number	113 ± 208.4	234 ± 431.6
% in PSD	8.3 ± 15.3%	8.0 ± 14.8%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1362.8 ± 2513.3	$0.2 \pm 0.3\%$	17.3 ± 31.9	113 ± 208.4
Stubby	2922.1 ± 5389.1	$0.3 \pm 0.5\%$	27.6 ± 50.9	234 ± 431.6



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1362.8 ± 2513.3	$0.2 \pm 0.3\%$	17.3 ± 31.9	113 ± 208.4
Stubby	2922.1 ± 5389.1	$0.3 \pm 0.5\%$	27.6 ± 50.9	234 ± 431.6



References

Antibody: Synaptic Systems 111 011

Structure: From Takamori et al. 2006

Literature:

Aikawa et al., 2006, Mol. Biol. Cell.

Gu and Huganir, 2016, Proc. Natl. Acad. Sci. U S A

Gu et al., 2016, Proc. Natl. Acad. Sci. U S A

Lau et al., 2010, J. Neurosci.

McMahon and Südhof, 1995, J. Biol. Chem.

Söllner et al., 1993a, Nature

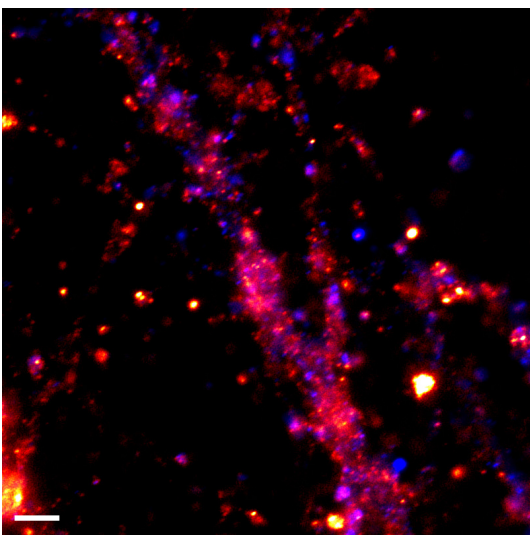
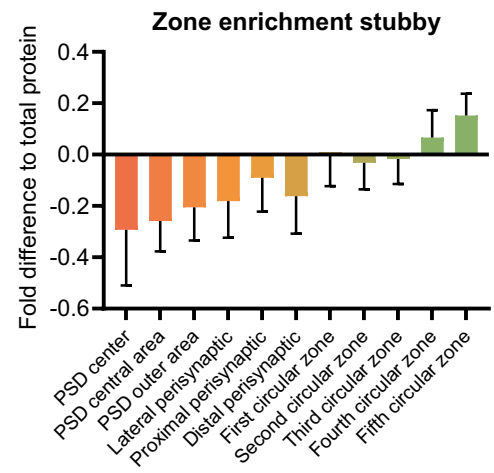
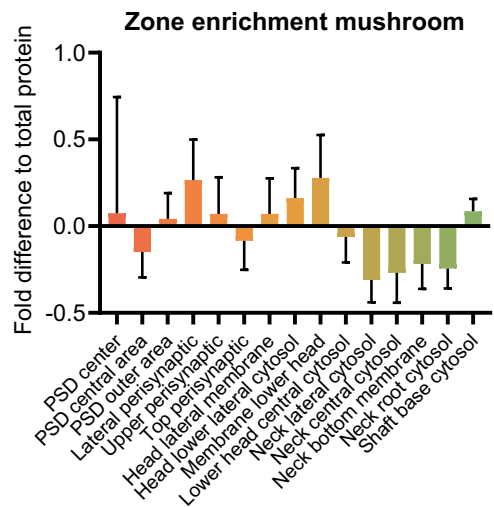
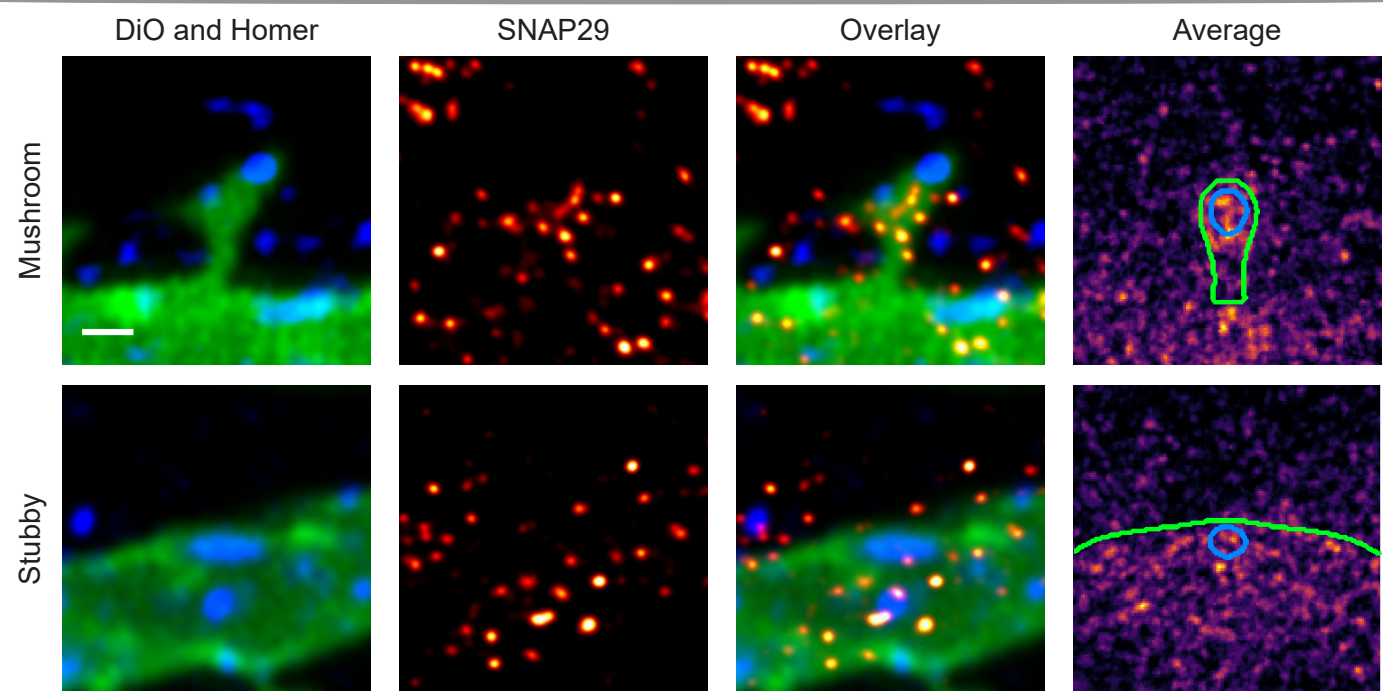
Veit et al., 1996, FEBS Lett.

SNAP29 (Gs32, Gene: Snap29, Uniprot ID: Q9Z2P6)

Known function: Qbc SNARE, Autophagosome-lysosome fusion, Inhibition of SNARE complex disassembly

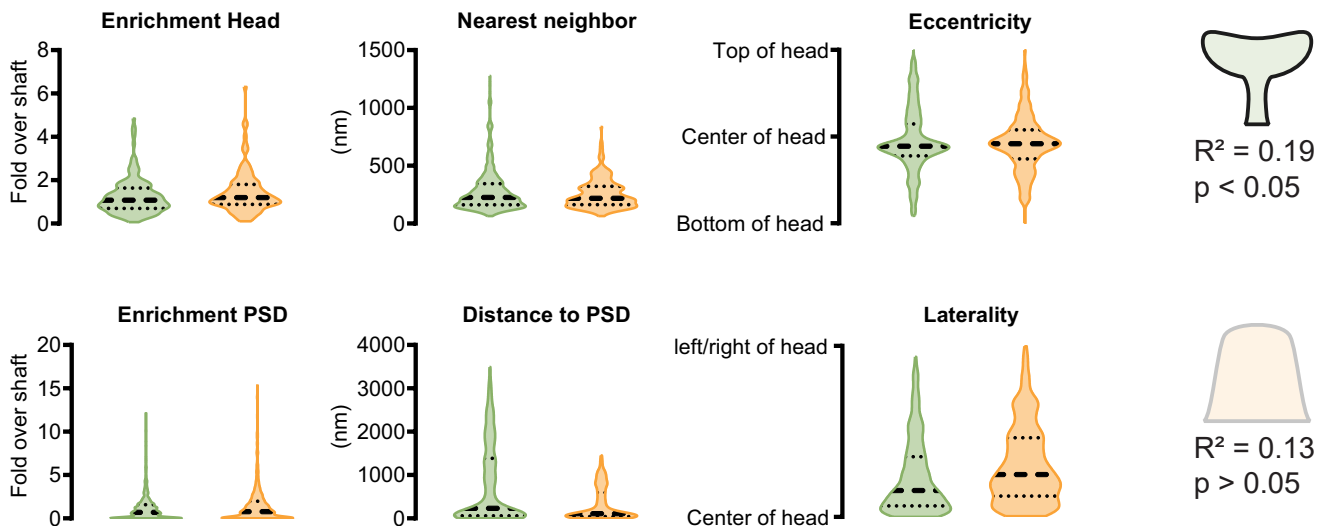
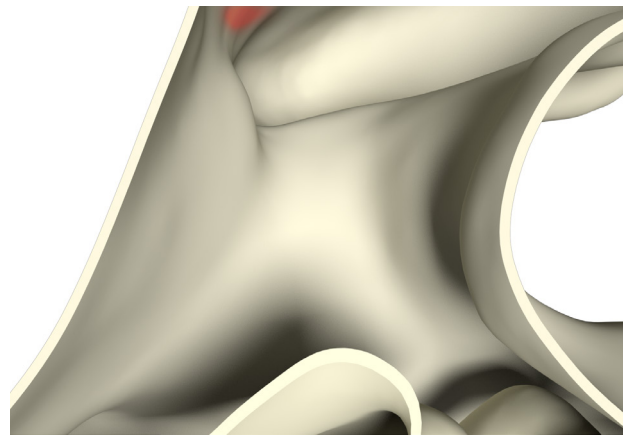
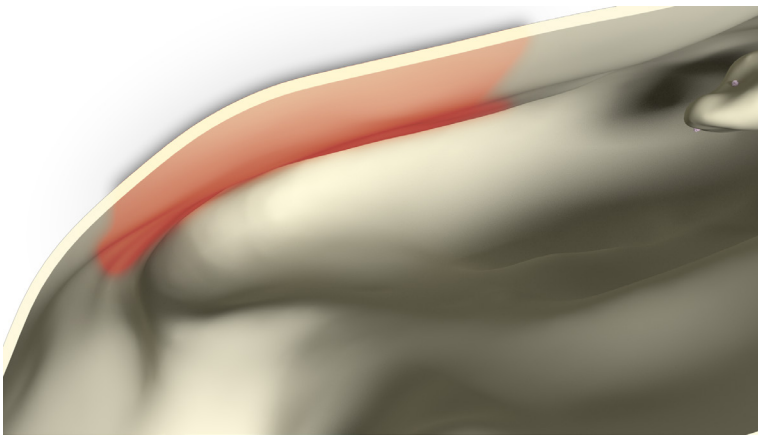
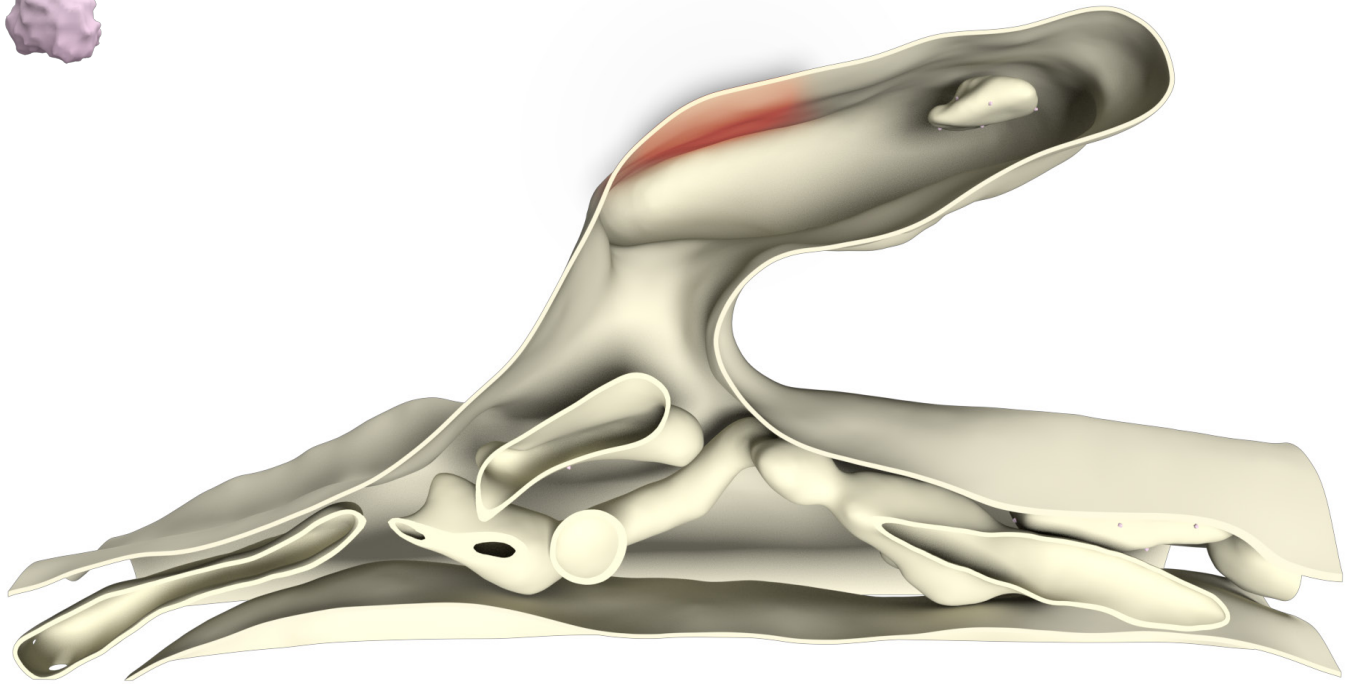
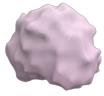
Known organization: Membrane-associated, On Golgi, Endosomes, SV, Also in cytosol

Known Interactions: Syntaxin3, Syntaxin6, VAMP7, SNARE complexes in general

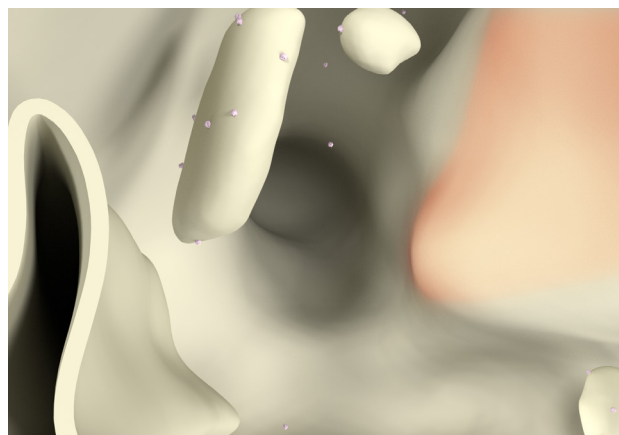
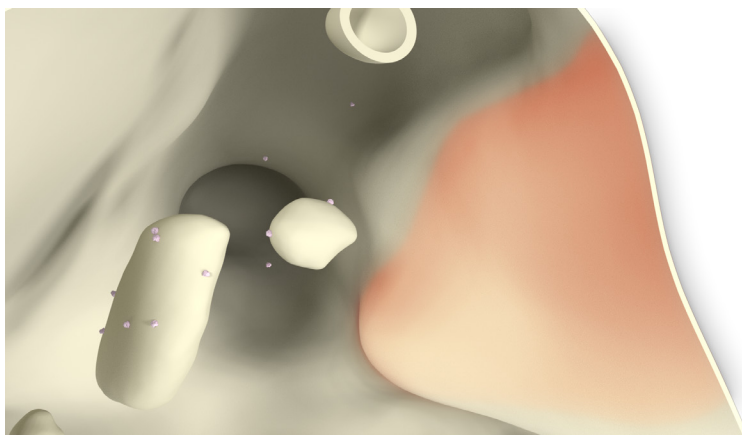
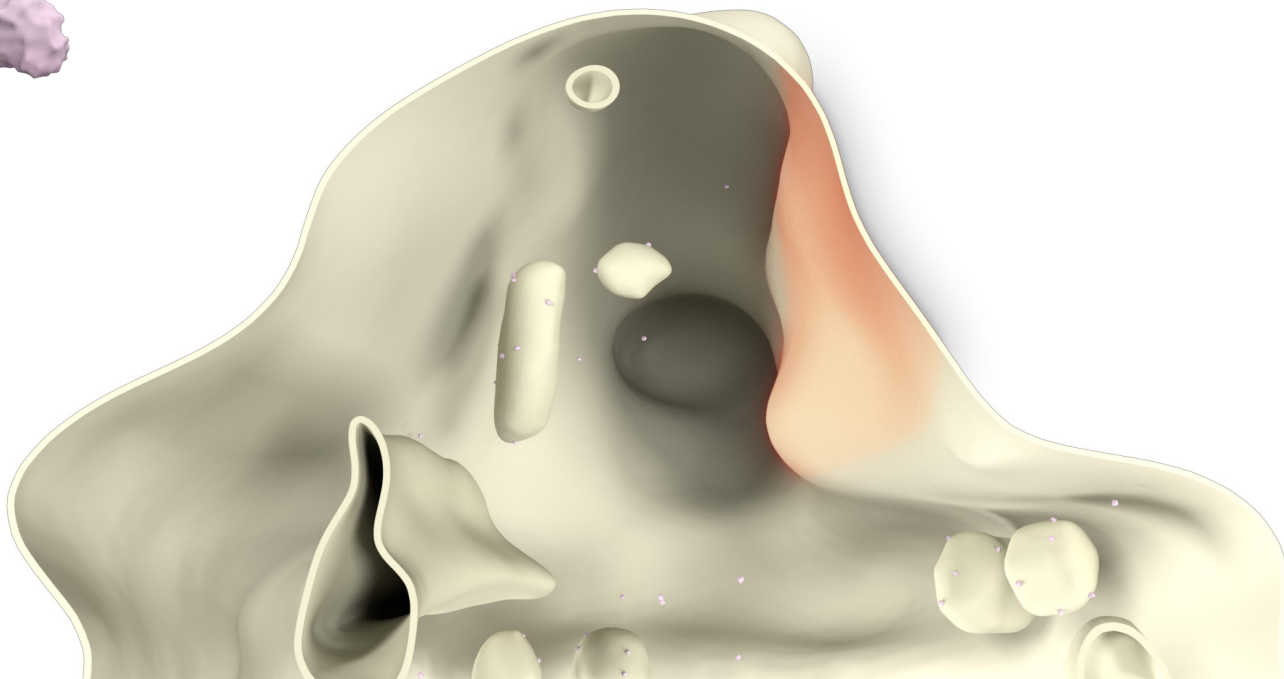
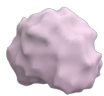


Whole cell copy number	631022.8 ± 160061.0	
Spine copy number	54.7 ± 31.2	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	47.9 ± 27.3	68.2 ± 38.9
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.6 ± 0.3	0.6 ± 0.4
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	47.9 ± 27.3	$0.0 \pm 0.0\%$	0.6 ± 0.3	0 ± 0.0
Stubby	68.2 ± 38.9	$0.0 \pm 0.0\%$	0.6 ± 0.4	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	47.9 ± 27.3	$0.0 \pm 0.0\%$	0.6 ± 0.3	0 ± 0.0
Stubby	68.2 ± 38.9	$0.0 \pm 0.0\%$	0.6 ± 0.4	0 ± 0.0



References

Antibody: Synaptic Systems 111 302

Structure: From Takamori et al. 2006

Literature:

Pan et al., 2005, J. Biol. Chem.

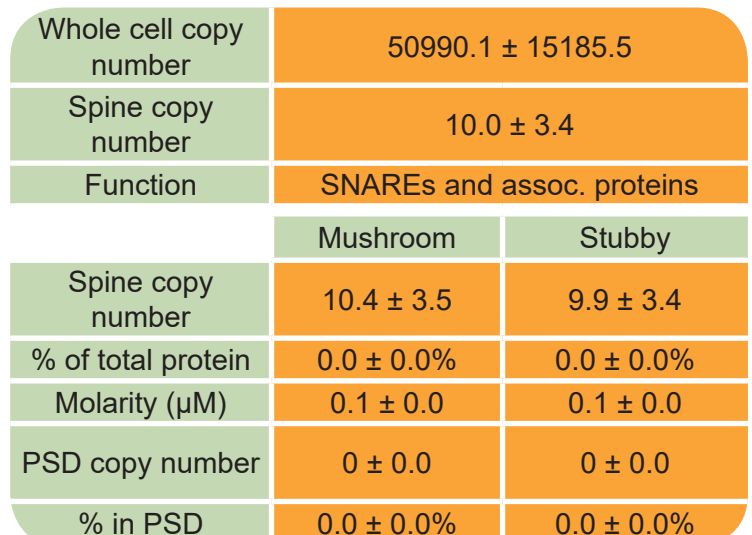
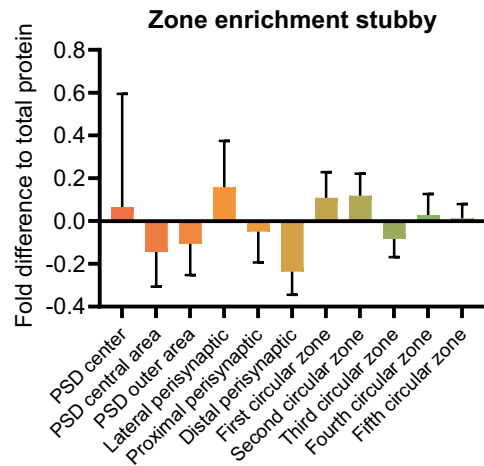
Steegmaier et al., 1998, J. Biol. Chem.

Su et al., 2001, Proc. Natl. Acad. Sci. U S A

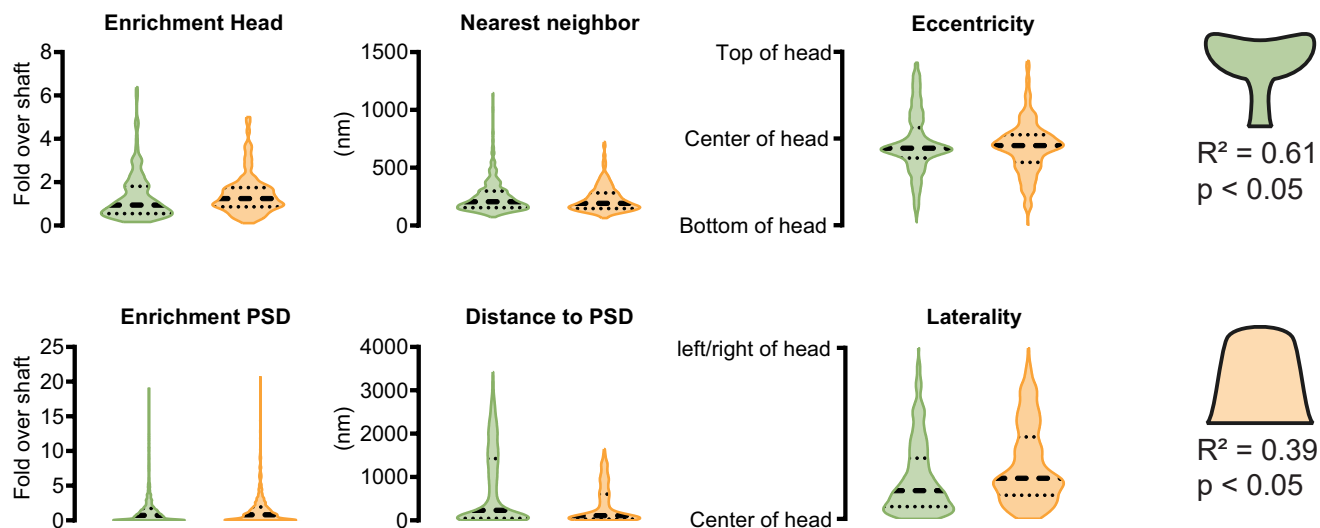
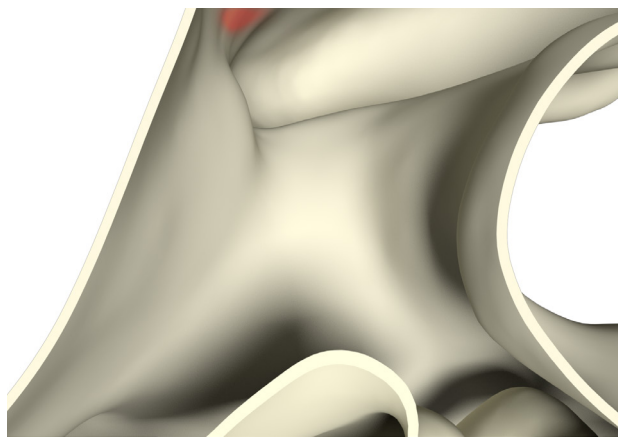
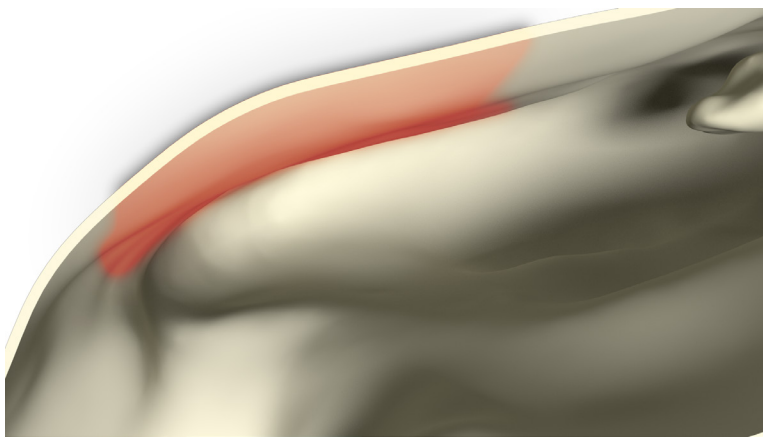
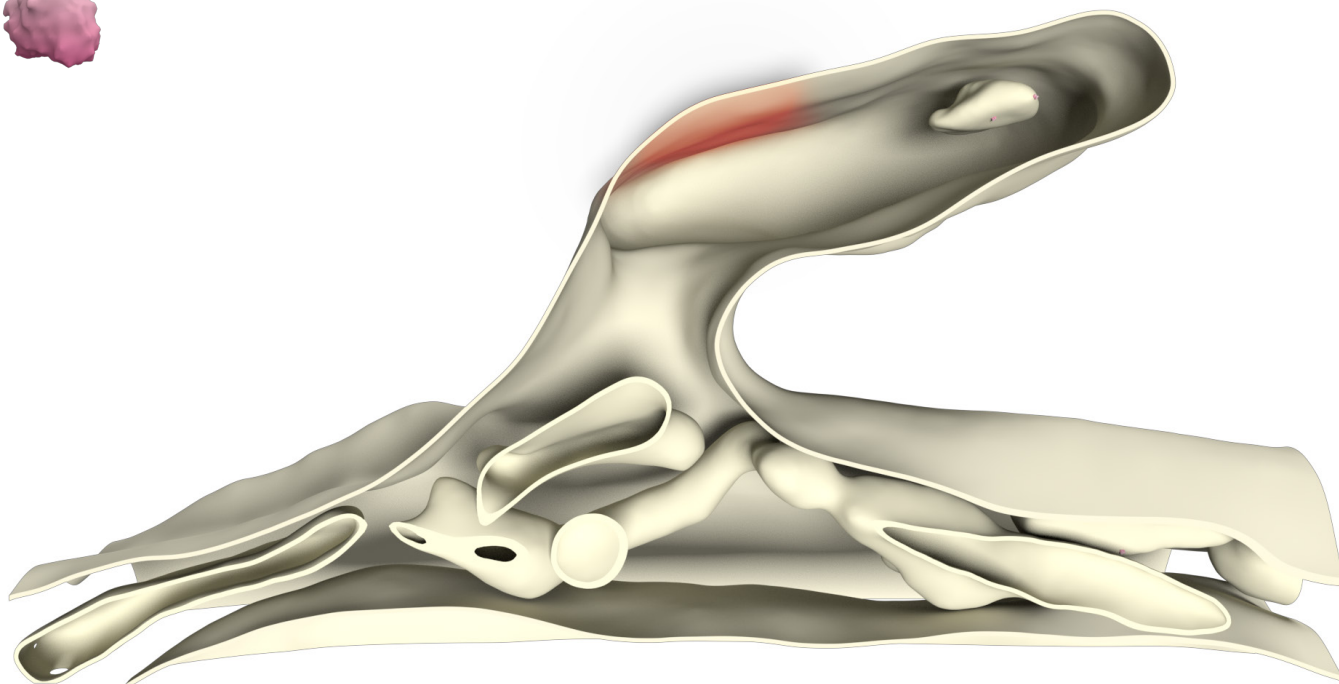
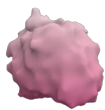
Wang et al., 2016, Mol. Cell

Wong et al., 1999, Mol. Biol. Cell.

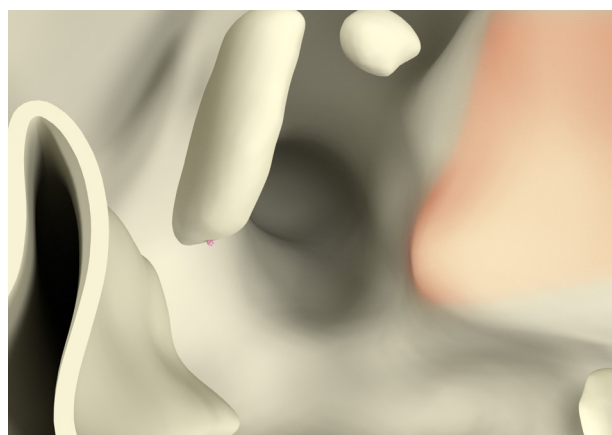
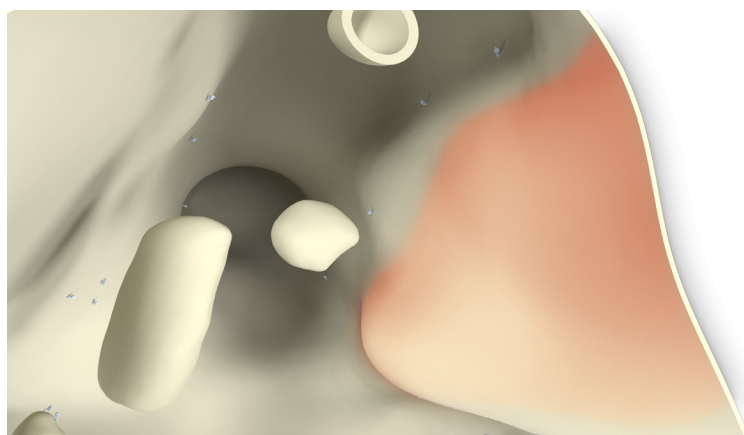
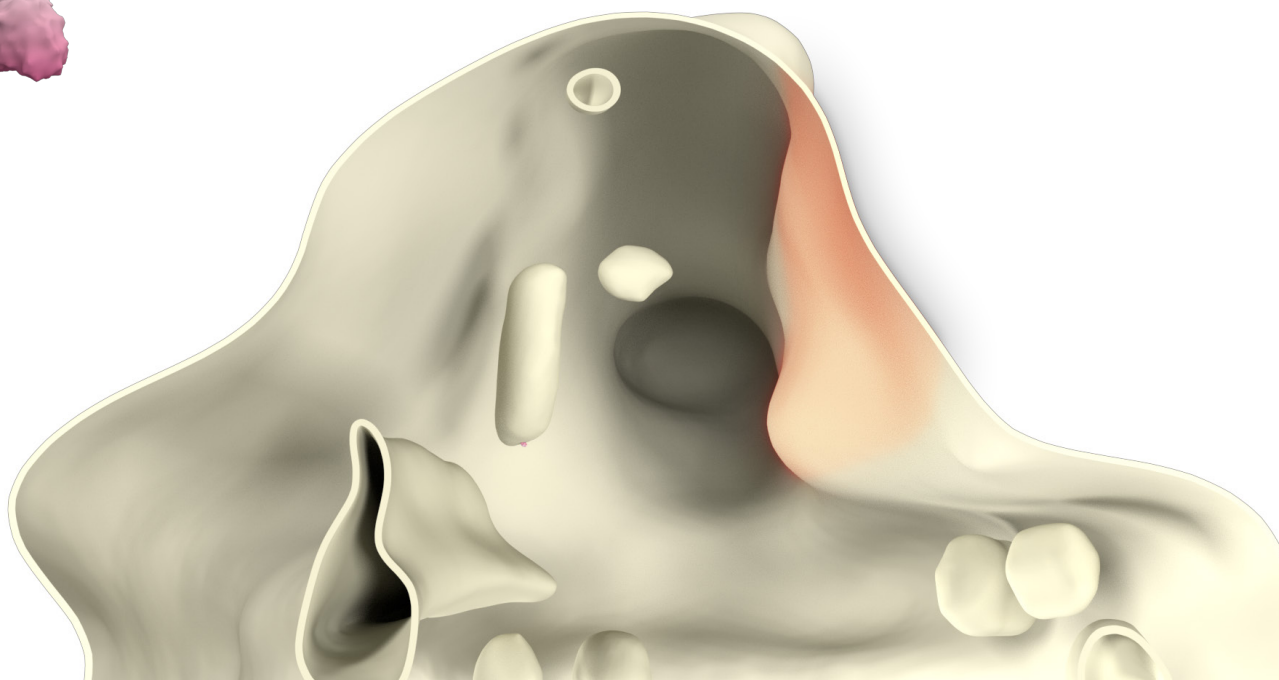
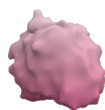
Known Interactions: Syntaxin1, Syntaxin3, VAMP2



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	10.4 ± 3.5	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0
Stubby	9.9 ± 3.4	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	10.4 ± 3.5	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0
Stubby	9.9 ± 3.4	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



References

Antibody: Synaptic Systems 111 403

PDB Identifier: Modified SNAP29

Literature:

Holt et al., 2006, J. Biol. Chem.

Jurado et al., 2013, Neuron

Münster-Wandowski et al., 2017

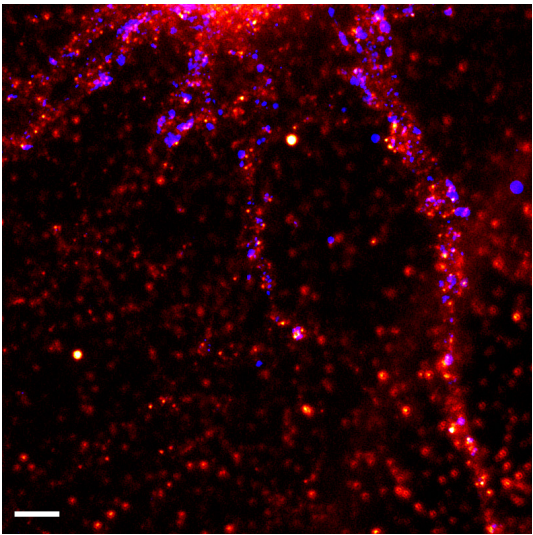
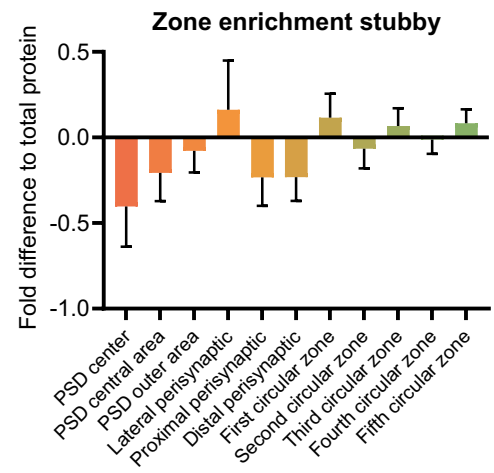
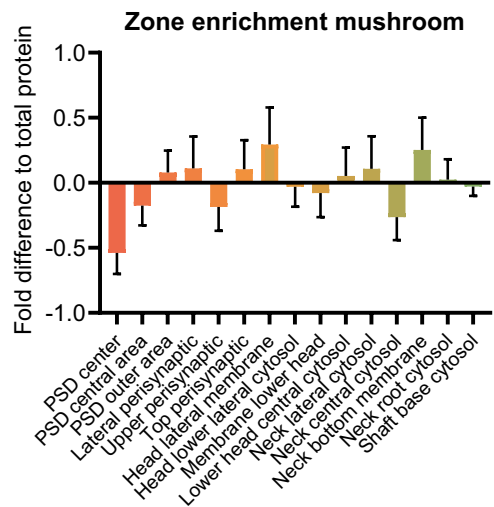
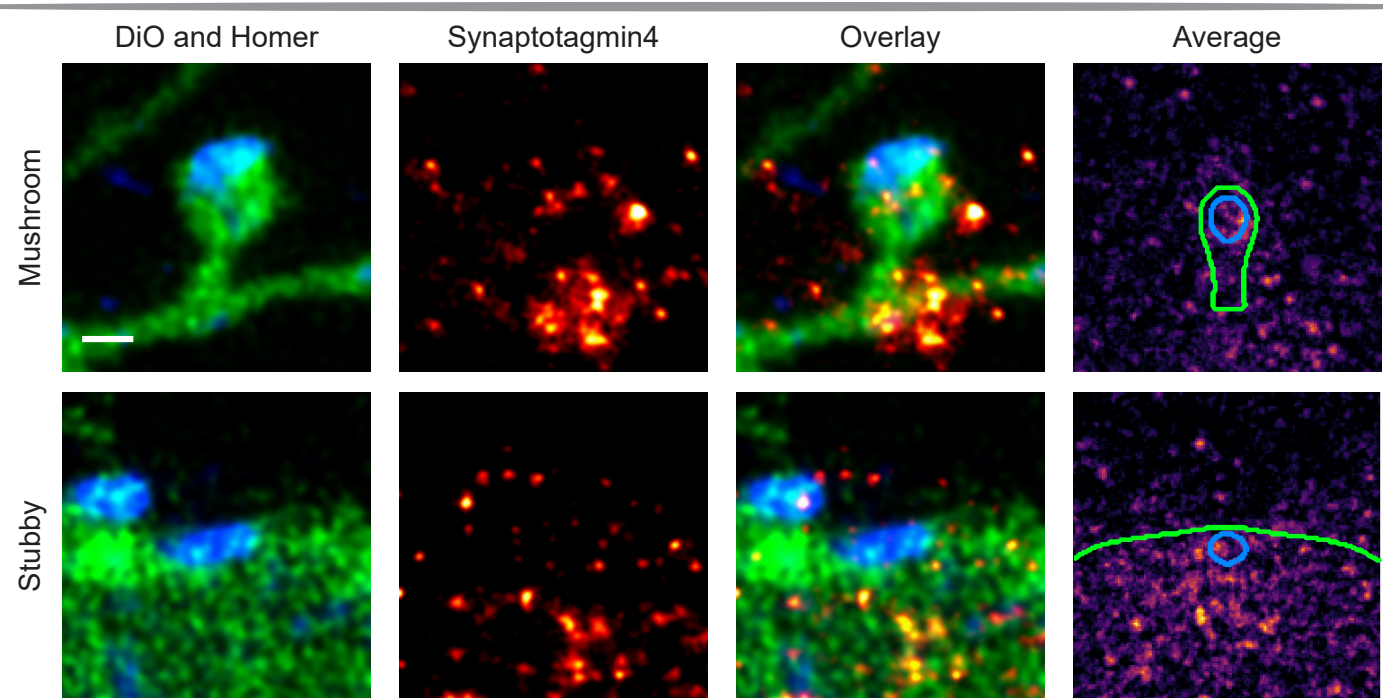
Shimojo et al., 2015, Front. Neuroanat.

Synaptotagmin4 (Gene: Syt4, Uniprot ID: P50232)

Known function: Retrograde signalling in drosophila

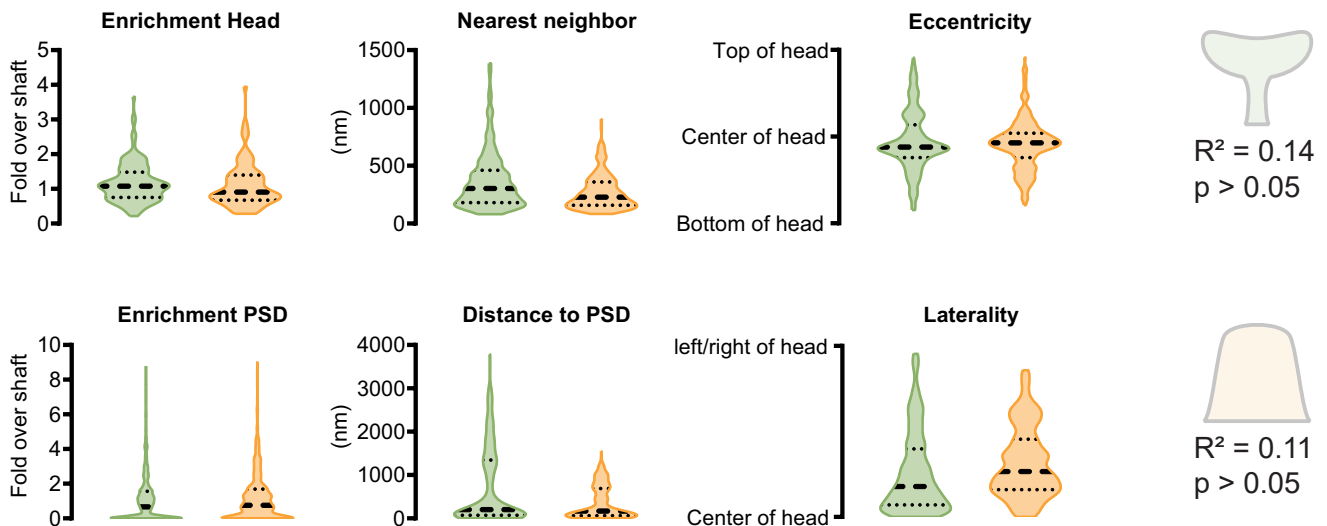
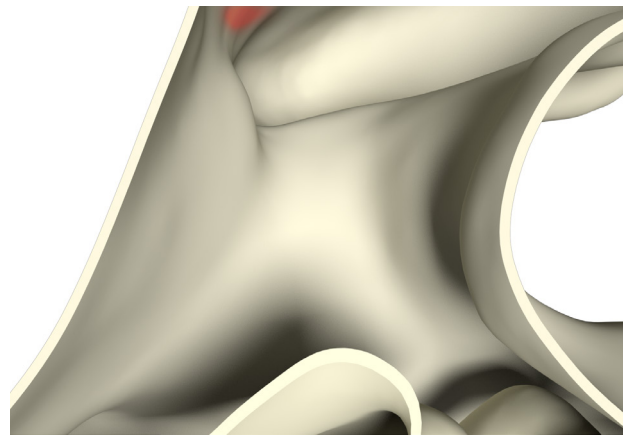
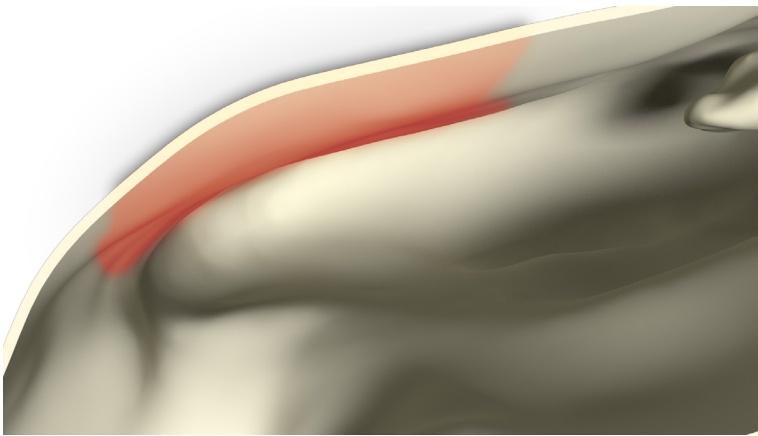
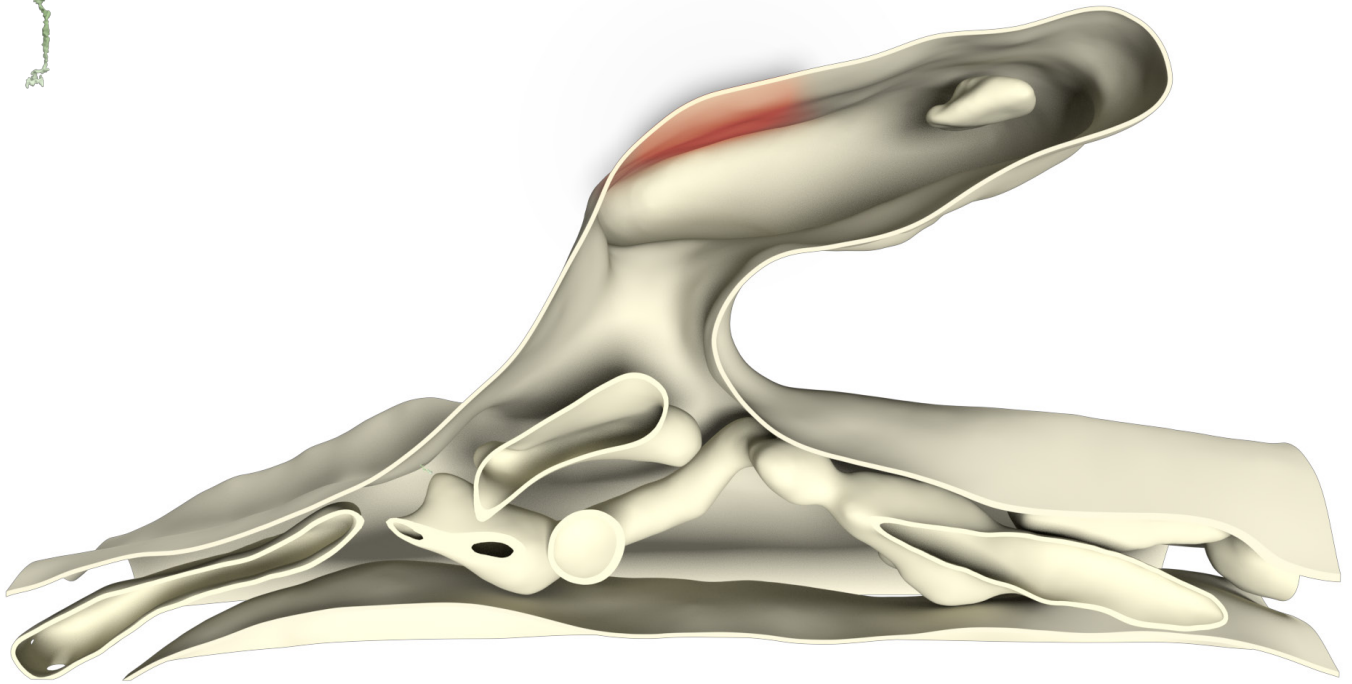
Known organization: Transmembrane protein

Known Interactions: None

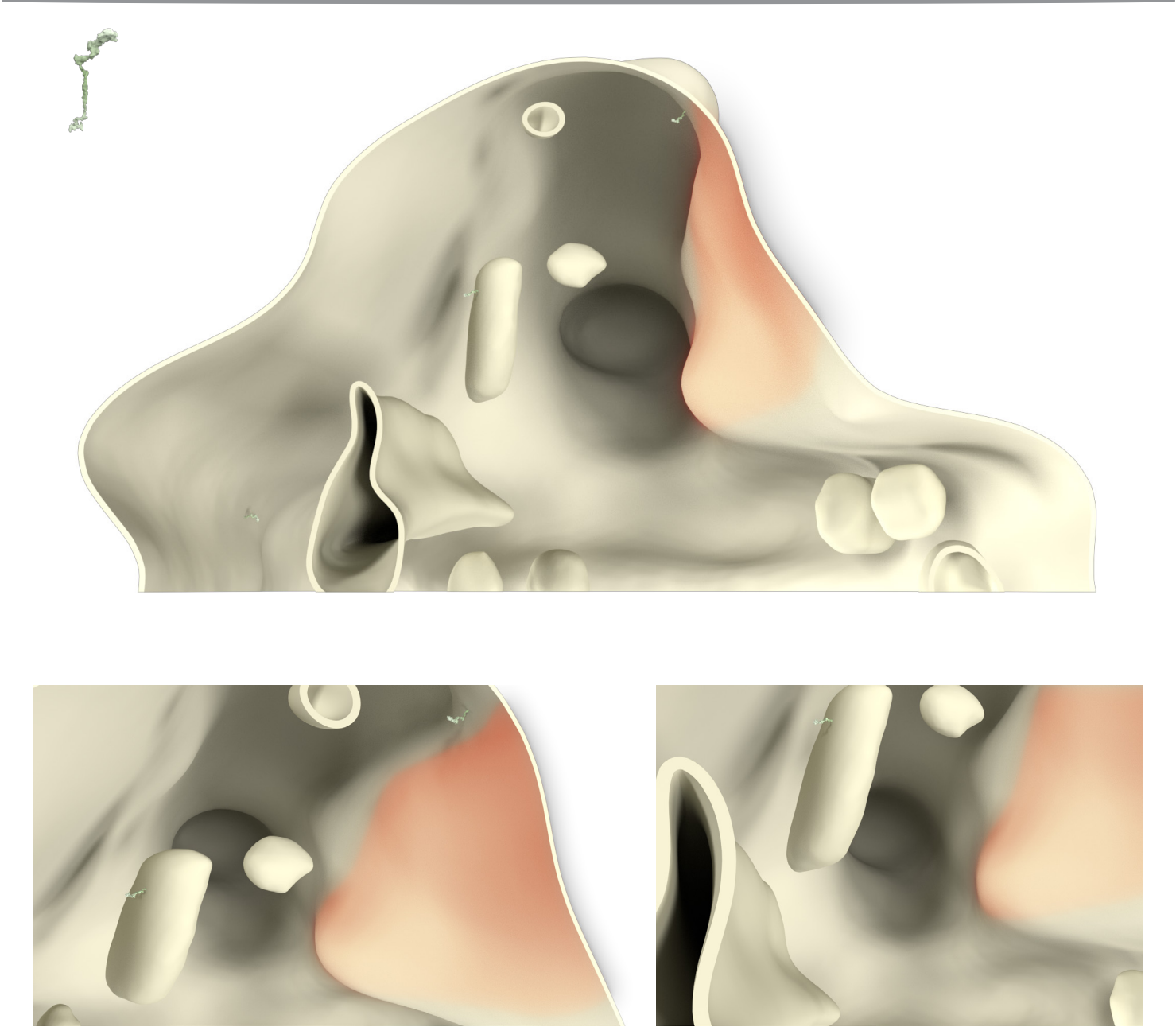


Whole cell copy number	96692.0 ± 19519.0	
Spine copy number	4.2 ± 2.2	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	3.1 ± 1.6	5.6 ± 2.9
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (µM)	0.0 ± 0.0	0.1 ± 0.0
PSD copy number	1 ± 0.5	0 ± 0.0
% in PSD	32.5 ± 17.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	3.1 ± 1.6	$0.0 \pm 0.0\%$	0.0 ± 0.0	1 ± 0.5
Stubby	5.6 ± 2.9	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	3.1 ± 1.6	$0.0 \pm 0.0\%$	0.0 ± 0.0	1 ± 0.5
Stubby	5.6 ± 2.9	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



References

Antibody: Synaptic Systems 105 143

PDB Identifier: 6ank

Literature:

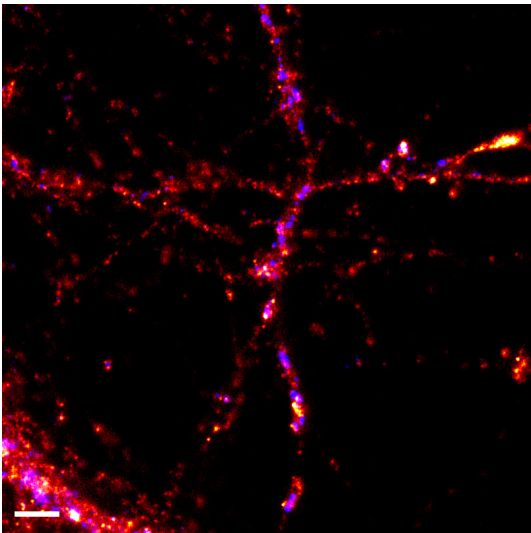
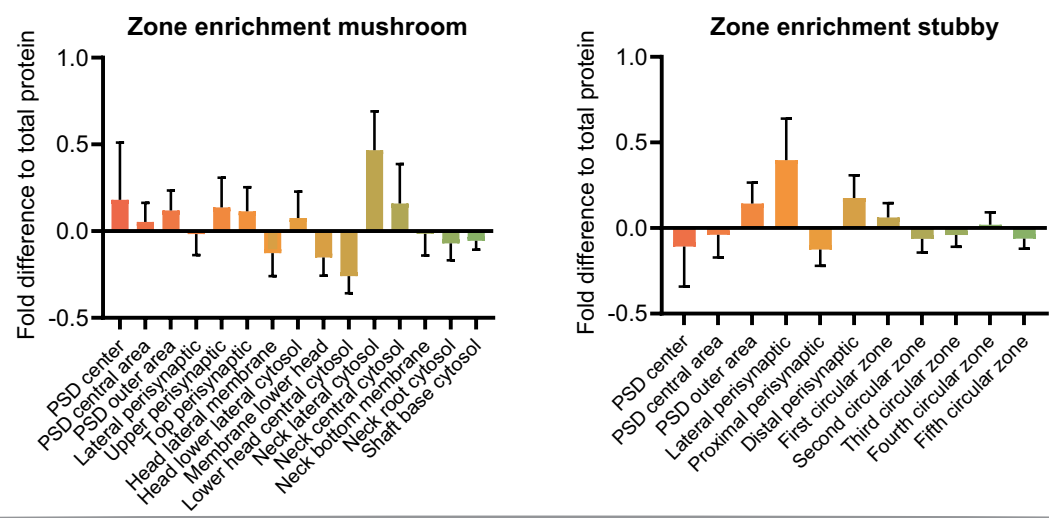
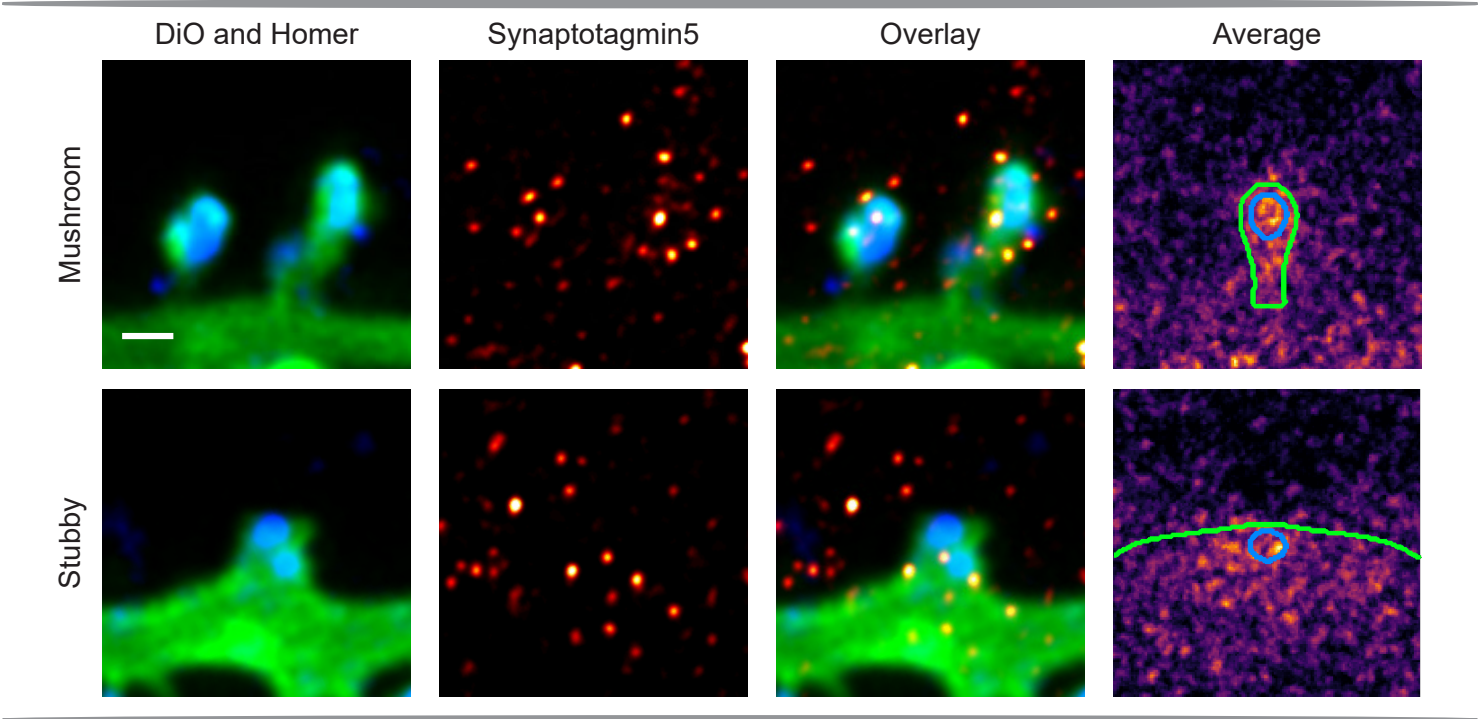
Harris et al., 2016, Elife

Korkut et al., 2013, Neuron

Yoshihara et al., 2005, Science

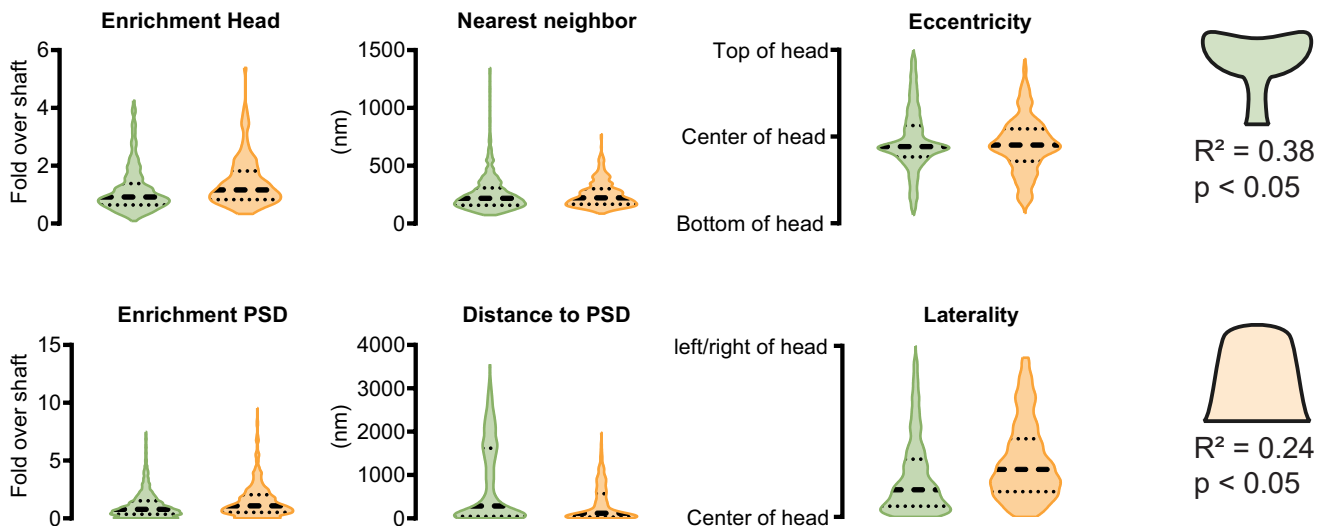
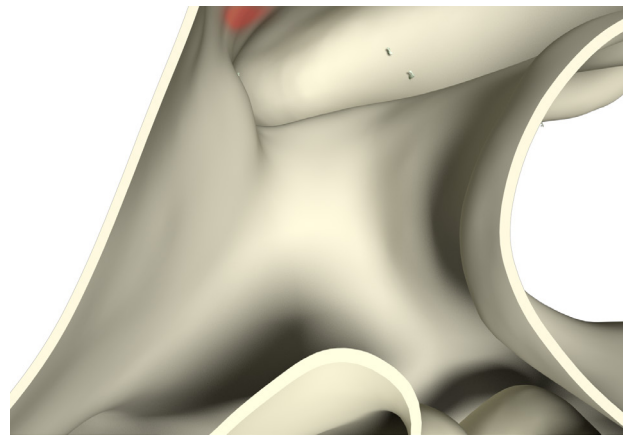
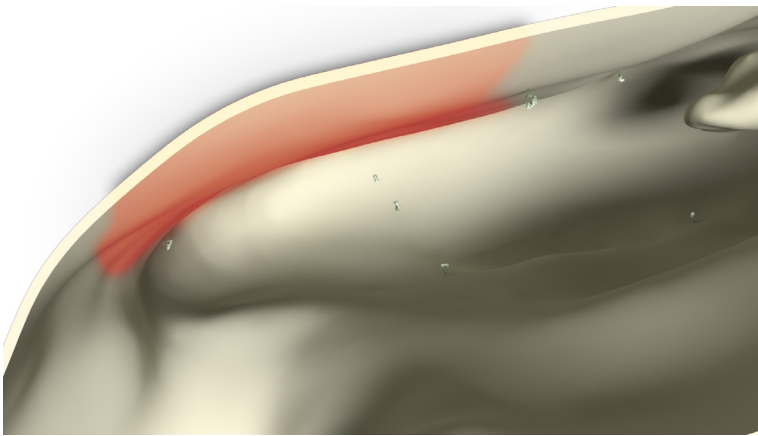
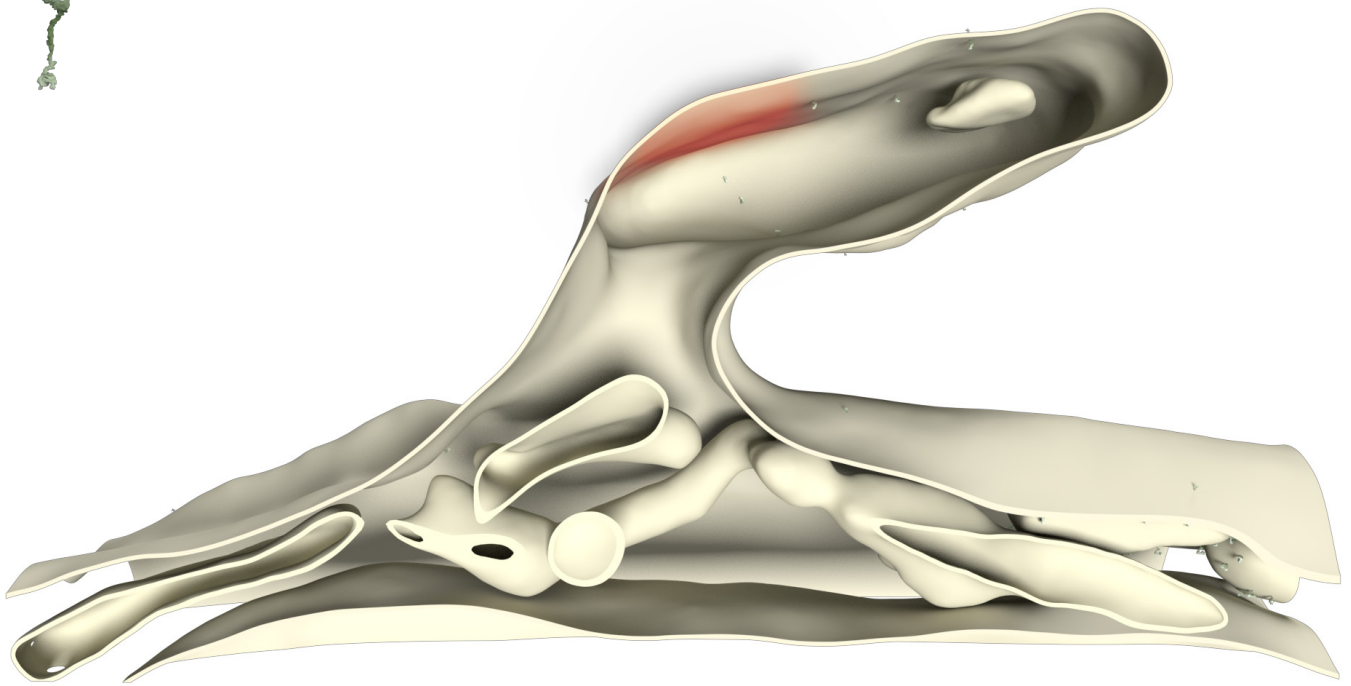
Synaptotagmin5 (Synaptotagmin9, Gene: Syt5, Uniprot ID: P47861)

Known function: Involved in dense-core vesicle as well as insulin exocytosis
Known organization: Transmembrane protein, On recycling endosome, LDCV
Known Interactions: None

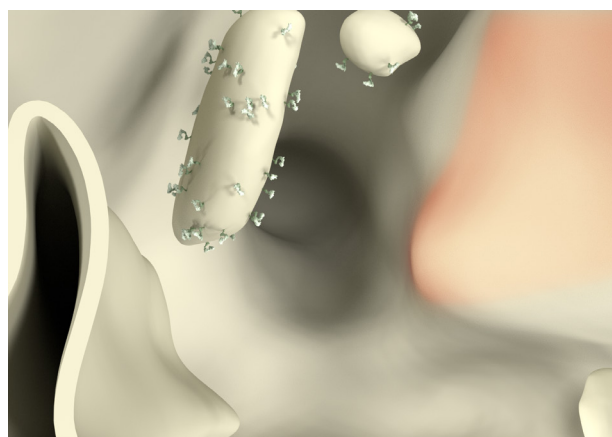
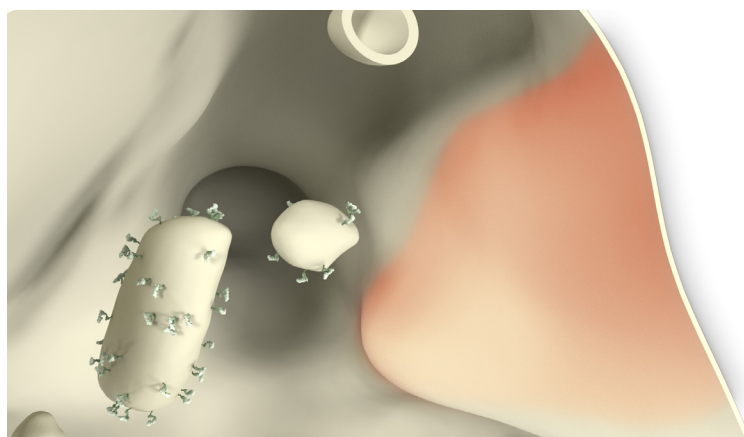
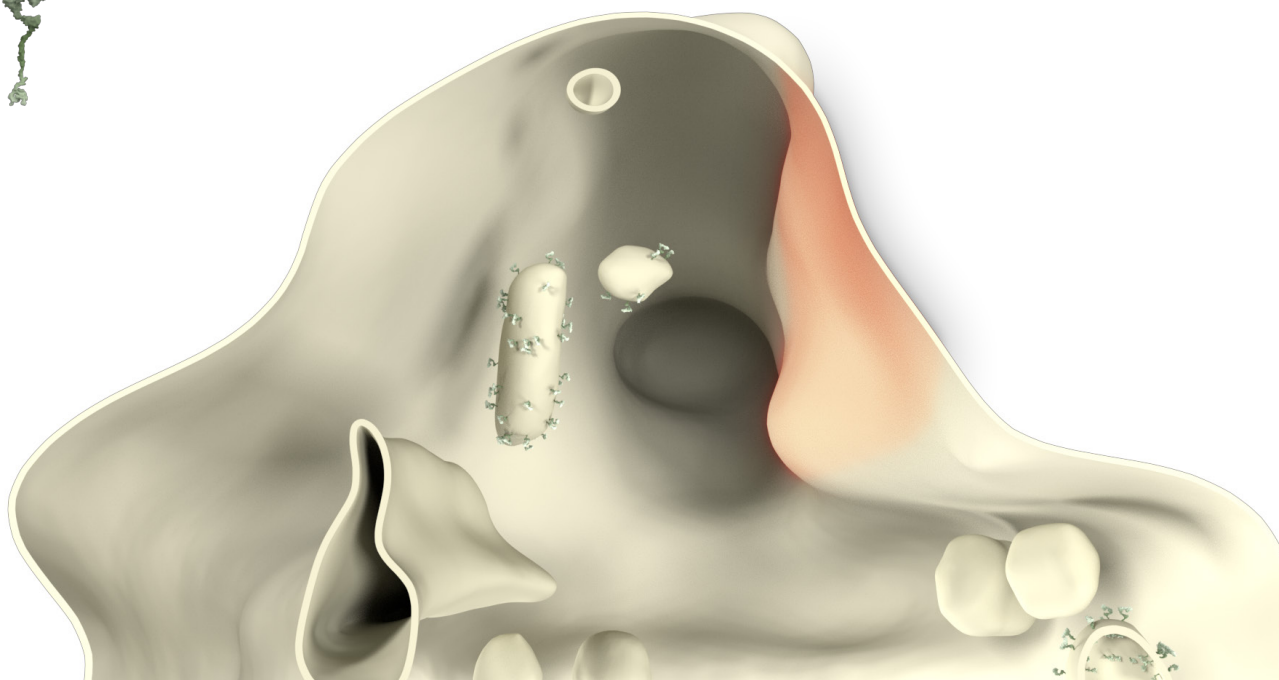


Whole cell copy number	1400586.5 ± 179599.9	
Spine copy number	164.4 ± 54.3	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	135.2 ± 44.7	219.2 ± 72.4
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	1.7 ± 0.6	2.1 ± 0.7
PSD copy number	5 ± 1.7	6 ± 2.0
% in PSD	3.7 ± 1.2%	2.7 ± 0.9%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	135.2 ± 44.7	$0.0 \pm 0.0\%$	1.7 ± 0.6	5 ± 1.7
Stubby	219.2 ± 72.4	$0.0 \pm 0.0\%$	2.1 ± 0.7	6 ± 2.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	135.2 ± 44.7	$0.0 \pm 0.0\%$	1.7 ± 0.6	5 ± 1.7
Stubby	219.2 ± 72.4	$0.0 \pm 0.0\%$	2.1 ± 0.7	6 ± 2.0



References

Antibody: Synaptic Systems 105 053

PDB Identifier: 6ank

Literature:

Hudson and Birnbaum, 1995, Proc. Natl. Acad. Sci.

U S A

Iezzi et al., 2004, J. Cell. Sci.

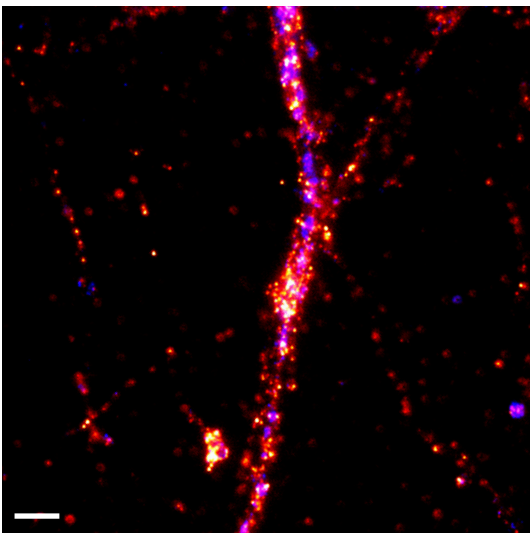
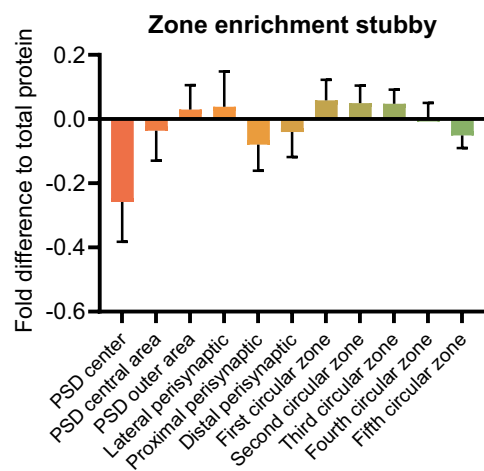
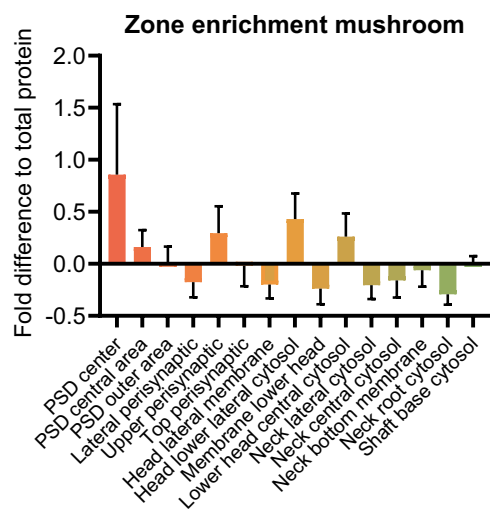
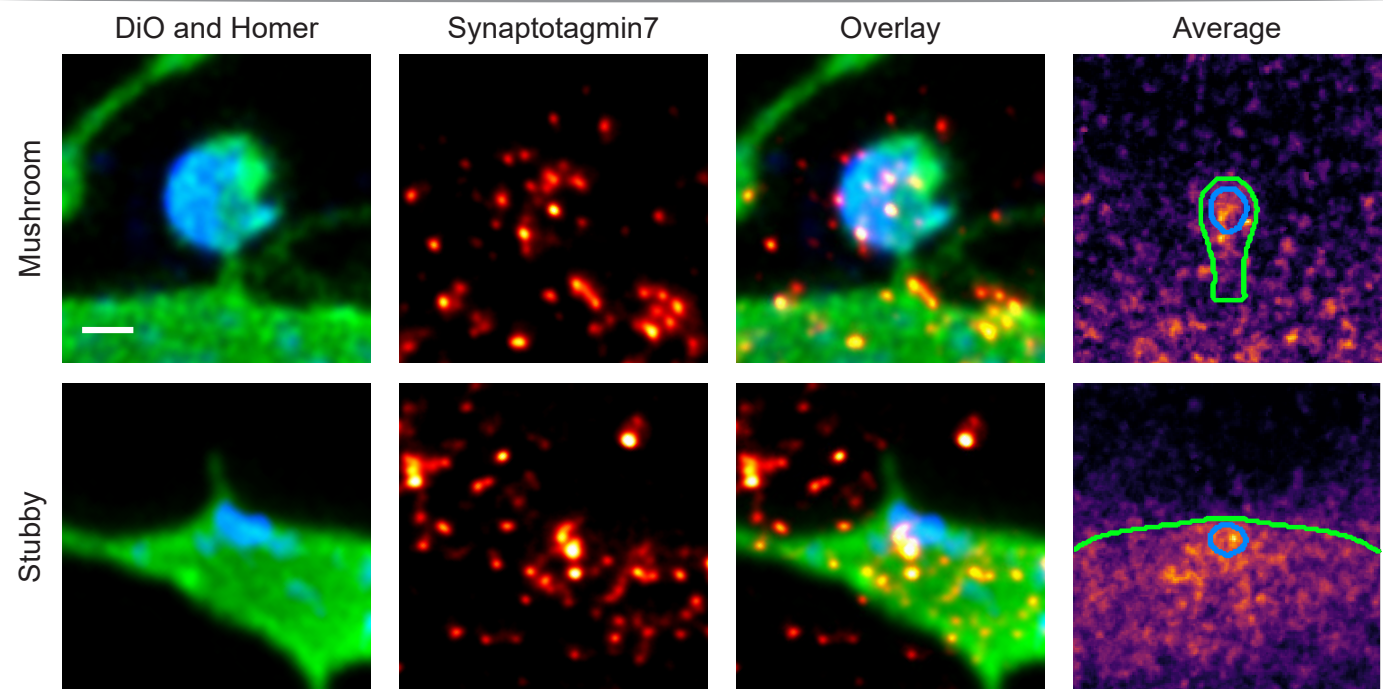
Saegusa et al., 2002, J. Biol. Chem.

Synaptotagmin7 (Gene: Syt7, Uniprot ID: Q62747)

Known function: Asynchronous SV release, AMPAR exocytosis during LTP

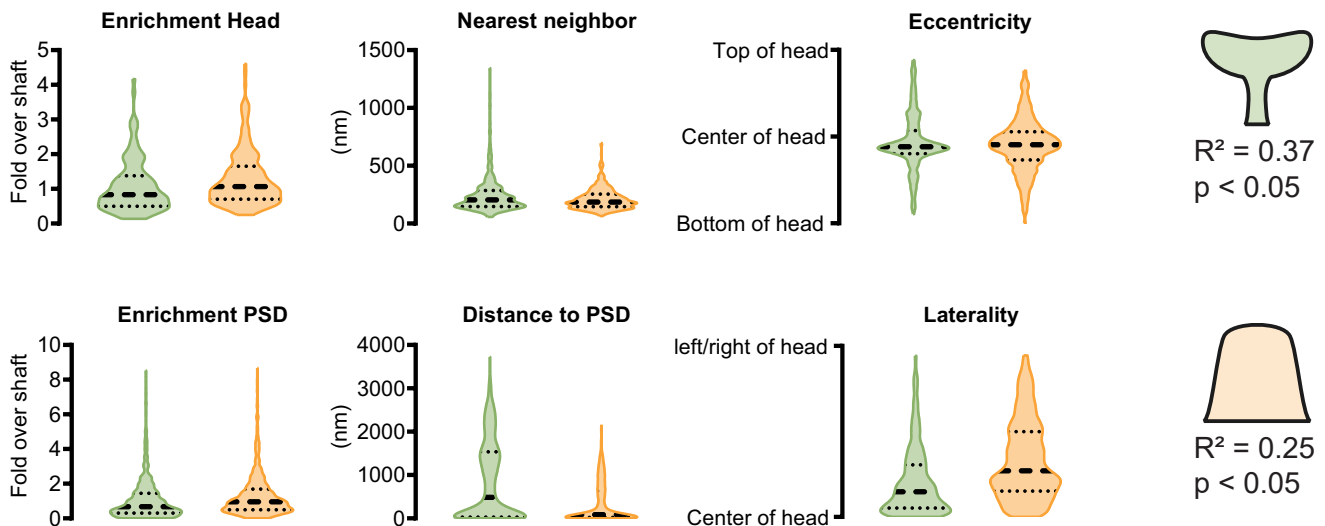
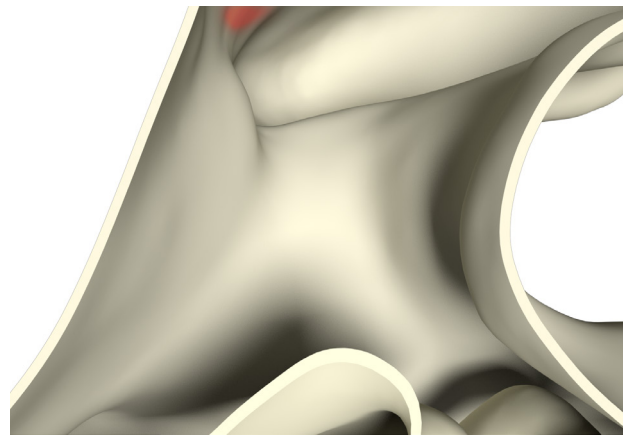
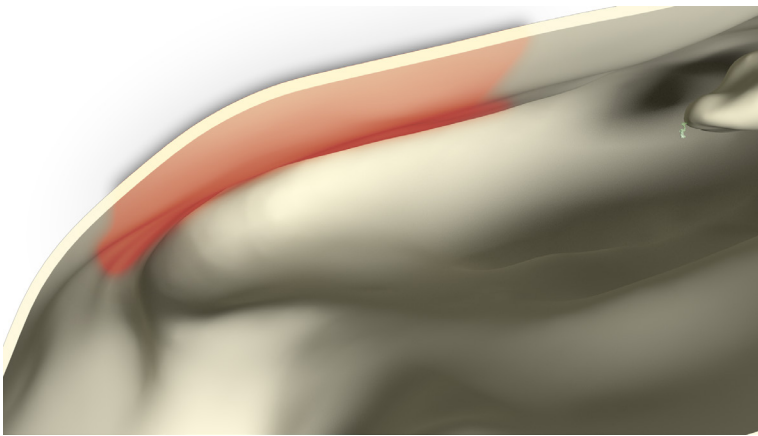
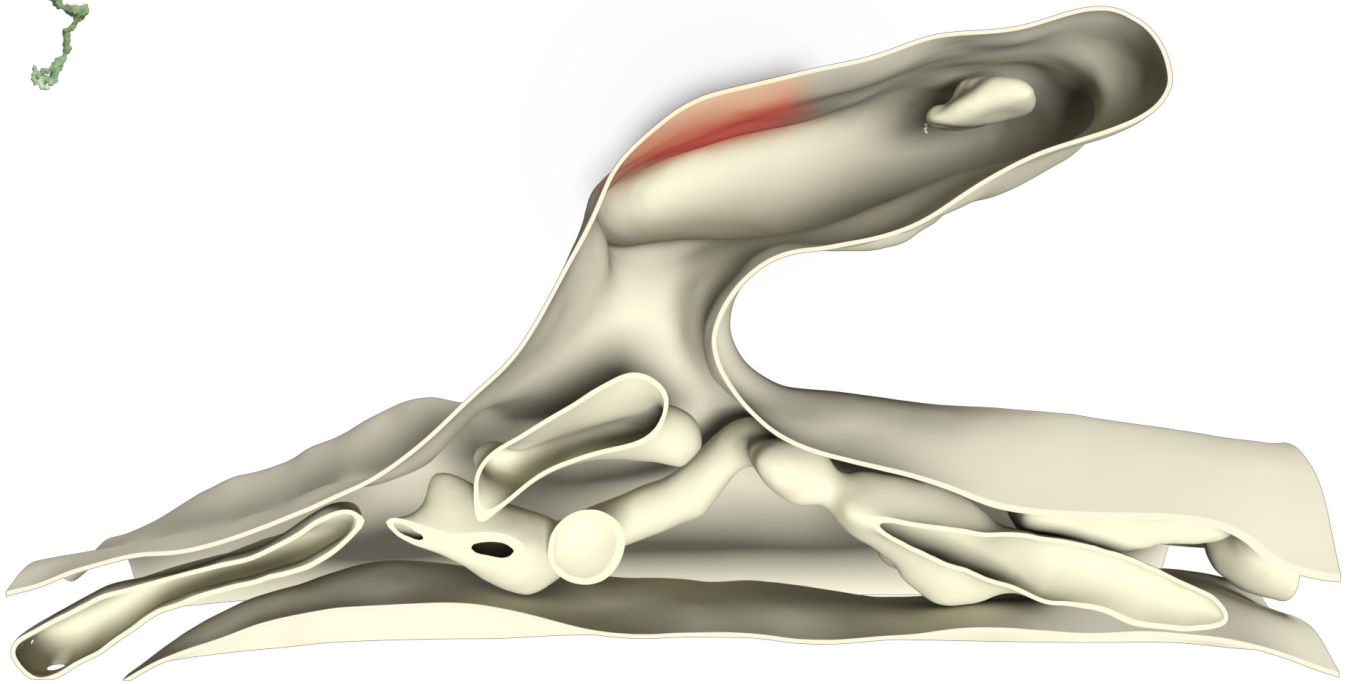
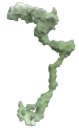
Known organization: Transmembrane protein, Homo- or Heterodimers, On SV, endosomes, lysosomes

Known Interactions: Synaptotagmin5, Calmodulin

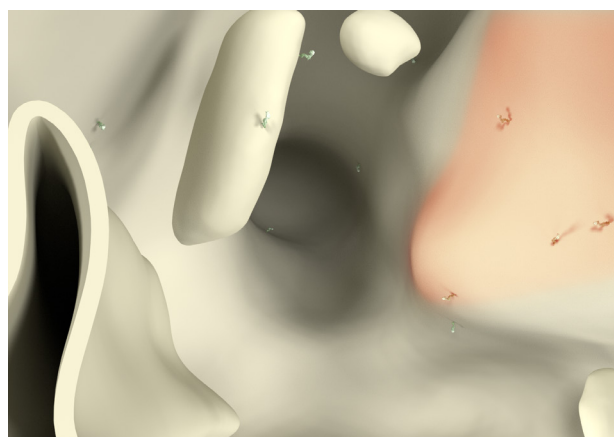
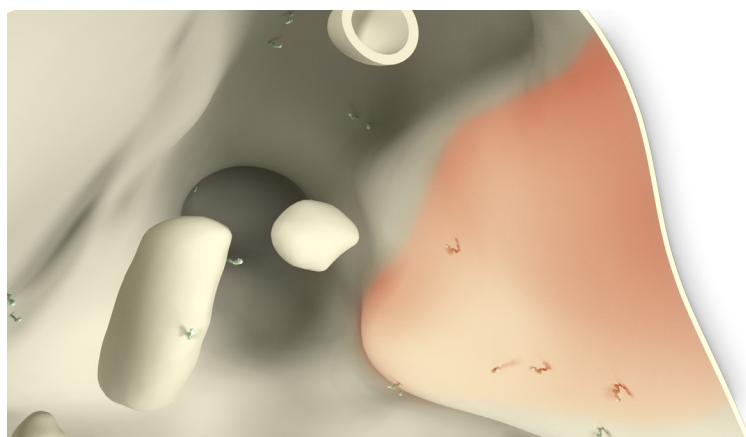
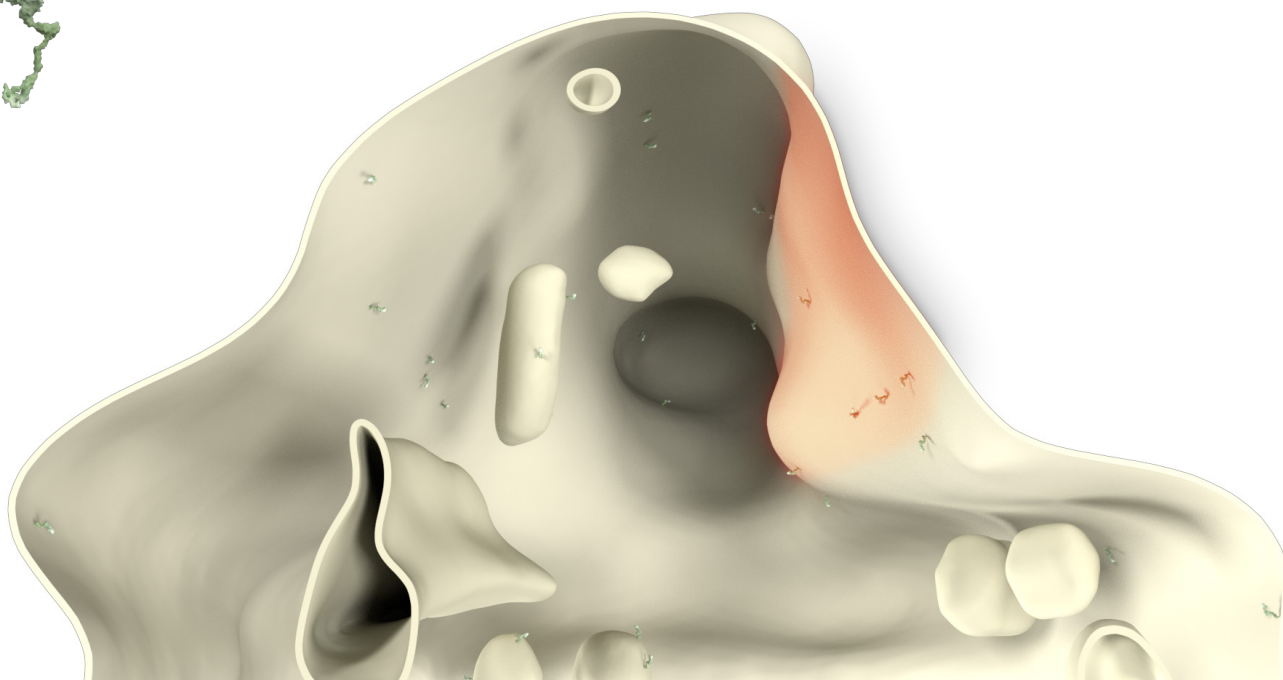


Whole cell copy number	35042.4 ± 5109.3	
Spine copy number	10.5 ± 2.3	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	7.1 ± 1.5	14.7 ± 3.2
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (µM)	0.1 ± 0.0	0.1 ± 0.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	7.1 ± 1.5	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0
Stubby	14.7 ± 3.2	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	7.1 ± 1.5	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0
Stubby	14.7 ± 3.2	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



References

Antibody: Synaptic Systems 105 173

PDB Identifier: 6ank

Literature:

Bacaj et al., 2013, Neuron

Bacaj et al., 2015b, PLoS Biol.

Flannery et al., 2010, J. Cell. Biol.

Fukuda and Mikoshiba, 2000, J. Biol. Chem.

Luo et al., 2015, J. Neurosci.

Wen et al., 2010, Proc. Natl. Acad. Sci. U S A

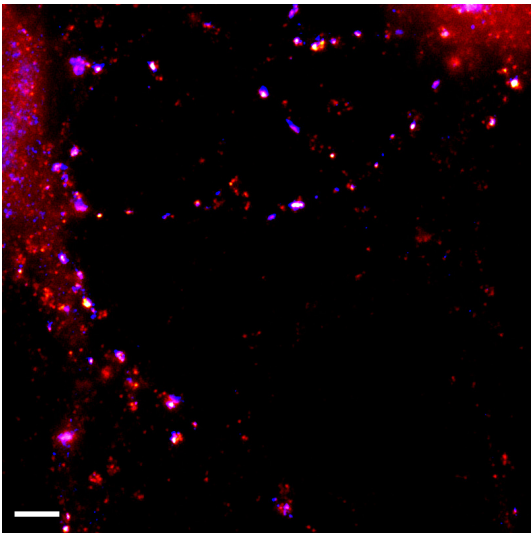
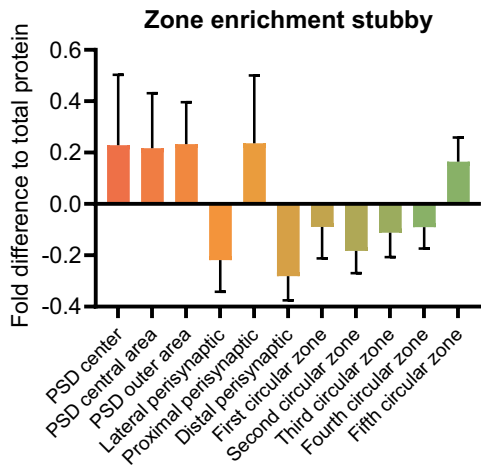
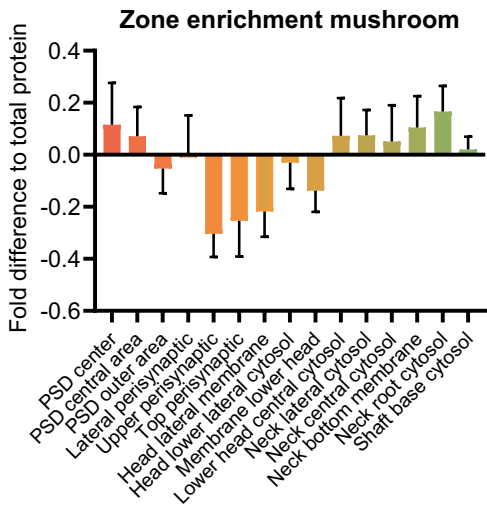
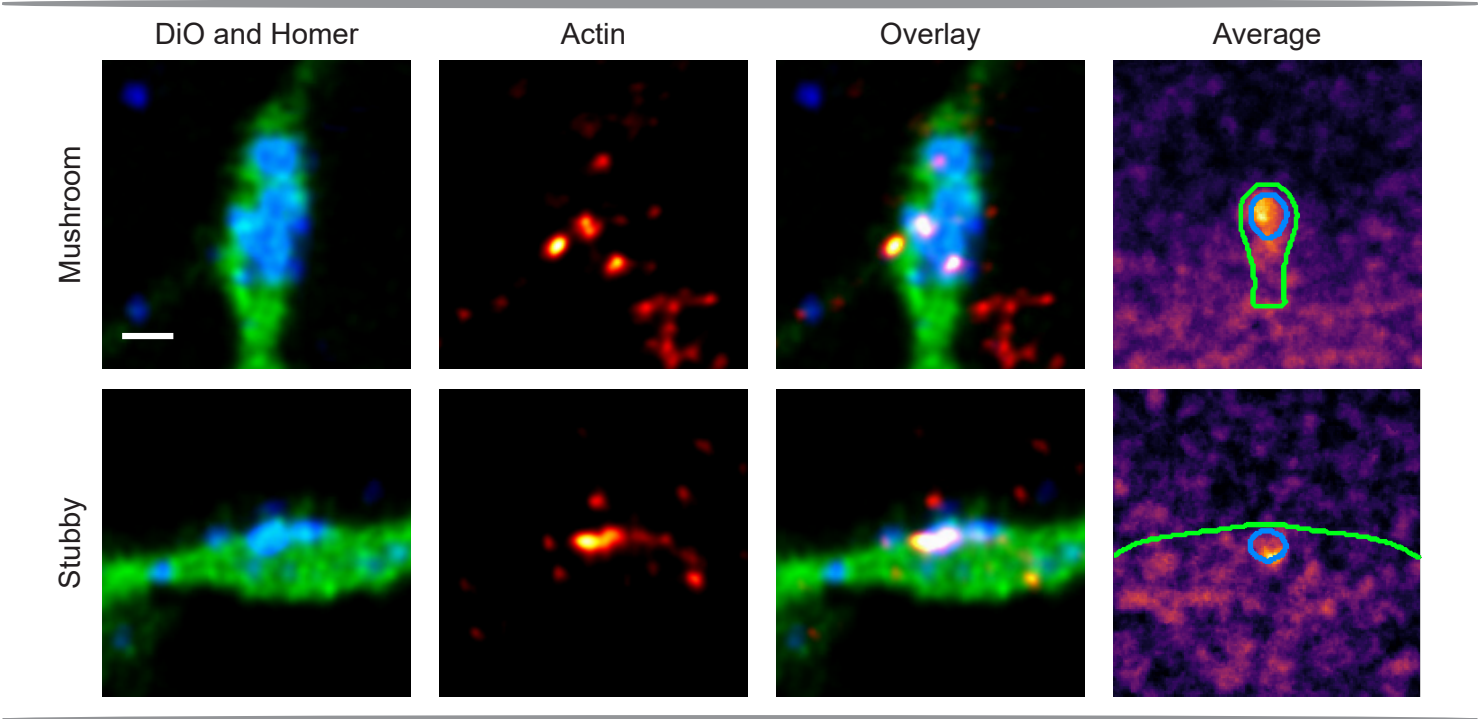
Wu et al., 2017, J. Neurosci.

SynGAP1 (p135 SynGAP, Gene: Syngap1, Uniprot ID: Q9QUH6)

Known function: RasGAP, Important for plasticity, regulates spine morphology, MAPK and ERK pathways

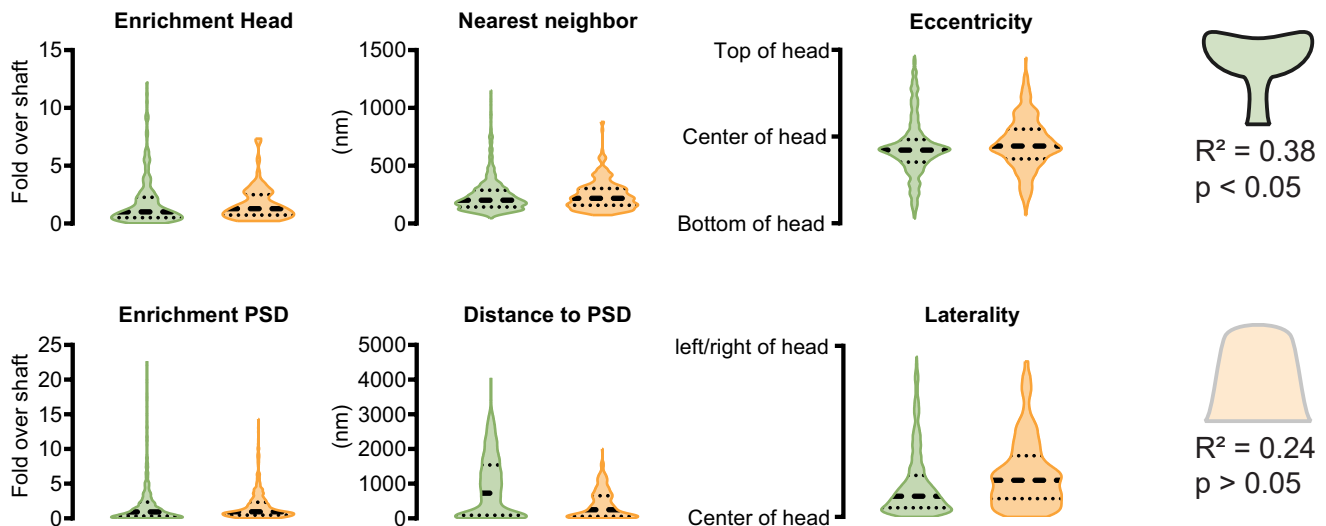
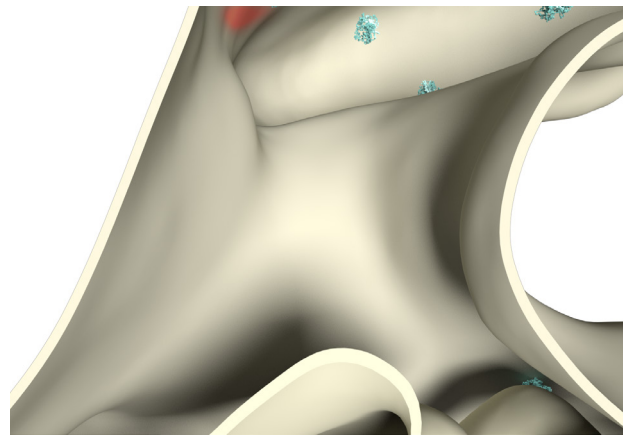
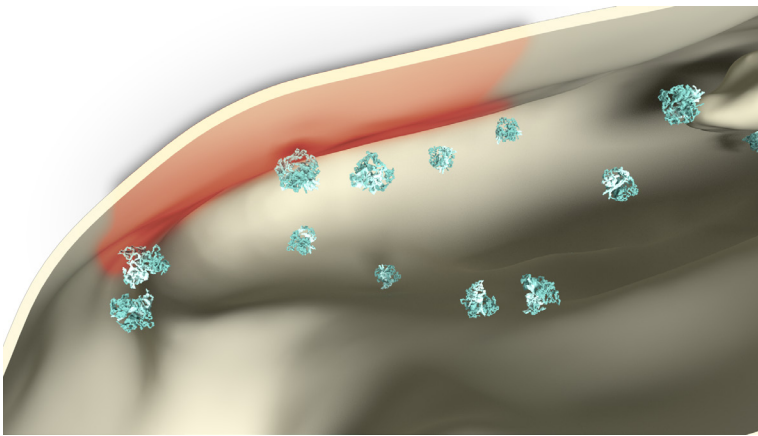
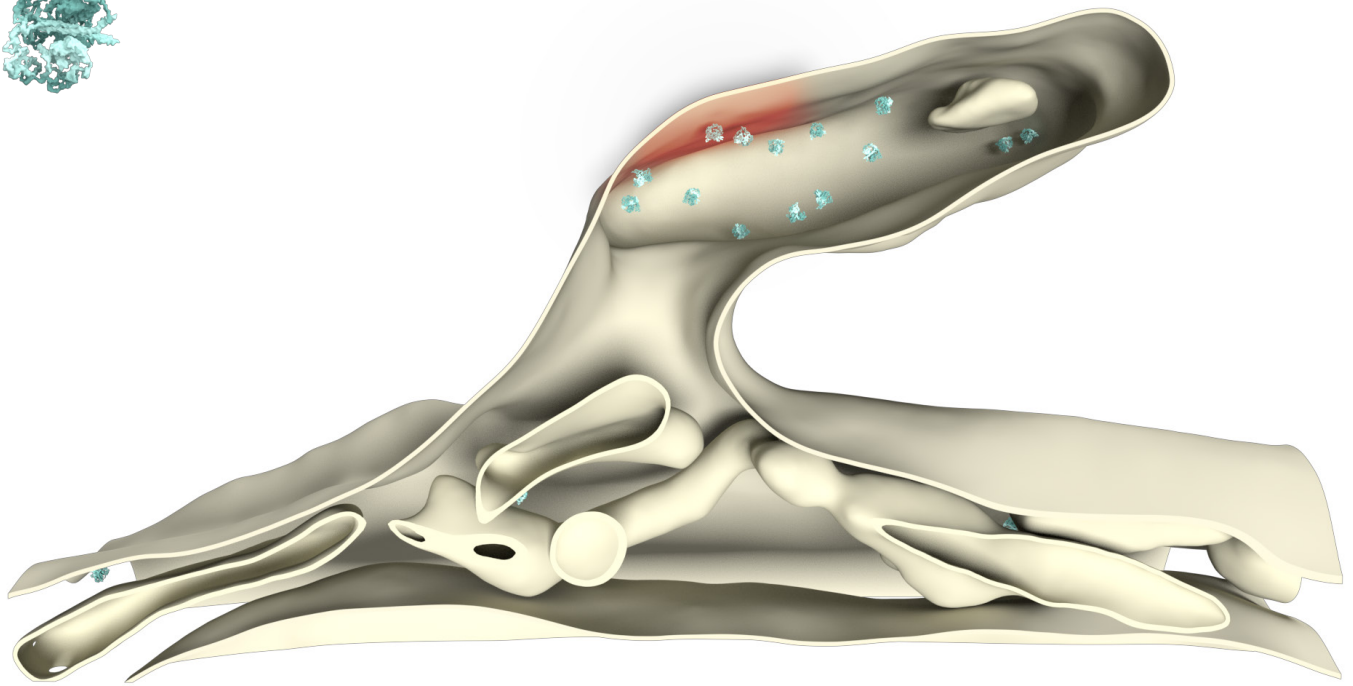
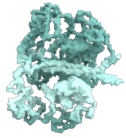
Known organization: In PSD

Known Interactions: CaMKII, NMDAR, PSD95

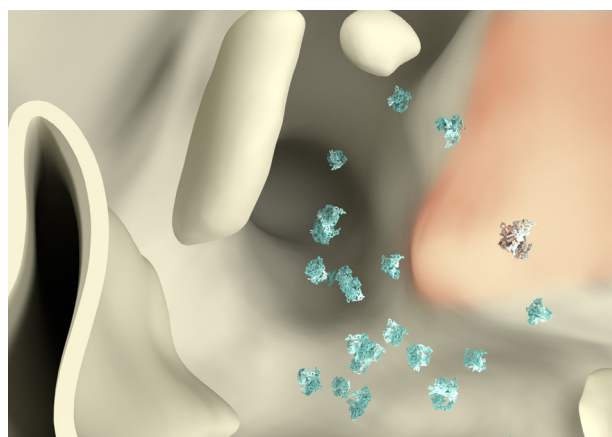
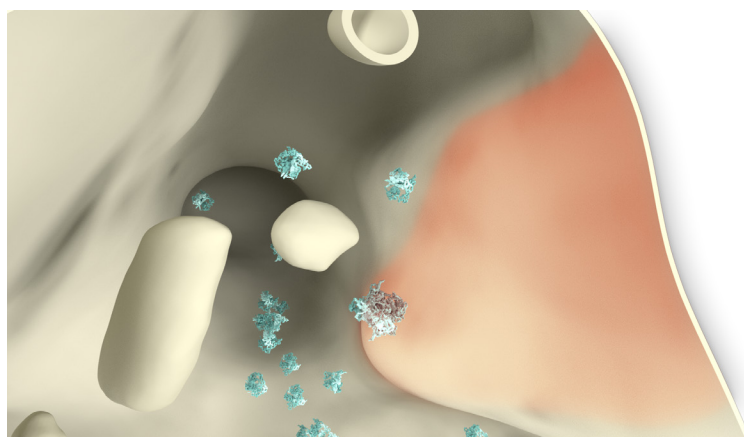
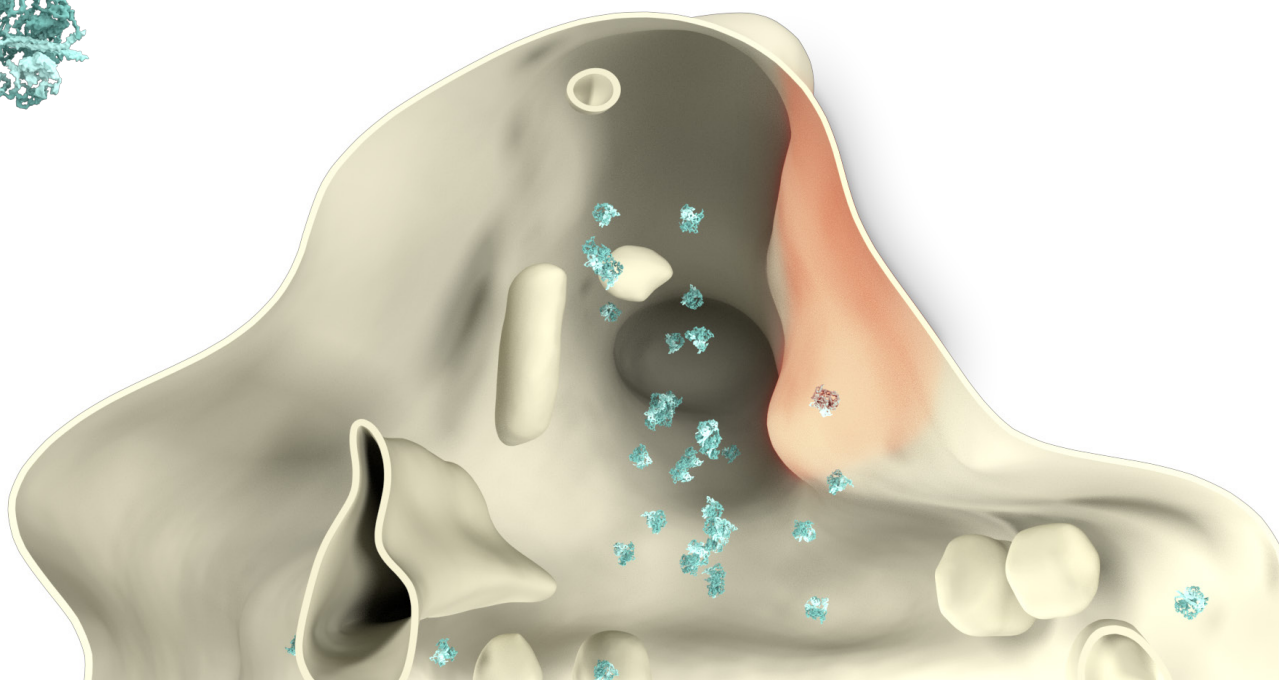
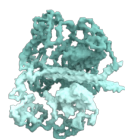


Whole cell copy number	231547.0 ± 35936.5	
Spine copy number	131.8 ± 25.3	
Function	Signaling	
	Mushroom	Stubby
Spine copy number	117.5 ± 22.6	131.7 ± 25.3
% of total protein	0.1 ± 0.0%	0.1 ± 0.0%
Molarity (µM)	1.5 ± 0.3	1.2 ± 0.2
PSD copy number	47 ± 0.9	36 ± 6.9
% in PSD	40.0 ± 7.7%	27.3 ± 5.3%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	117.5 ± 22.6	$0.1 \pm 0.0\%$	1.5 ± 0.3	47 ± 0.9
Stubby	131.7 ± 25.3	$0.1 \pm 0.0\%$	1.2 ± 0.2	36 ± 6.9



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	117.5 ± 22.6	$0.1 \pm 0.0\%$	1.5 ± 0.3	47 ± 0.9
Stubby	131.7 ± 25.3	$0.1 \pm 0.0\%$	1.2 ± 0.2	36 ± 6.9



References

Antibody: Thermo Scientific PA1-046

PDB Identifier: 5jxb, 5jxc, 3bxj

Literature:

Chen et al., 1998, Neuron

Clement et al., 2012, Cell

Clement et al., 2013, J. Neurosci.

Grant & O'Dell, 2001, Curr. Opin. Neurobiol.

Grant, 2003, Bioessays

Jeyabalan & Clement, 2016, Front. Cell. Neurosci.

Kim et al., 1998, Neuron

Komiyama et al., 2002, J. Neurosci.

Krapivinsky et al., 2004, Neuron

Pena et al., 2008, EMBO Rep.

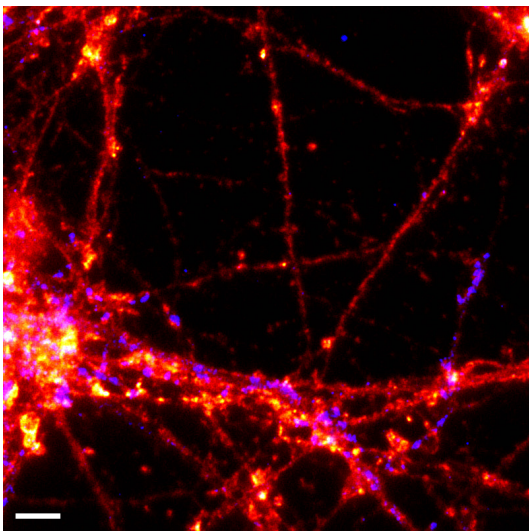
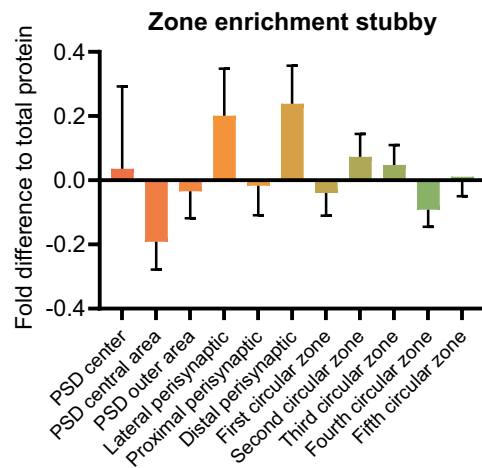
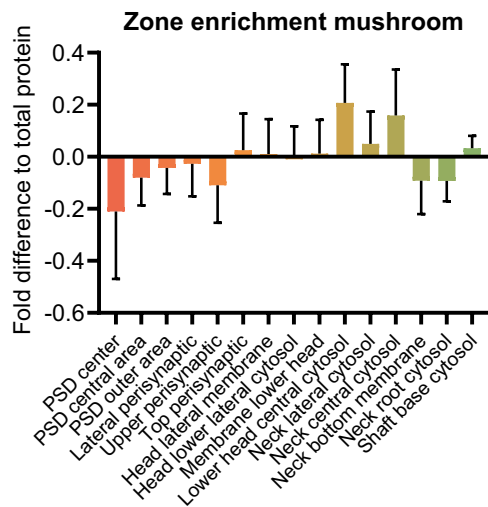
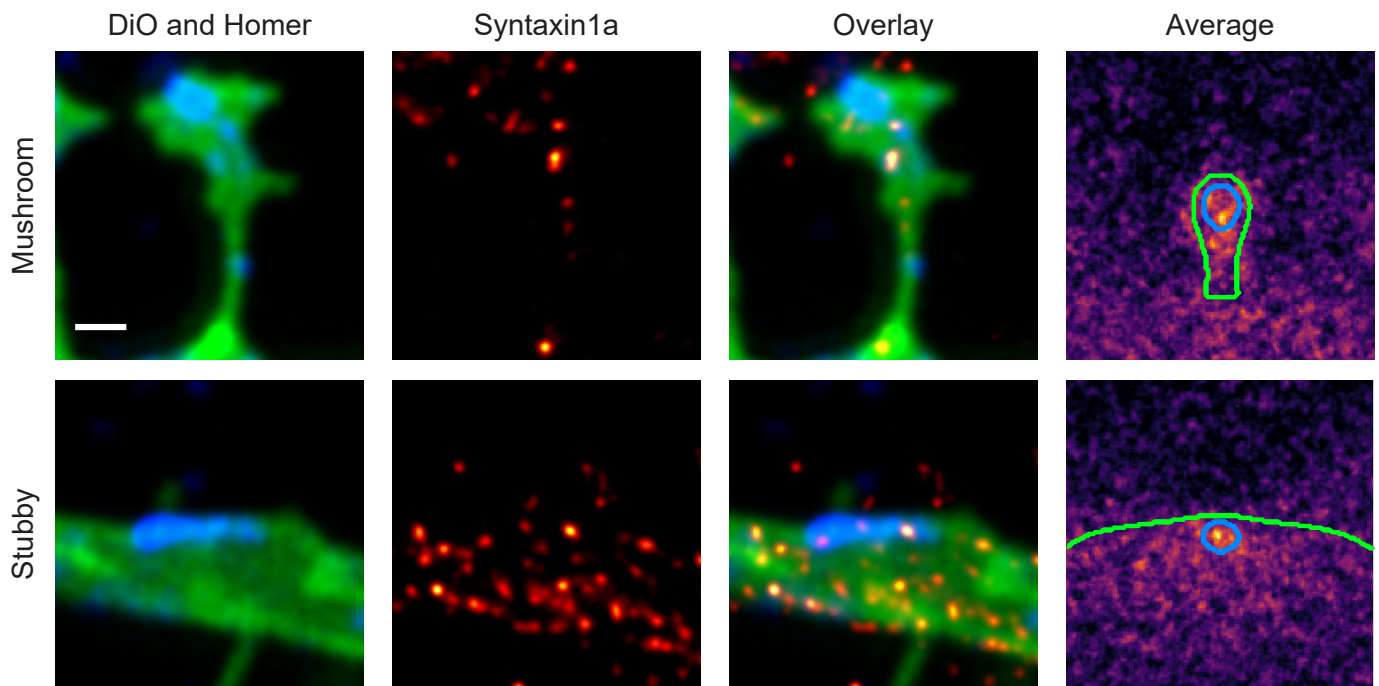
Rumbaugh et al., 2006, Proc. Natl. Acad. Sci. U S A

Syntaxin1a (Gene: Stx1a, Uniprot ID: P32851)

Known function: Qa SNARE, SV fusion, Delivery of AMPAR and GABAAR to PM

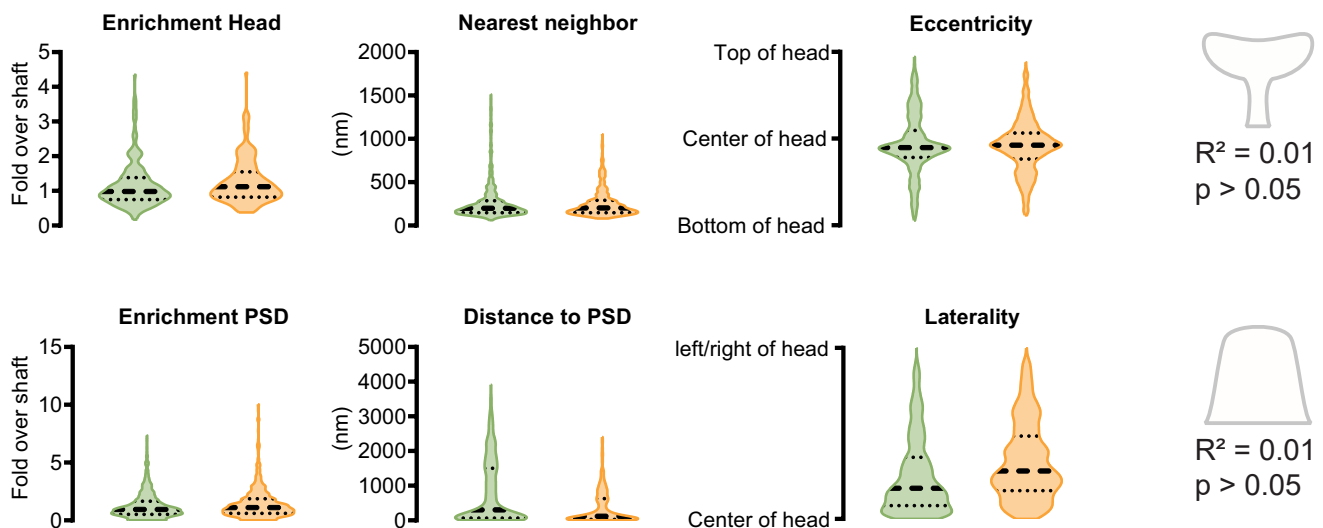
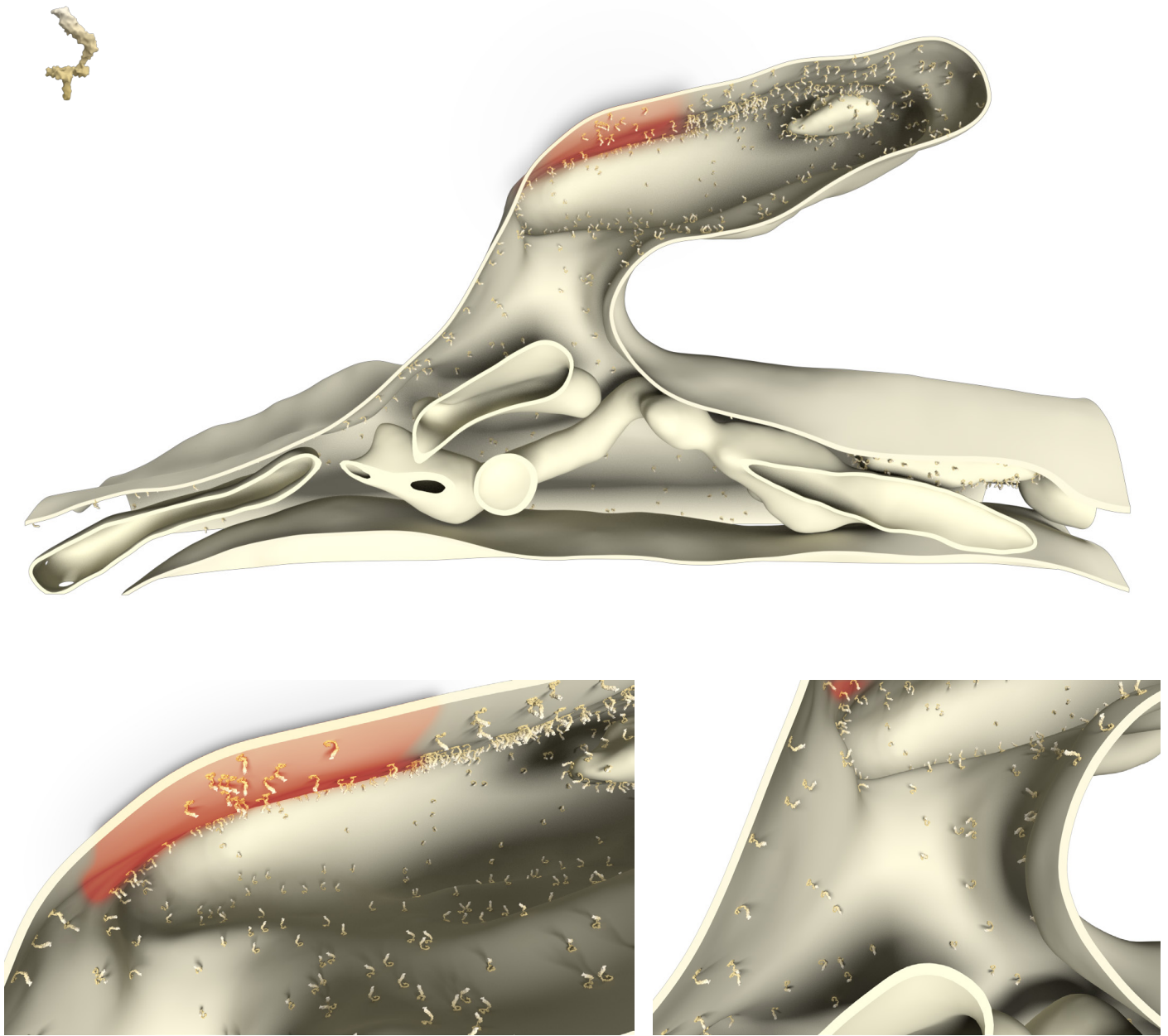
Known organization: Transmembrane protein, On PM, Homooligomeric clusters

Known Interactions: VAMP1, VAMP2, SNAP25

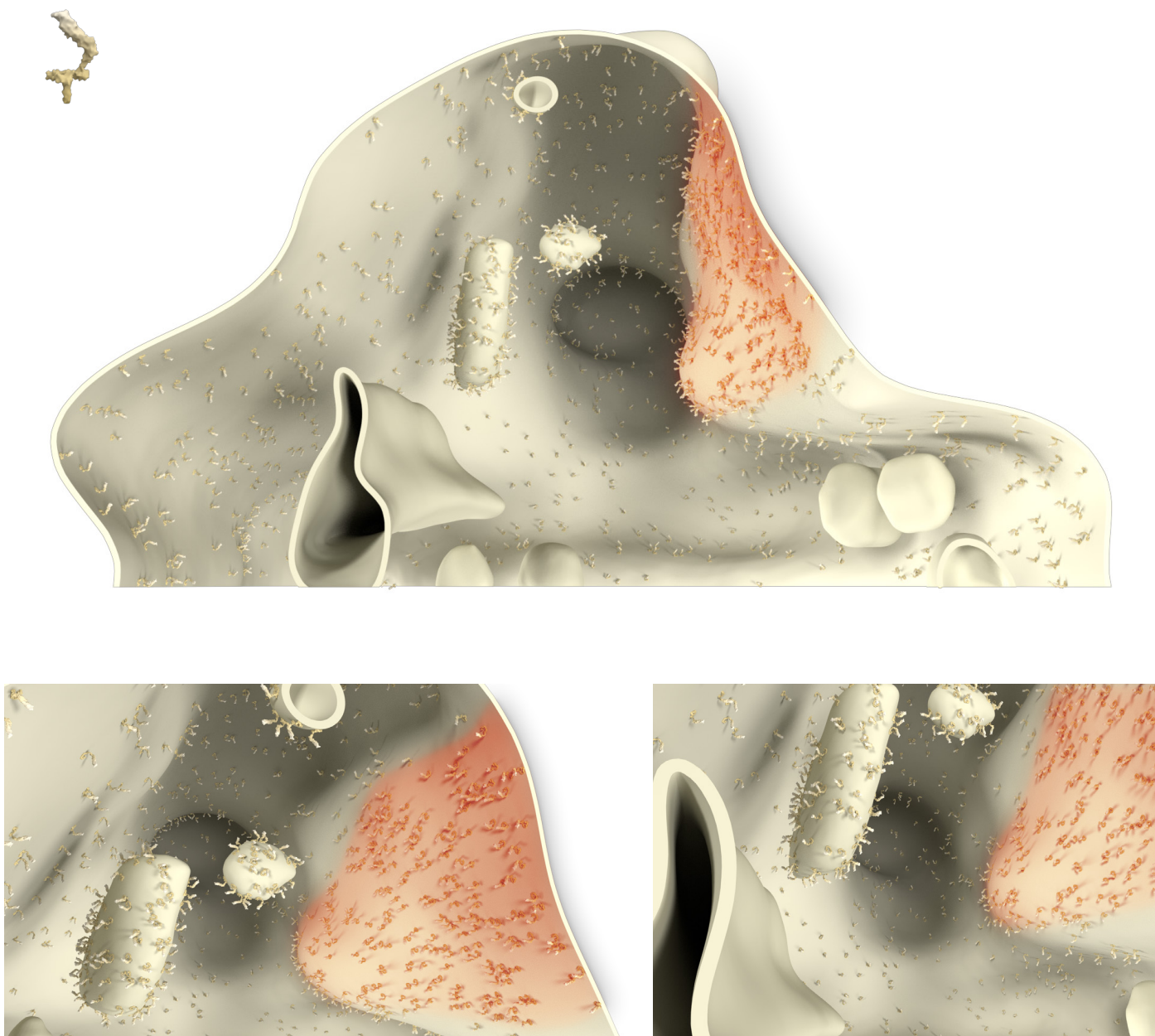


Whole cell copy number	16247222.1 ± 2820308.7	
Spine copy number	1806.0 ± 560.8	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	1596.2 ± 495.6	2149.3 ± 667.3
% of total protein	0.3 ± 0.1%	0.3 ± 0.1%
Molarity (μM)	20.3 ± 6.3	20.3 ± 6.3
PSD copy number	176 ± 54.6	261 ± 81.0
% in PSD	11.0 ± 3.4%	12.1 ± 3.8%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1596.2 ± 495.6	$0.3 \pm 0.1\%$	20.3 ± 6.3	176 ± 54.6
Stubby	2149.3 ± 667.3	$0.3 \pm 0.1\%$	20.3 ± 6.3	261 ± 81.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1596.2 ± 495.6	$0.3 \pm 0.1\%$	20.3 ± 6.3	176 ± 54.6
Stubby	2149.3 ± 667.3	$0.3 \pm 0.1\%$	20.3 ± 6.3	261 ± 81.0



References

Antibody: Synaptic Systems 110 011

PDB Identifier: 2m8r, 1bro

Literature:

Calakos et al., 1994, Science

Hussain et al., 2016, Front. Mol. Neurosci.

Lang et al., 2002, J. Cell. Biol.

Maidorn, 2019, Mabs

Oyler et al., 1989, J. Cell. Biol.

Sieber et al., 2006, Biophys. J.

Sieber et al., 2007, Science

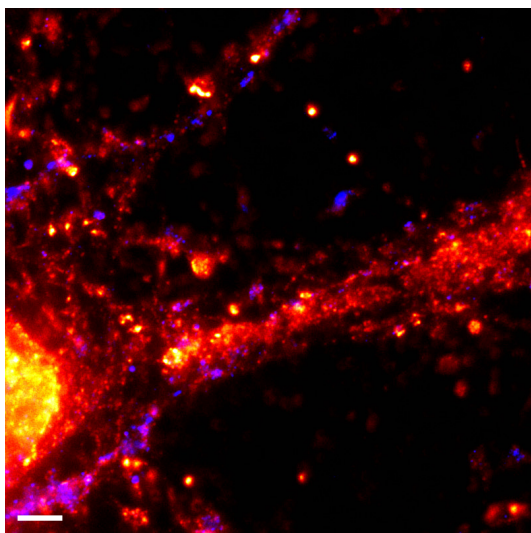
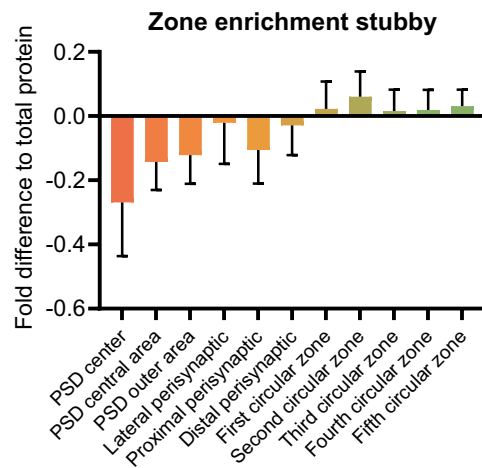
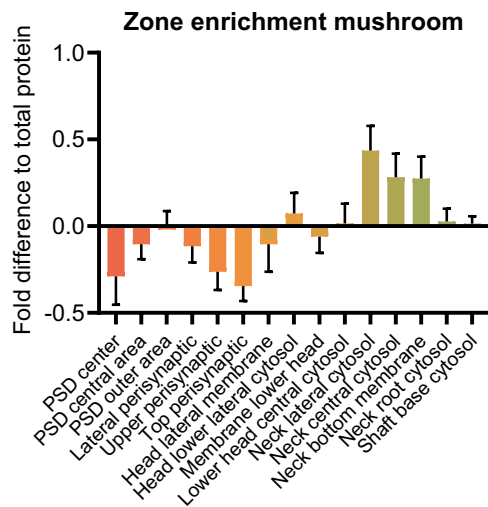
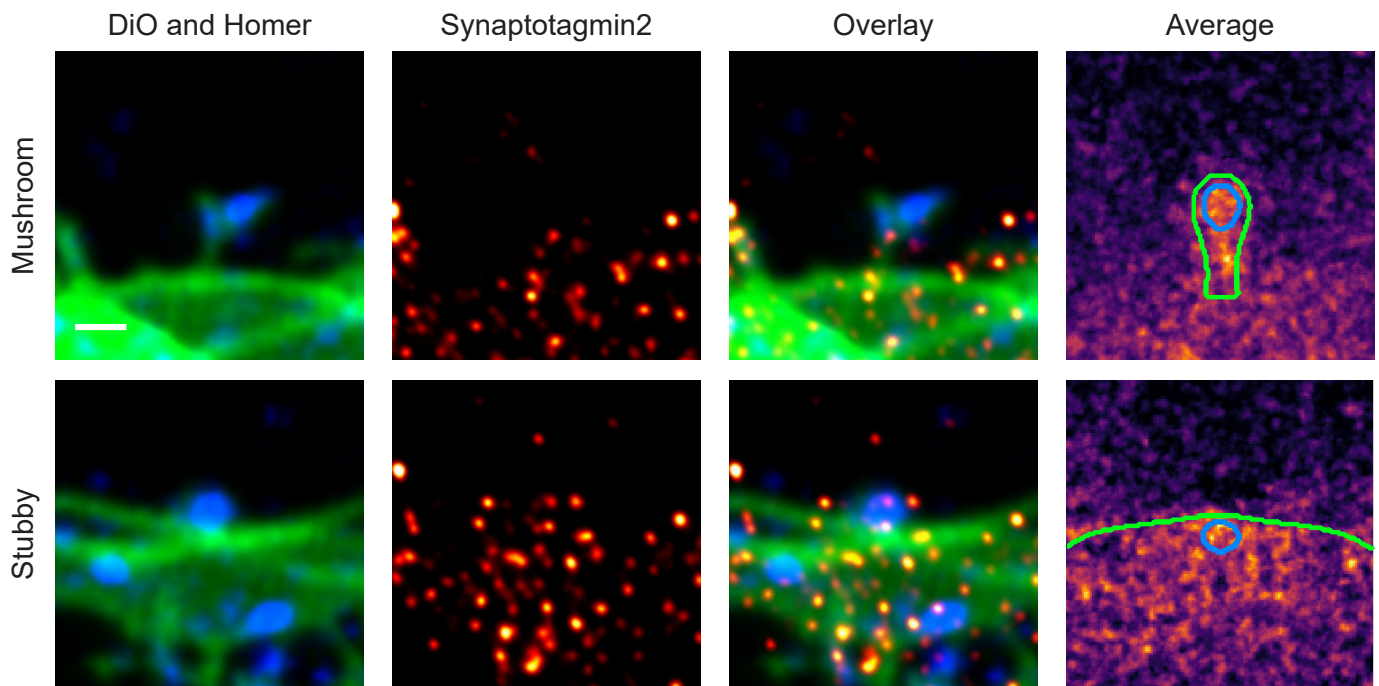
Trimble et al., 1988, Proc. Natl. Acad. Sci. U S A

Syntaxin2 (Epimorphin, Gene: Stx2, Uniprot ID: P50279)

Known function: Qa SNARE, Endosome-Recycling Endosome fusion, LDCV release

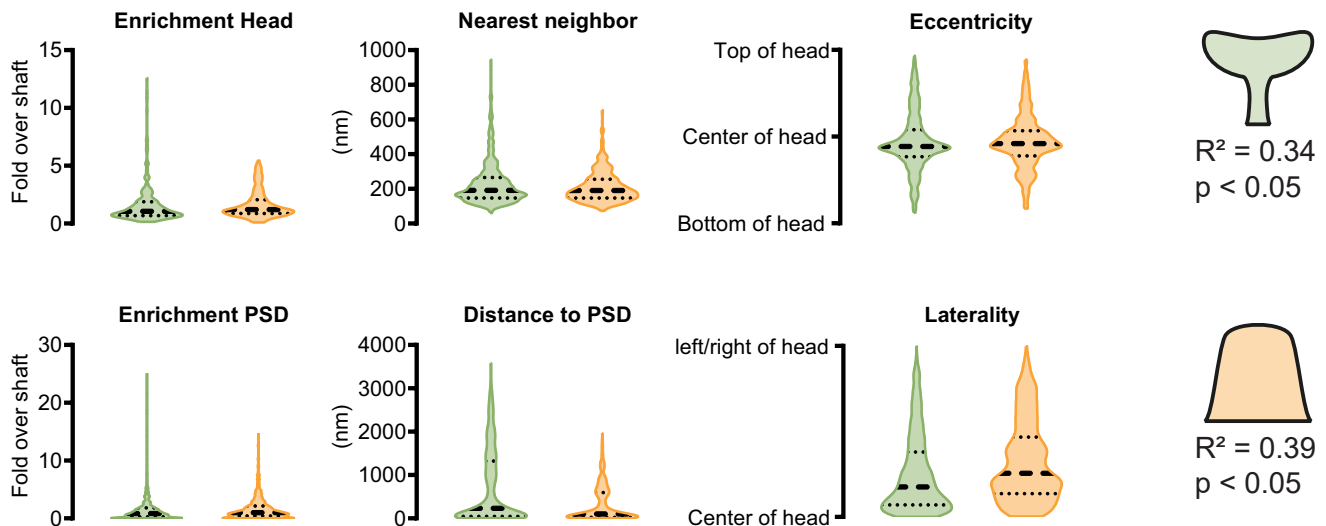
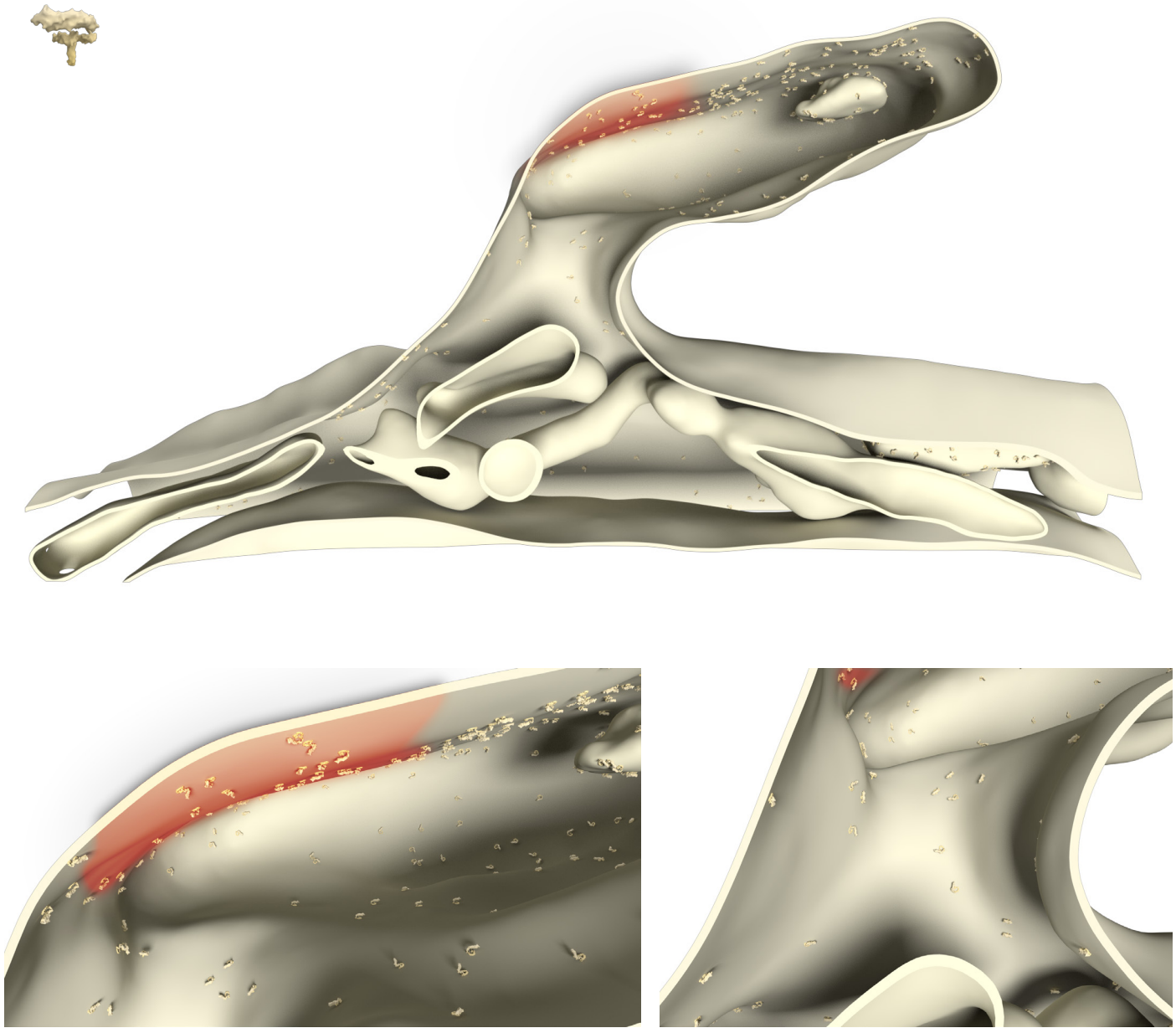
Known organization: Transmembrane protein, On PM

Known Interactions: VAMP1, VAMP2, VAMP7, SNAP23

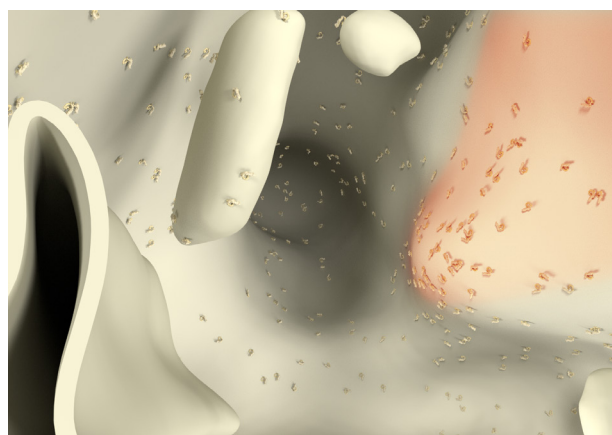
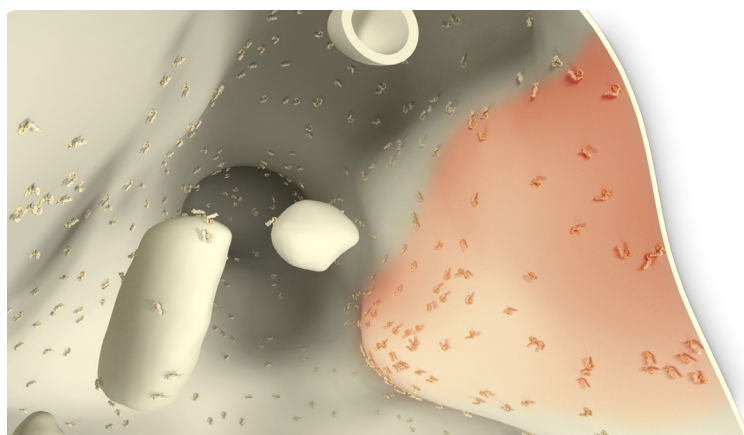
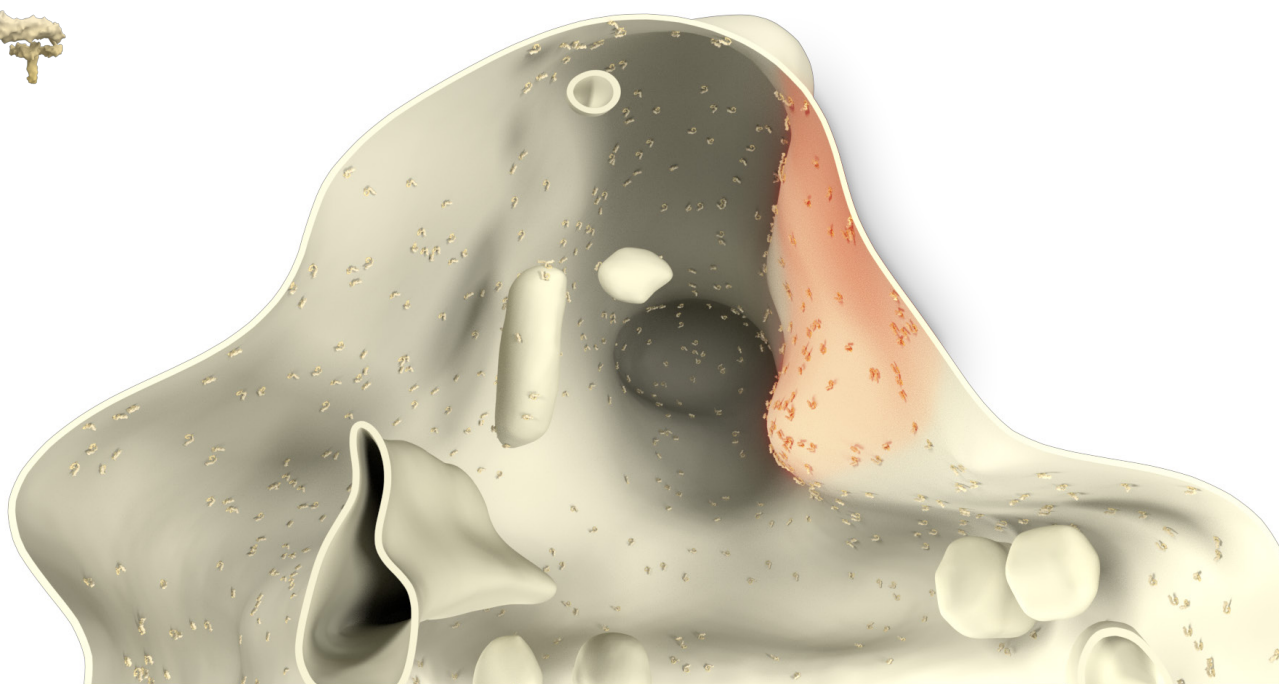


Whole cell copy number	3413950.0 ± 588226.1	
Spine copy number	913.5 ± 205.8	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	825.5 ± 186.0	1114.5 ± 251.1
% of total protein	0.1 ± 0.0%	0.2 ± 0.0%
Molarity (μM)	10.5 ± 2.4	10.5 ± 2.4
PSD copy number	155 ± 34.9	108 ± 24.3
% in PSD	18.8 ± 4.2%	9.7 ± 2.2%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	825.5 ± 186.0	$0.1 \pm 0.0\%$	10.5 ± 2.4	155 ± 34.9
Stubby	1114.5 ± 251.1	$0.2 \pm 0.0\%$	10.5 ± 2.4	108 ± 24.3



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	825.5 ± 186.0	$0.1 \pm 0.0\%$	10.5 ± 2.4	155 ± 34.9
Stubby	1114.5 ± 251.1	$0.2 \pm 0.0\%$	10.5 ± 2.4	108 ± 24.3



References

Antibody: Synaptic Systems 110 022

PDB Identifier: modified Syntaxin1

Literature:

Calakos et al., 1994, Science

Chen et al., 2000, Blood

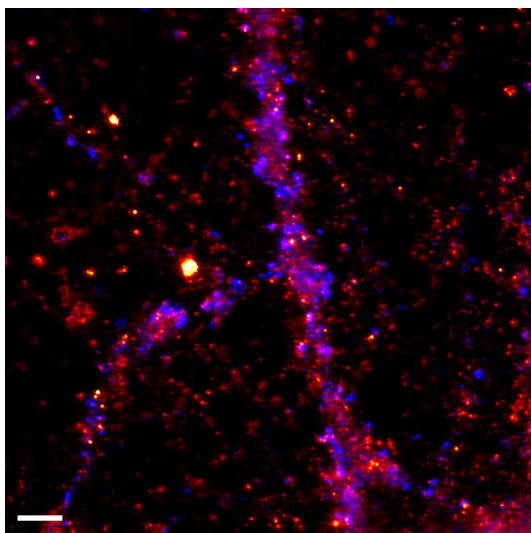
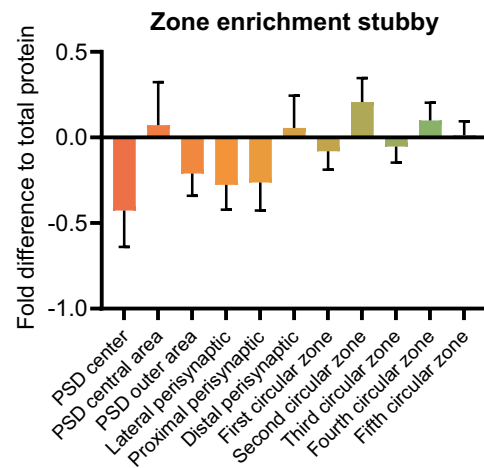
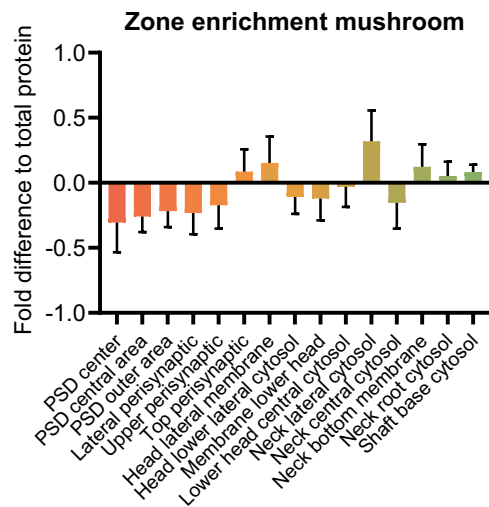
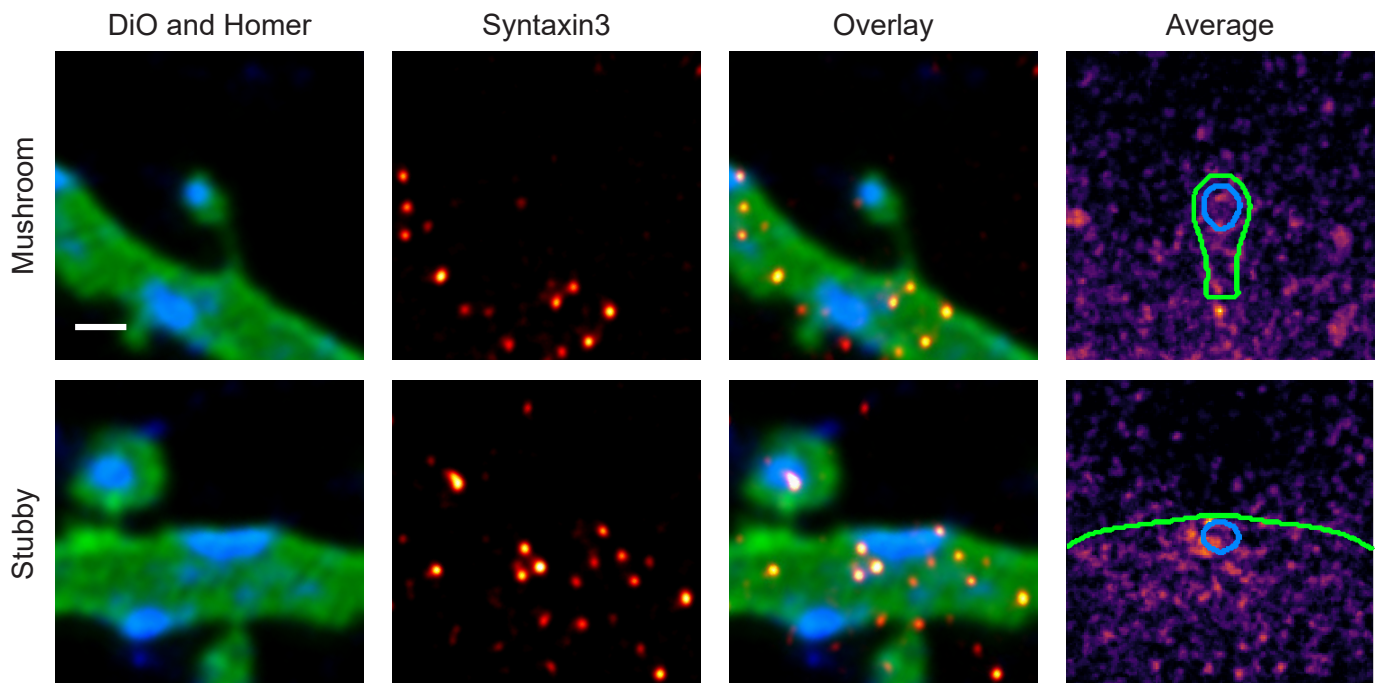
Kennedy et al., 2010, Cell

Syntaxin3 (Gene: Stx3, Uniprot ID: Q08849)

Known function: Qa SNARE, Delivery of AMPAR during LTP

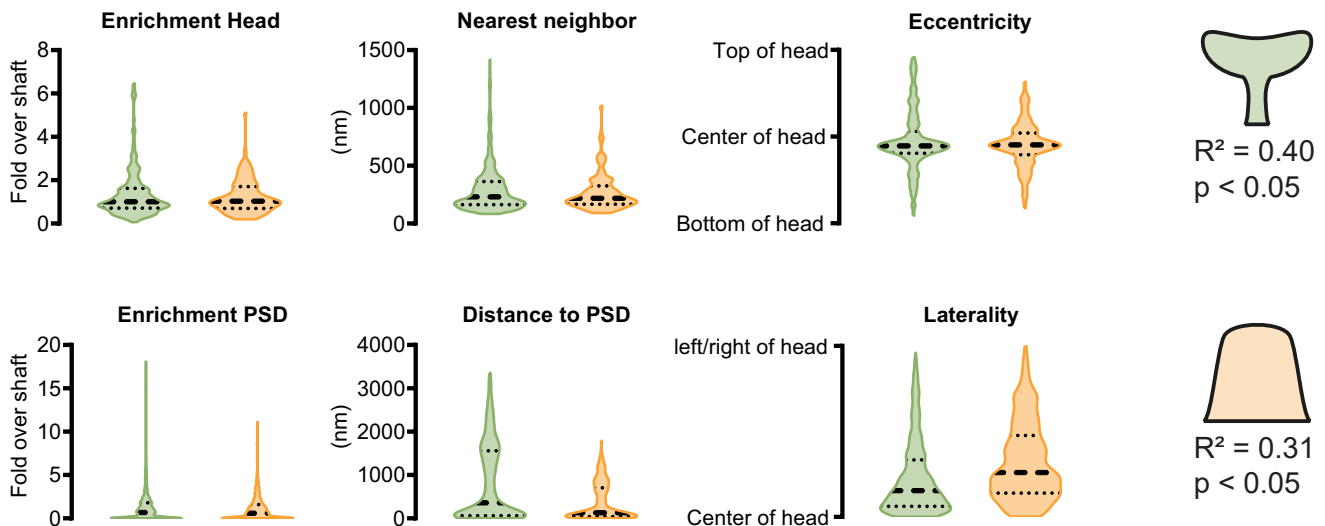
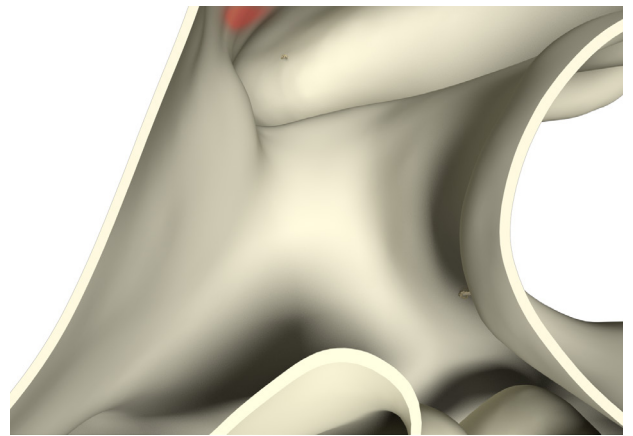
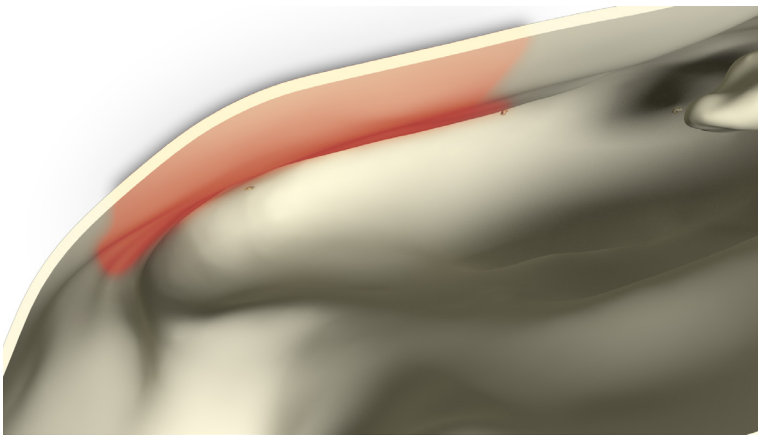
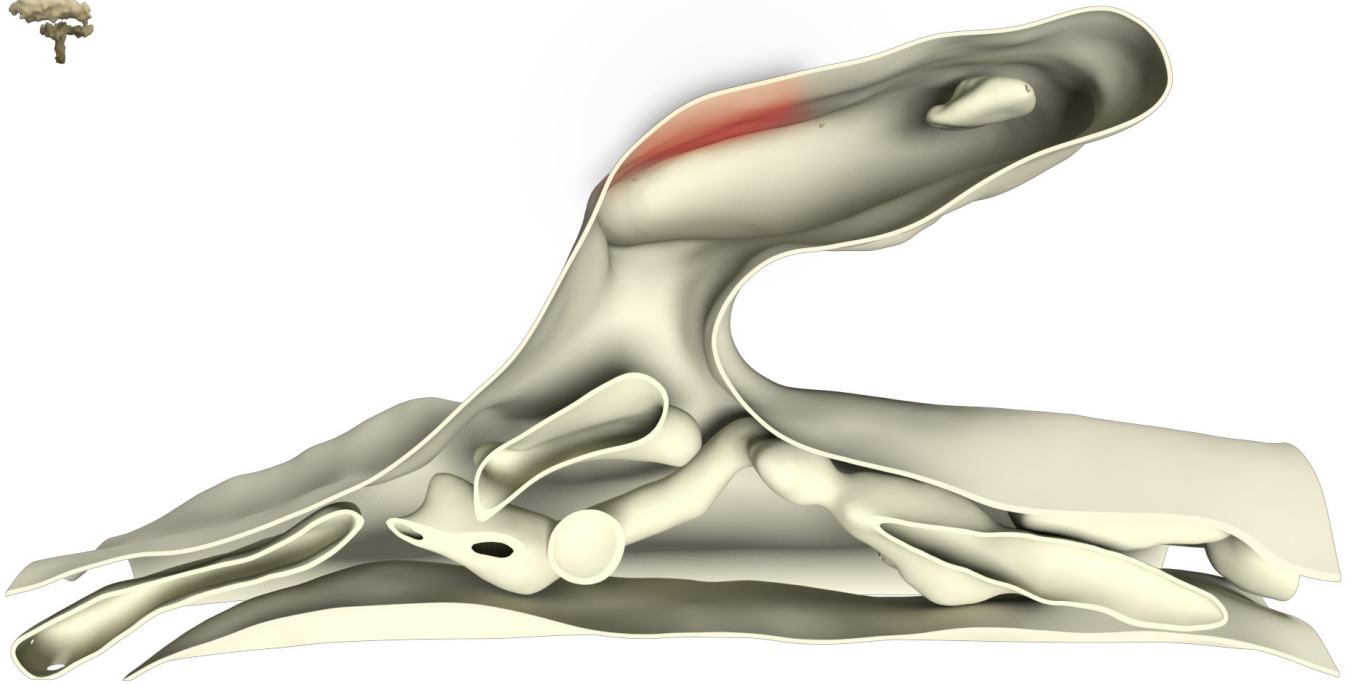
Known organization: Transmembrane protein, On PM

Known Interactions: SNAP47, VAMP2

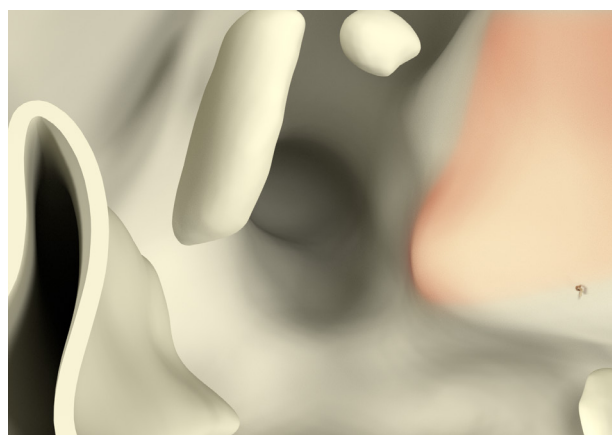
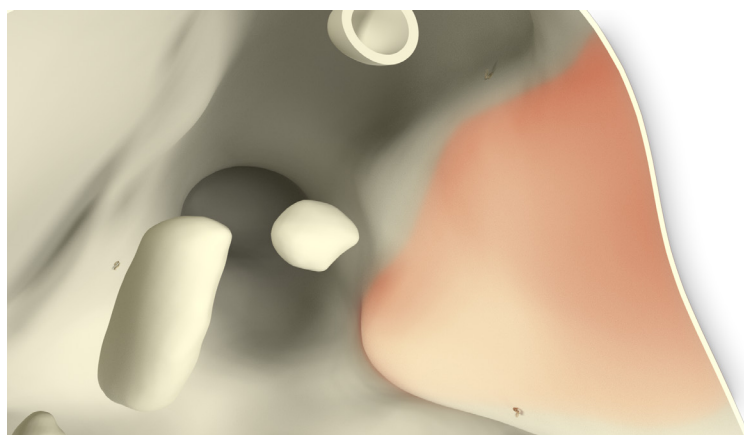
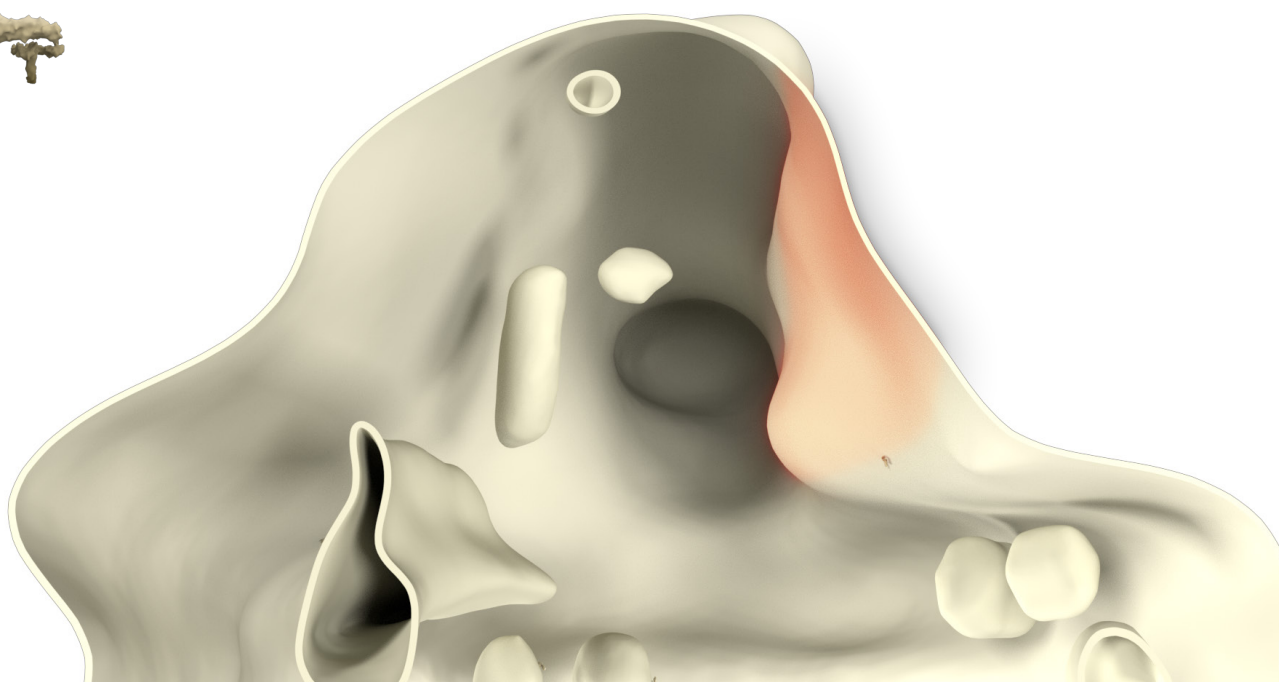


Whole cell copy number	81279.9 ± 0 (only detected in 1 replicate)	
Spine copy number	13.9 ± 2.5	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	12.4 ± 2.2	18 ± 3.3
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.2 ± 0.0	0.2 ± 0.0
PSD copy number	1 ± 0.0	1 ± 0.0
% in PSD	8.1 ± 0.0%	5.6 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	12.4 ± 2.2	$0.0 \pm 0.0\%$	0.2 ± 0.0	1 ± 0.0
Stubby	18 ± 3.3	$0.0 \pm 0.0\%$	0.2 ± 0.0	1 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	12.4 ± 2.2	$0.0 \pm 0.0\%$	0.2 ± 0.0	1 ± 0.0
Stubby	18 ± 3.3	$0.0 \pm 0.0\%$	0.2 ± 0.0	1 ± 0.0



References

Antibody: Synaptic Systems 110 033

PDB Identifier: modified Syntaxin1

Literature:

Arendt et al., 2015, Proc. Natl. Acad. Sci. U S A

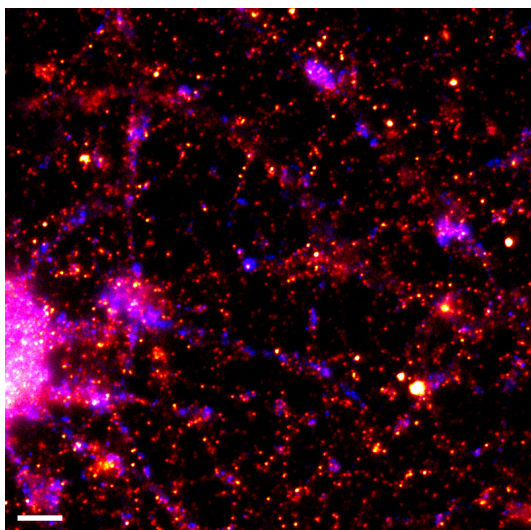
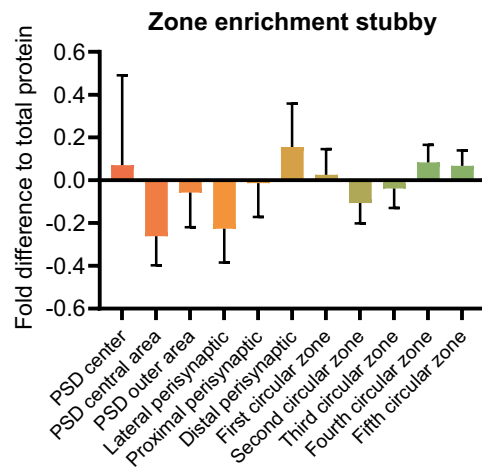
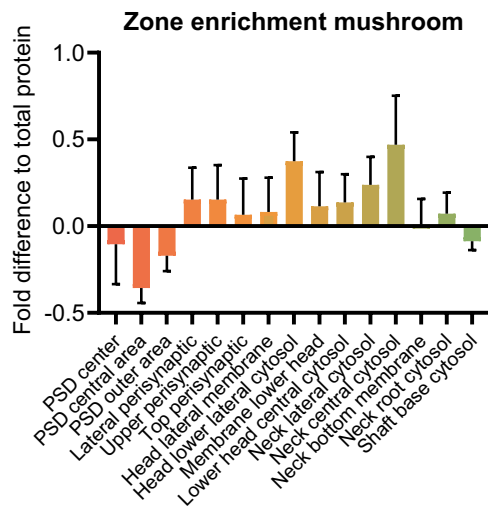
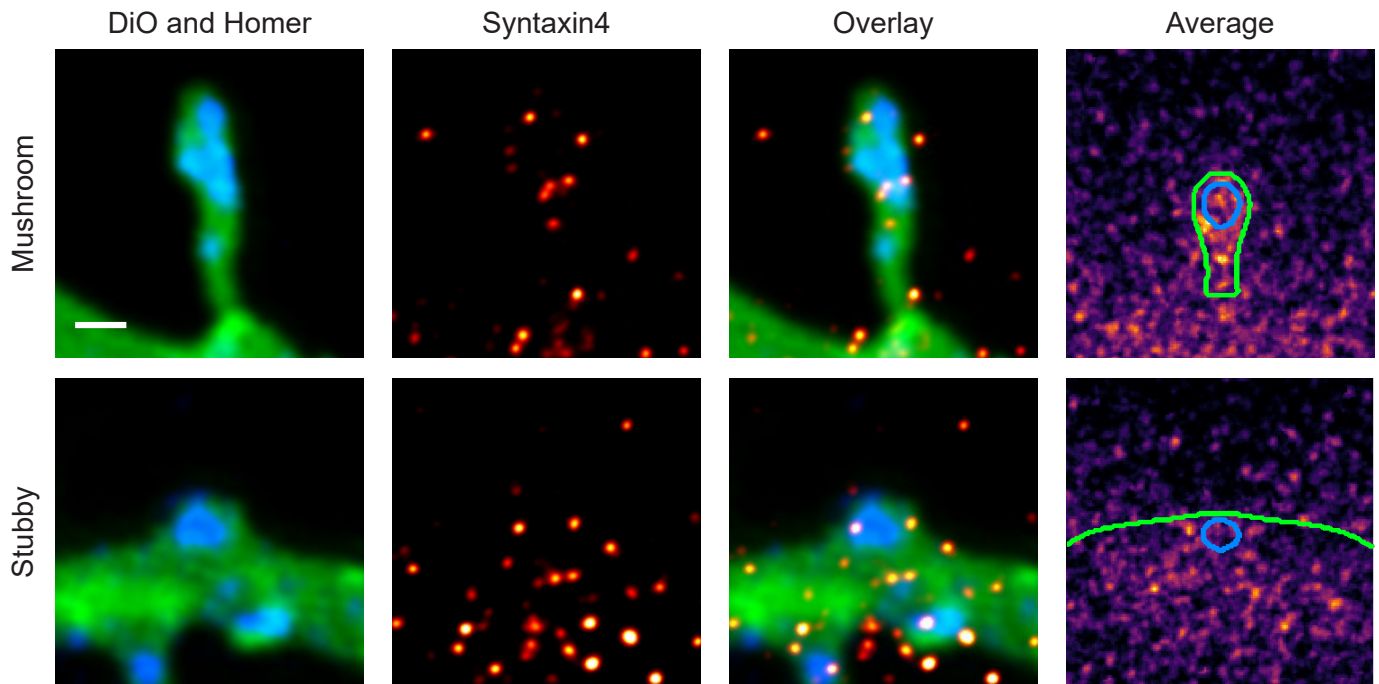
Jurado et al., 2013, Neuron

Syntaxin4 (Gene: Stx4, Uniprot ID: Q08850)

Known function: Qa SNARE, Delivery of AMPAR, NMDAR and Nlg1 to PM, Involved in Homeostatic plasticity, Retrograde signaling, Caveolea fusion

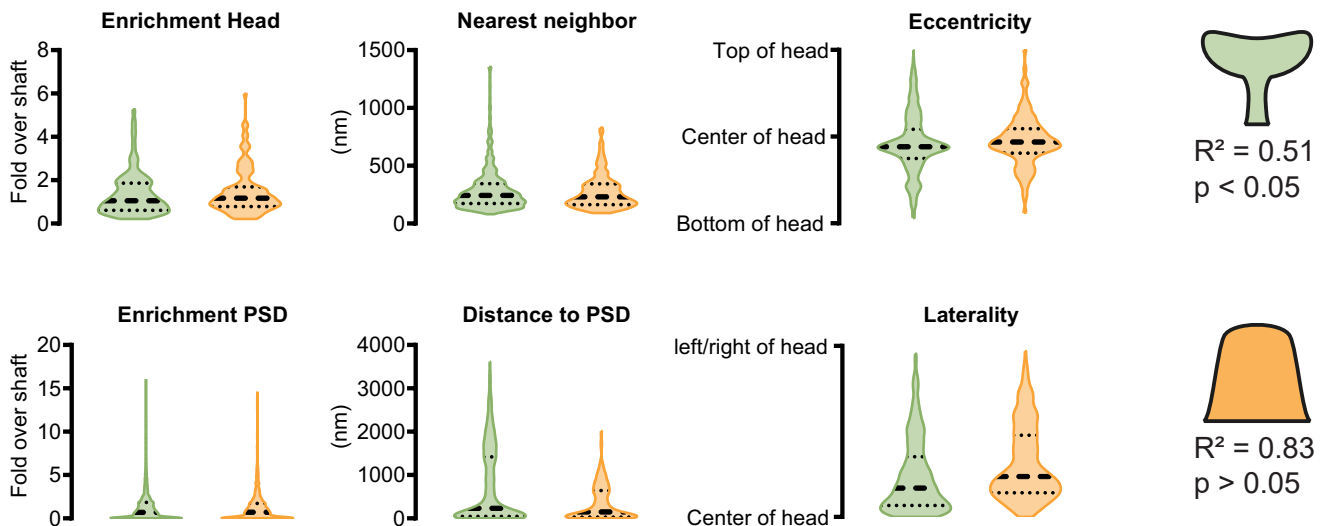
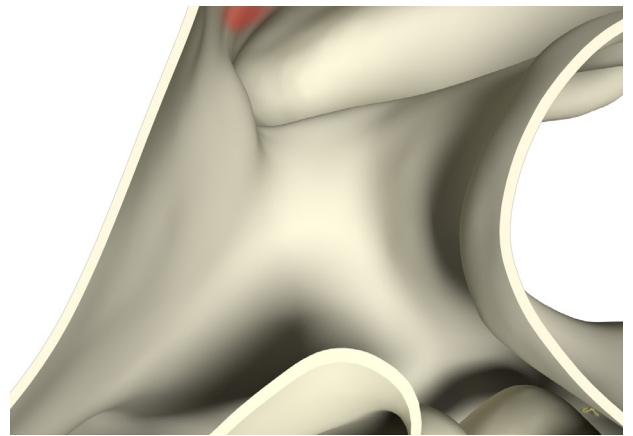
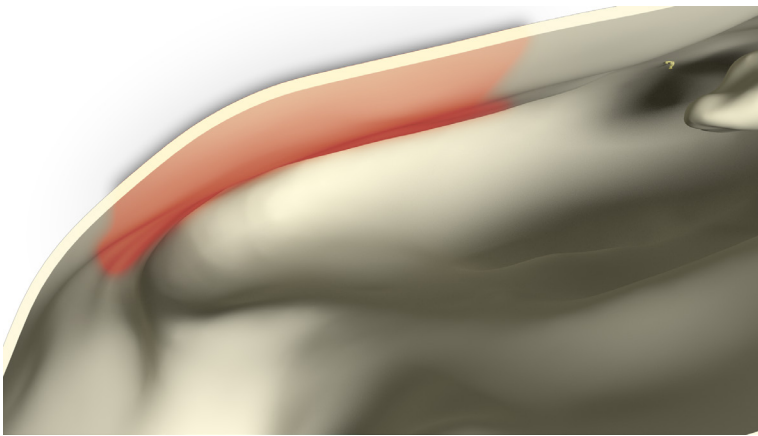
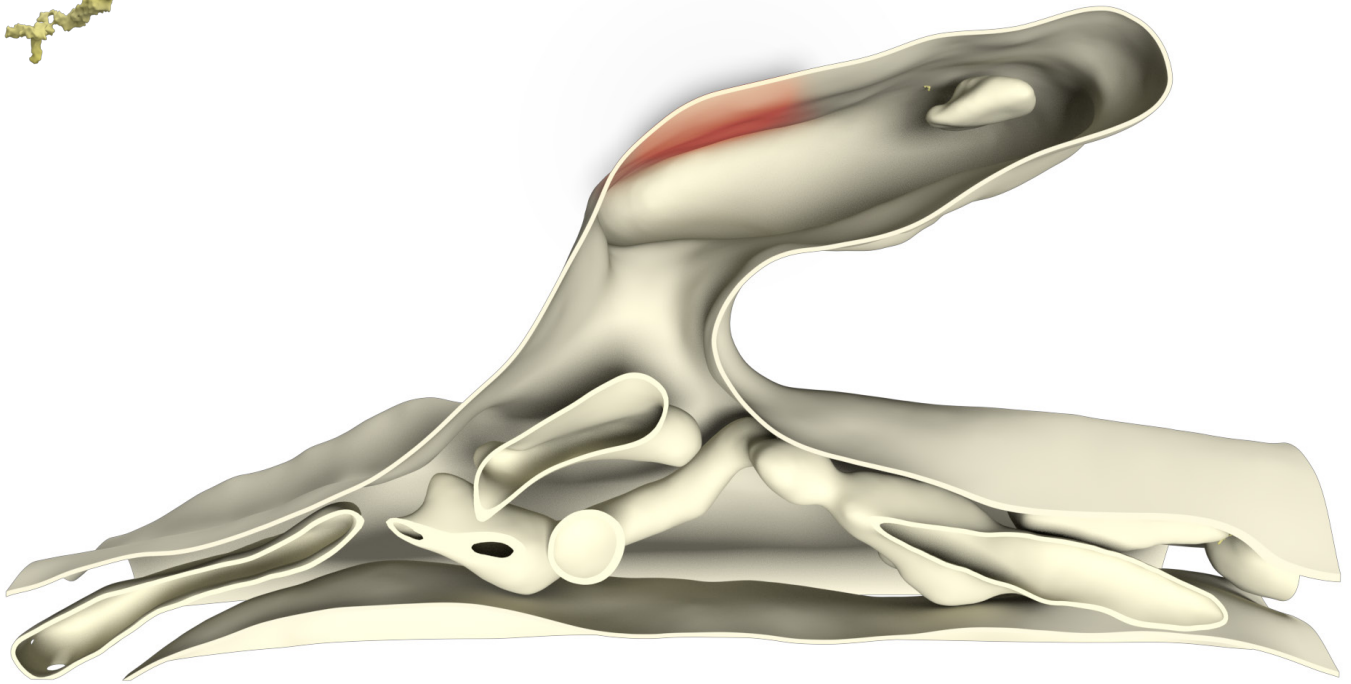
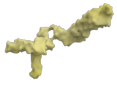
Known organization: Transmembrane protein, Homooligomeric clusters, Lateral spine head

Known Interactions: VAMP1, VAMP2, SNAP23, SNAP47

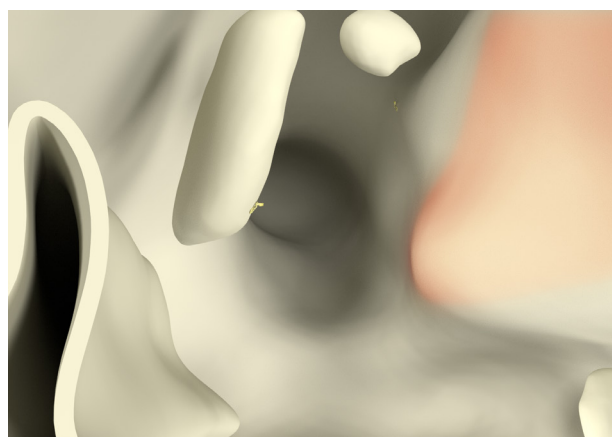
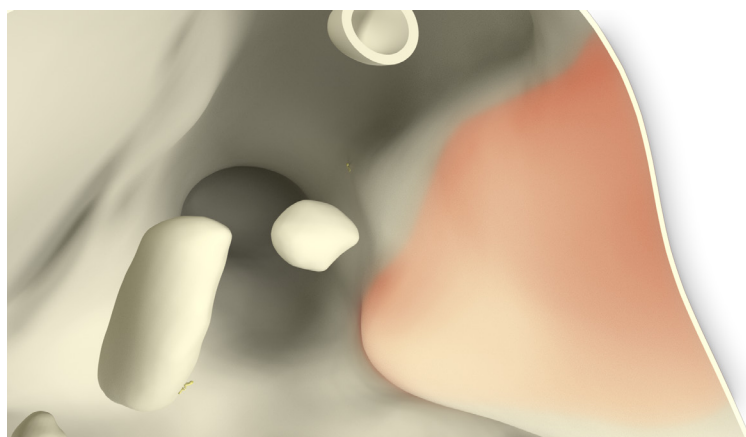
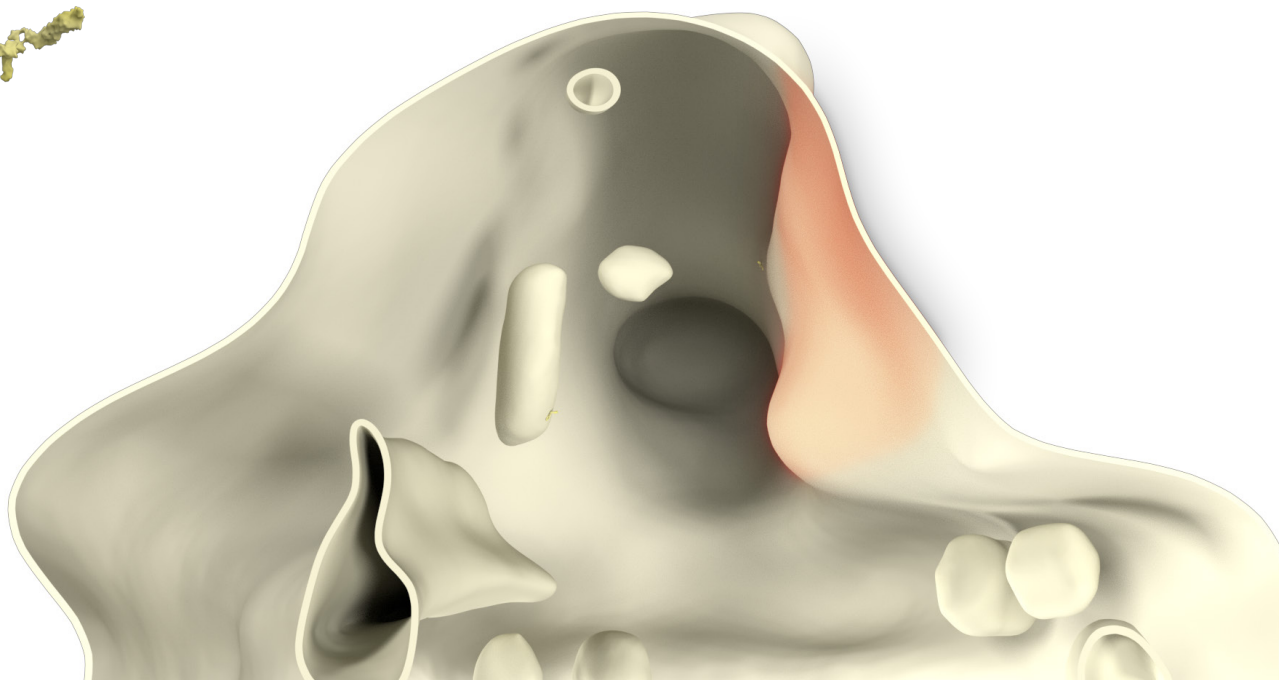
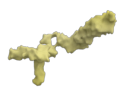


Whole cell copy number	35244.9 ± 0 (only detected in 1 replicate)	
Spine copy number	7.1	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	7.4 ± 1.3	7.6 ± 1.3
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.1 ± 0.0	0.1 ± 0.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	7.4 ± 1.3	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0
Stubby	7.6 ± 1.3	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	7.4 ± 1.3	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0
Stubby	7.6 ± 1.3	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



References

Antibody: Synaptic Systems 110 042

PDB Identifier: modified Syntaxin1

Literature:

Bin et al., 2018, Cell Rep.

Bin et al., 2018, Cell Rep.

Gu and Huganir, 2016, Proc. Natl. Acad. Sci. U S A

Harris et al., 2016, Elife

Kennedy et al., 2010, Cell

Predescu et al., 2005, J. Biol. Chem.

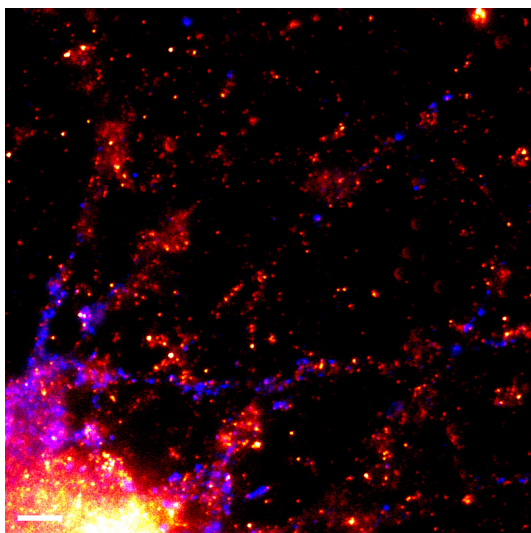
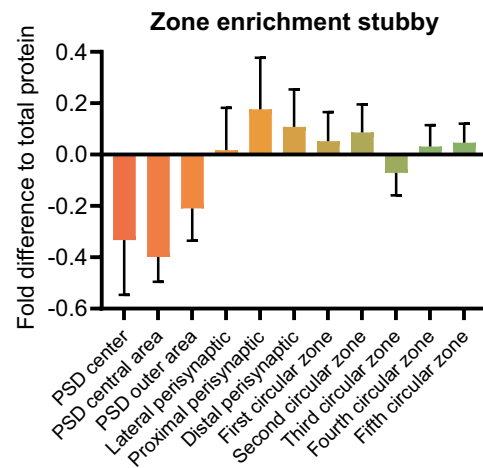
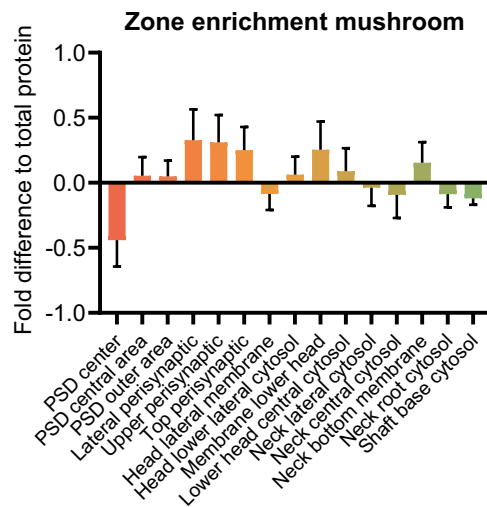
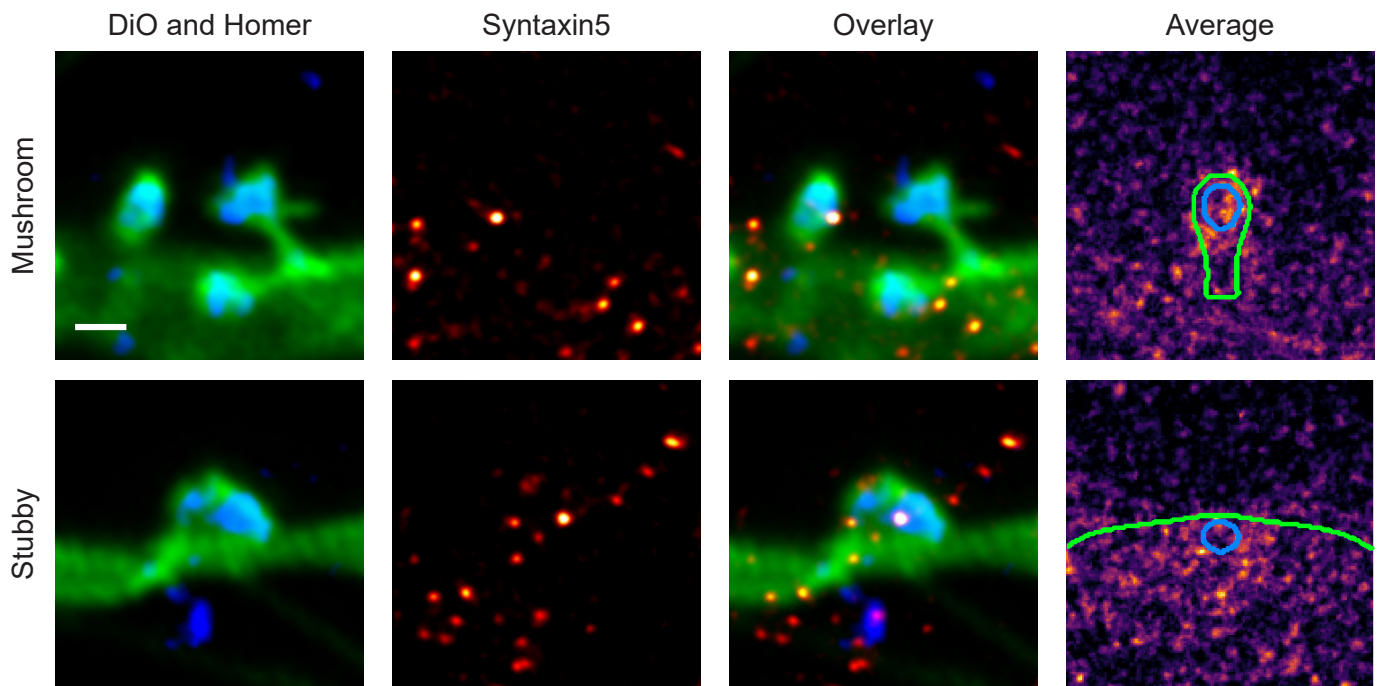
Sieber et al., 2006, Biophys. J.

Syntaxin5 (Gene: Stx5, Uniprot ID: Q08851)

Known function: Qa SNARE, ER-Golgi transport

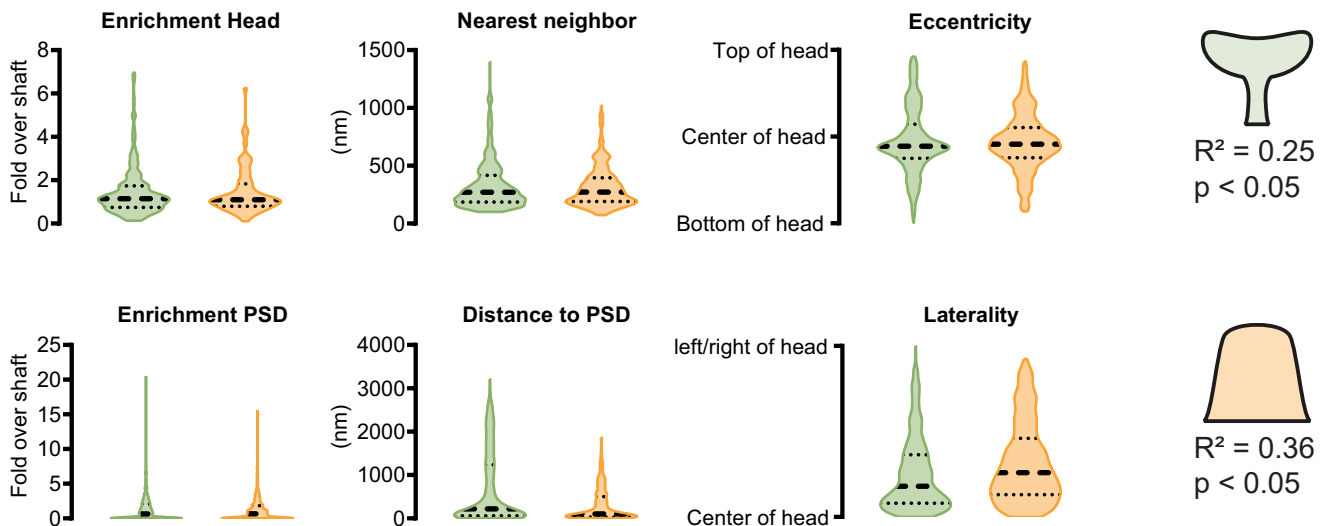
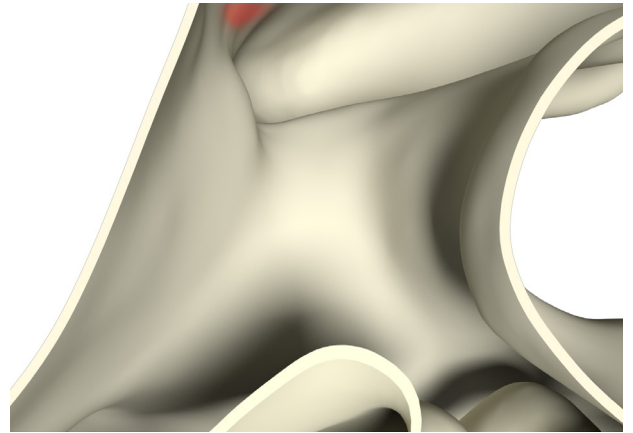
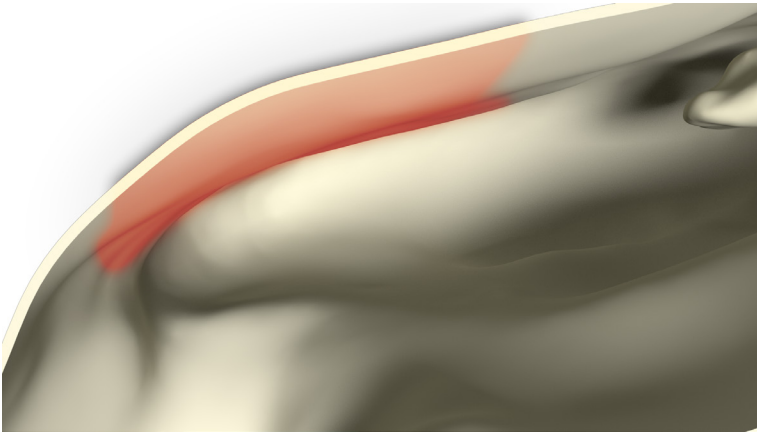
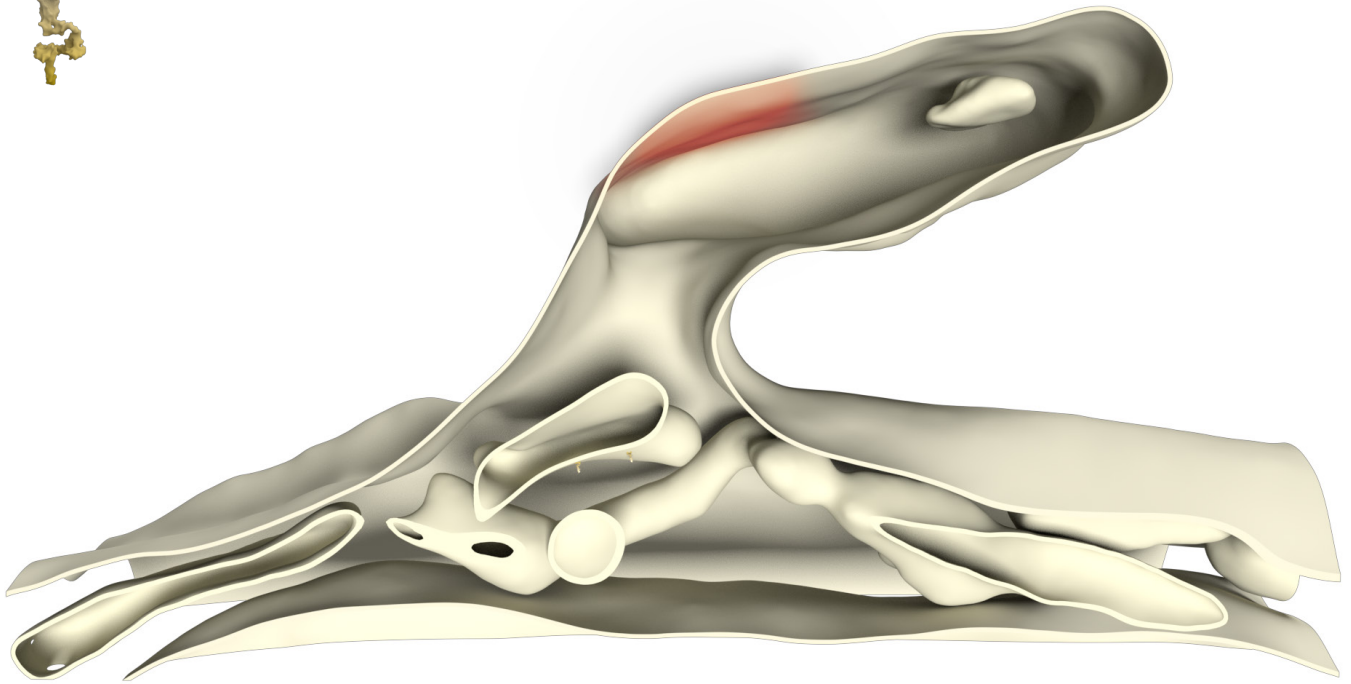
Known organization: Transmembrane protein, On Golgi

Known Interactions: Sec22b

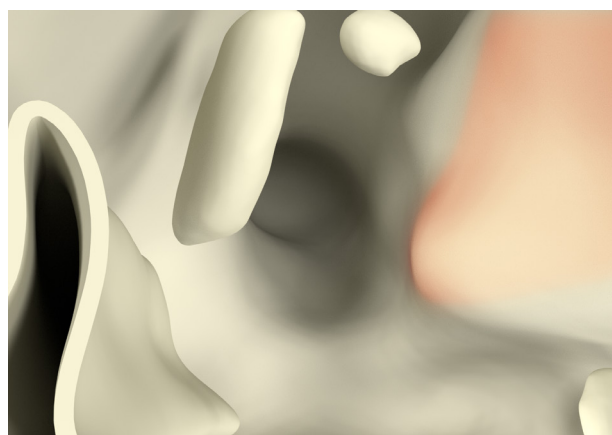
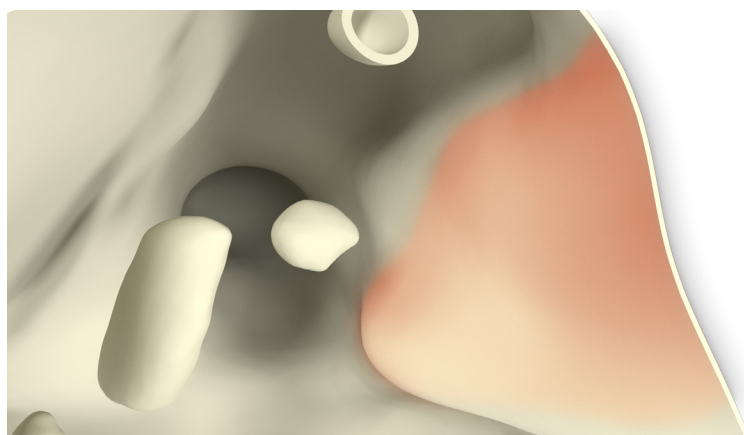
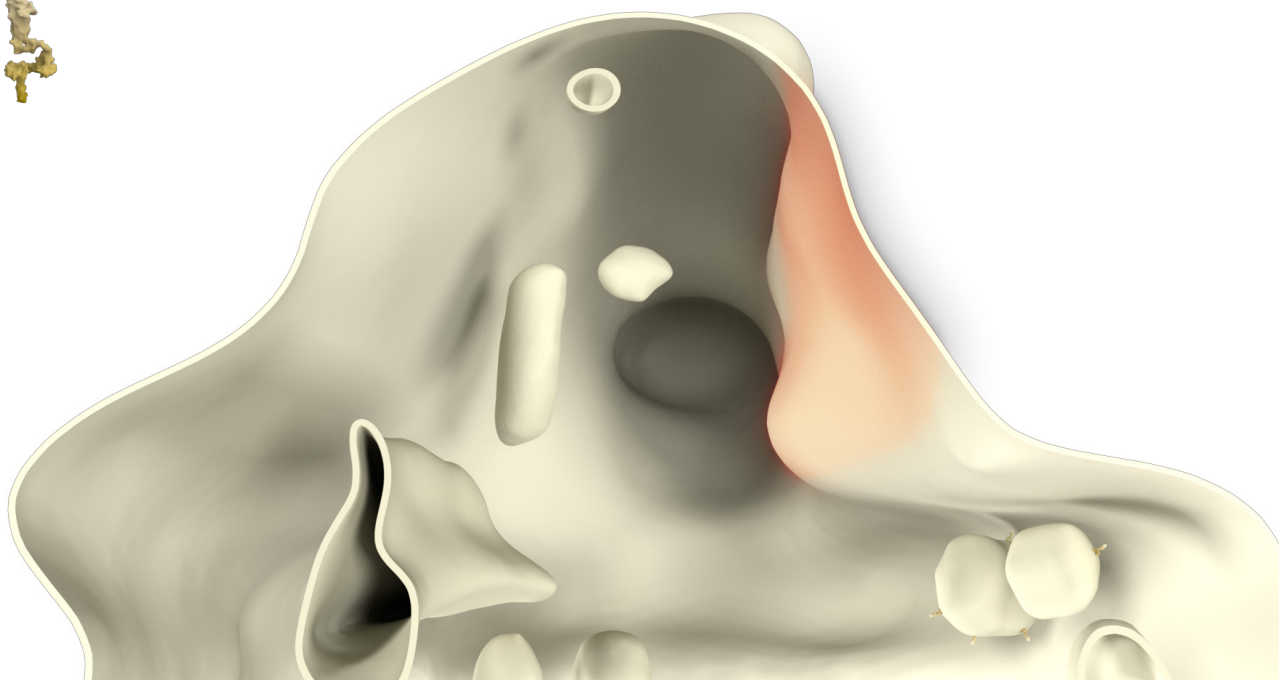


Whole cell copy number	115366.8 ± 41933.2	
Spine copy number	7.8 ± 3.7	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	7.3 ± 3.5	9.1 ± 4.4
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.1 ± 0.0	0.1 ± 0.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	7.3 ± 3.5	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0
Stubby	9.1 ± 4.4	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	7.3 ± 3.5	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0
Stubby	9.1 ± 4.4	$0.0 \pm 0.0\%$	0.1 ± 0.0	0 ± 0.0



References

Antibody: Synaptic Systems 110 053

PDB Identifier: modified Syntaxin1

Literature:

Hay et al., 1997, Cell

Hong, 2005, Biochim. Biophys. Acta.

Parlati et al., 2000, Nature

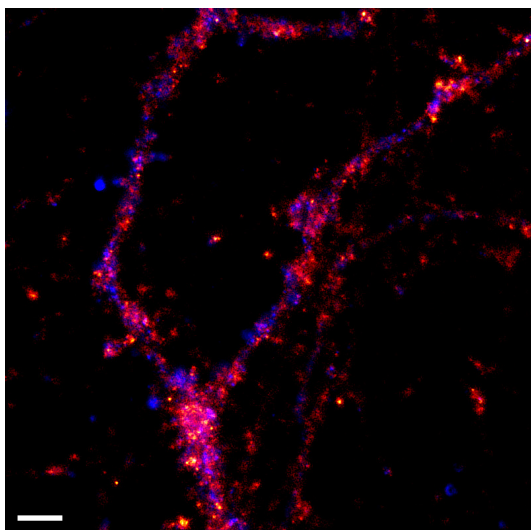
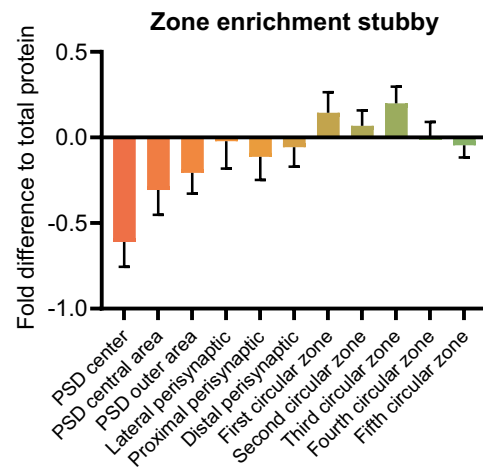
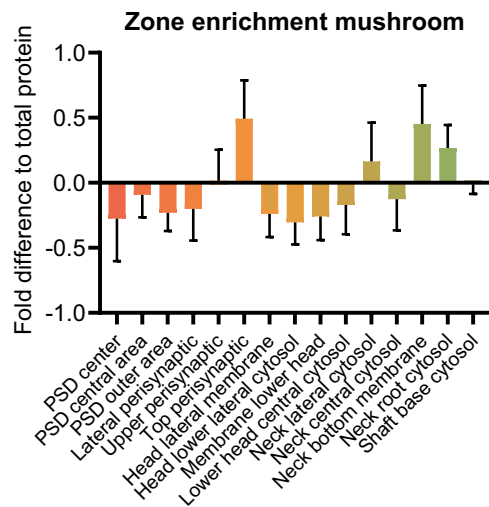
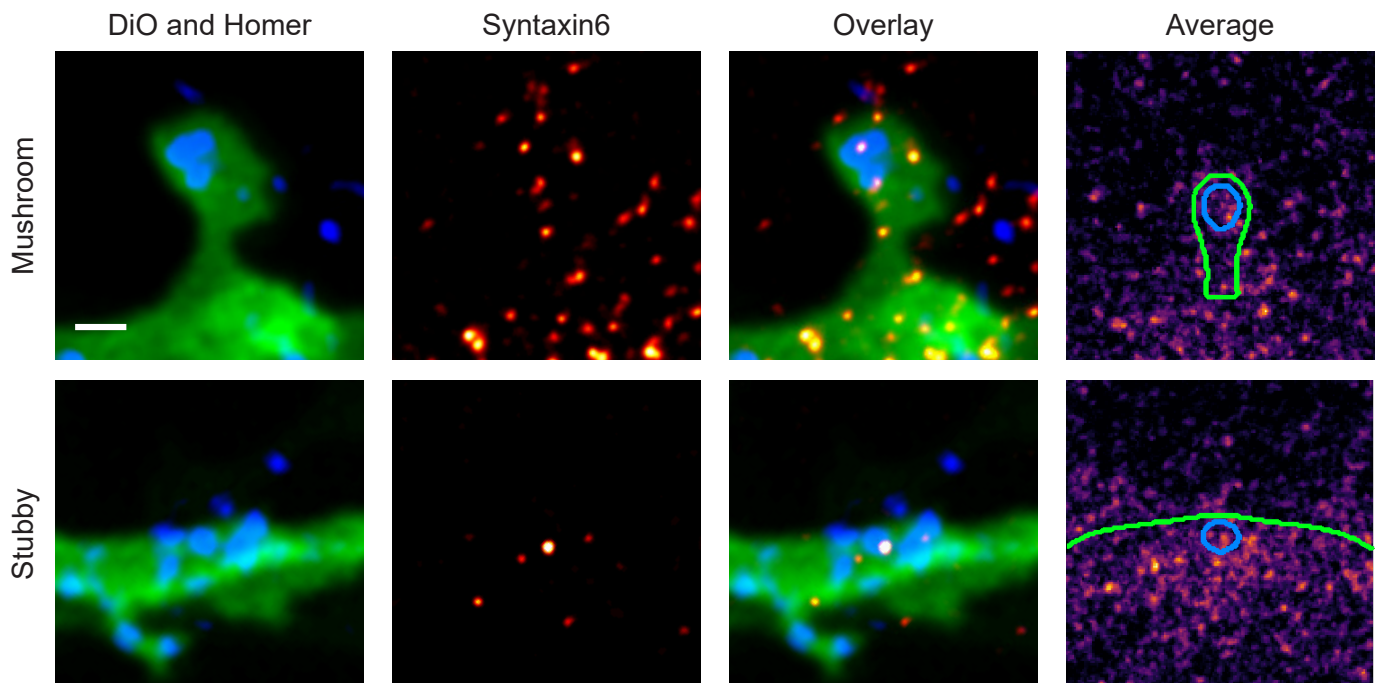
Renna et al., 2011, J. Cell. Sci.

Syntaxin6 (Gene: Stx6, Uniprot ID: Q63635)

Known function: Qc SNARE, Late secretory pathway, Various endosomal fusion events

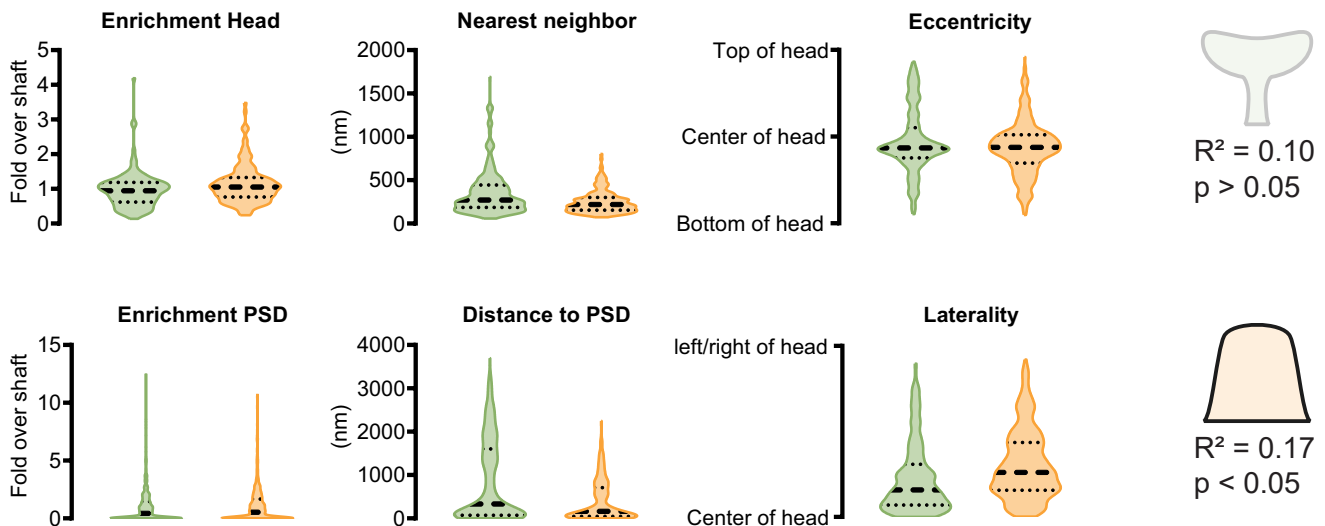
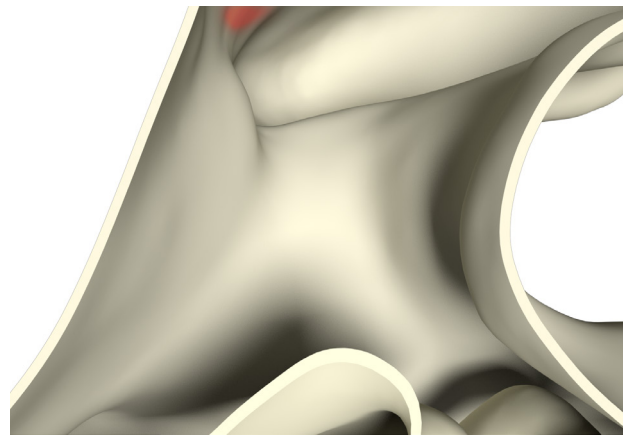
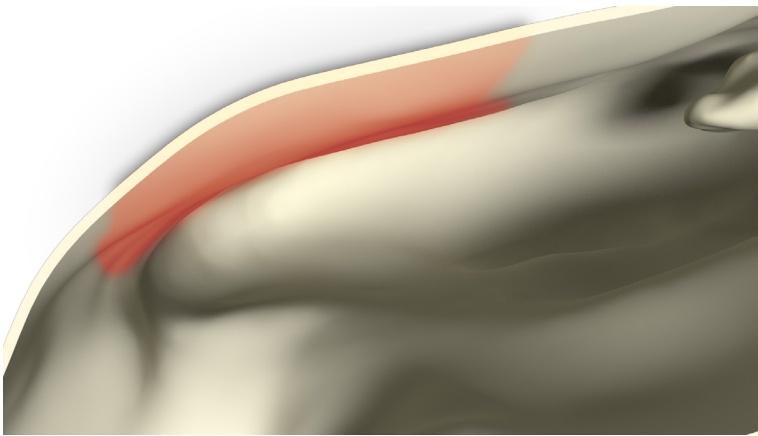
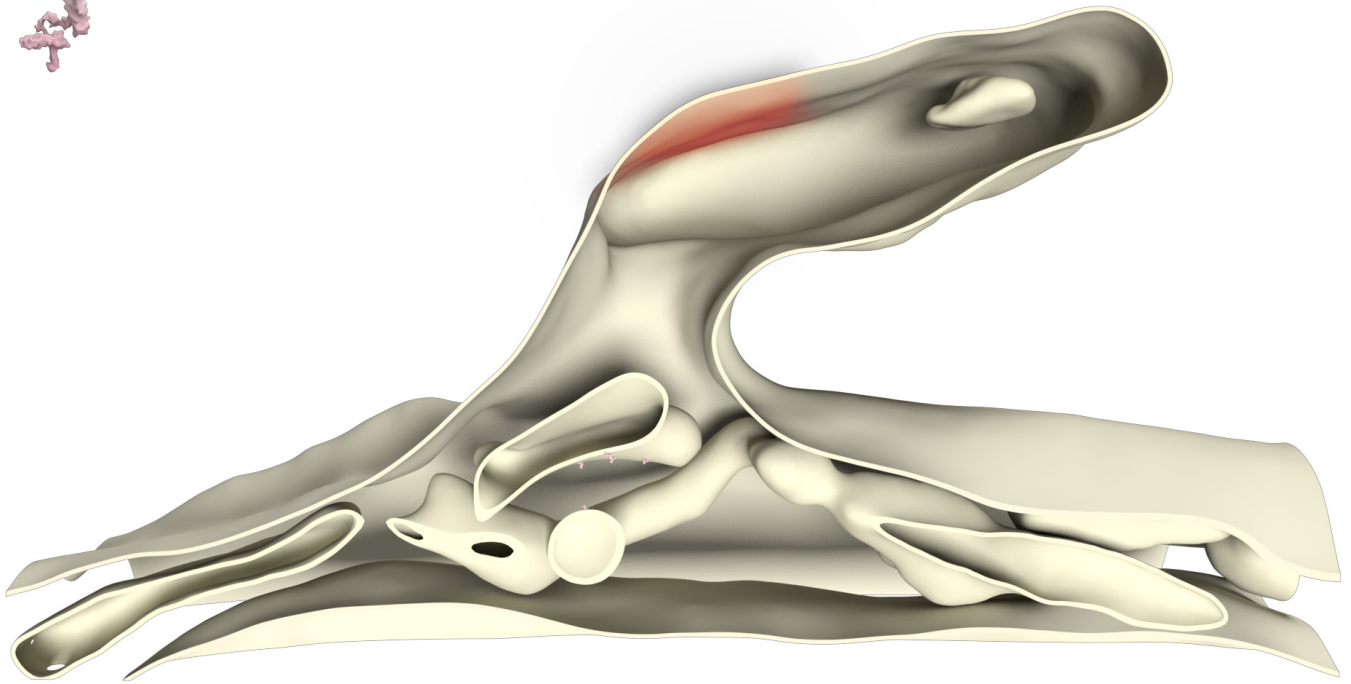
Known organization: Transmembrane protein, On TGN and endosomes

Known Interactions: Syntaxin4, Syntaxin16, VAMP2, VAMP7, SNAP23, SNAP25, SNAP29, Vti1a

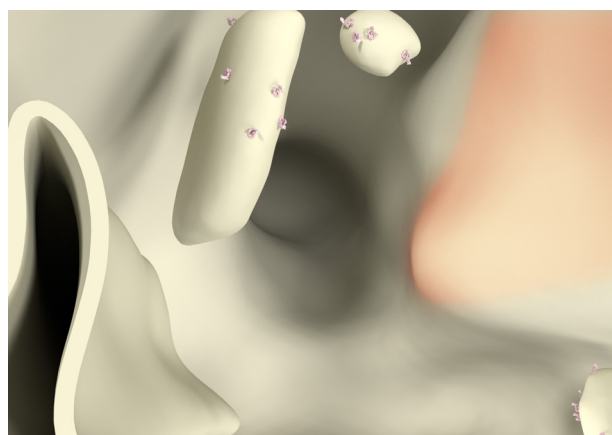
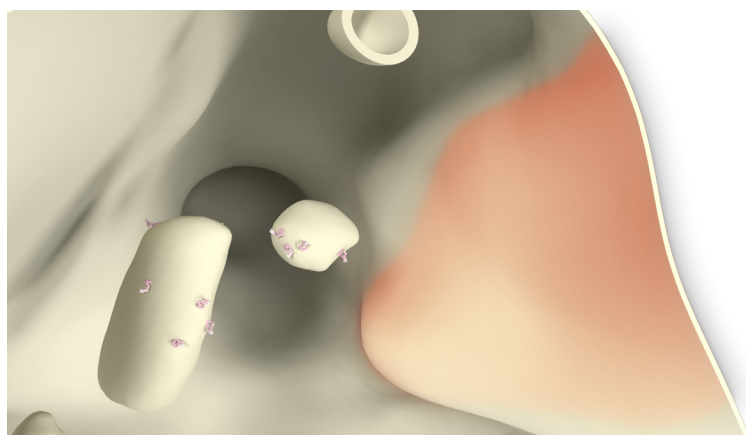
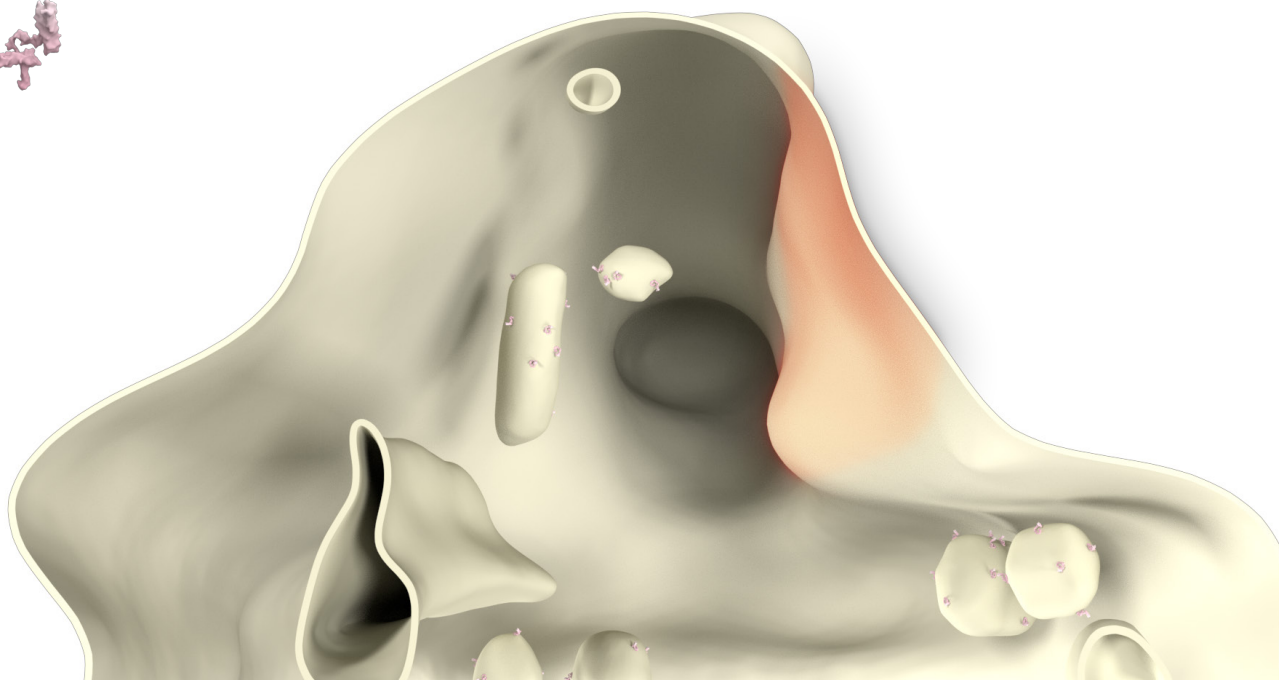


Whole cell copy number	724286.9 ± 177387.1	
Spine copy number	38.9 ± 23.5	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	33.0 ± 19.9	46.8 ± 28.2
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.4 ± 0.3	0.4 ± 0.3
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	33.0 ± 19.9	$0.0 \pm 0.0\%$	0.4 ± 0.3	0 ± 0.0
Stubby	46.8 ± 28.2	$0.0 \pm 0.0\%$	0.4 ± 0.3	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	33.0 ± 19.9	$0.0 \pm 0.0\%$	0.4 ± 0.3	0 ± 0.0
Stubby	46.8 ± 28.2	$0.0 \pm 0.0\%$	0.4 ± 0.3	0 ± 0.0



References

Antibody: Cell Signalin 2869

PDB Identifier: 1lvf, 4j2c

Literature:

Antonin et al., 2000, EMBO J.

Gerrard et al., 2000, Traffic

Hanson et al., 1995, J. Biol. Chem.

Hong, 2005, Biochim. Biophys. Acta.

McMahon et al., 1993, Nature

Wade et al., 2001, J. Biol. Chem.

Watson and Pessin, 2000, J. Biol. Chem.

Wendler and Tooze, 2001, Traffic

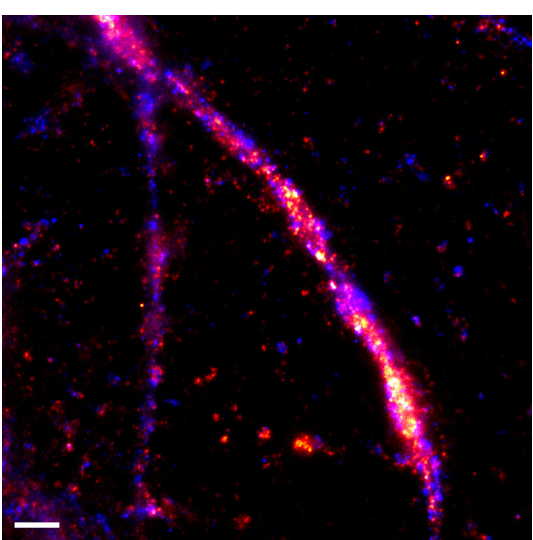
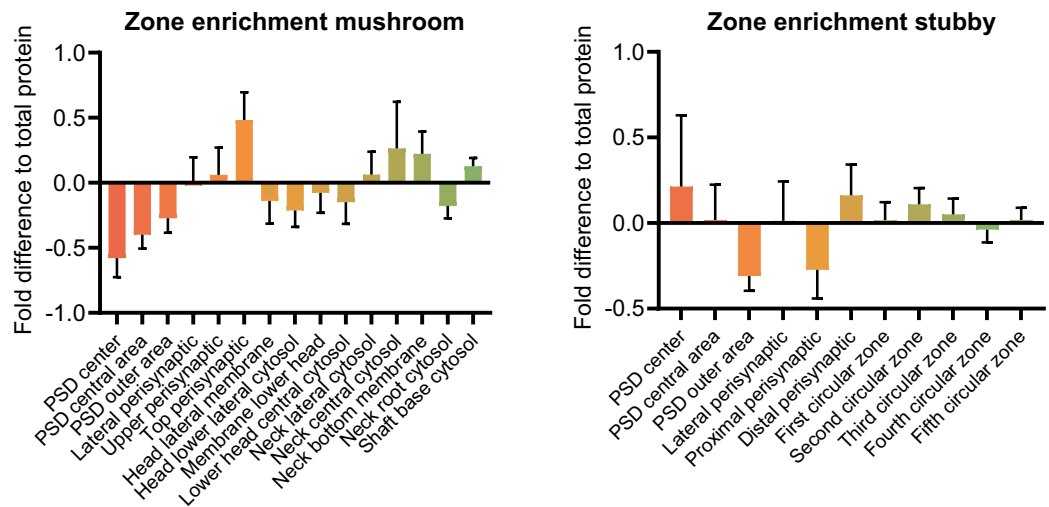
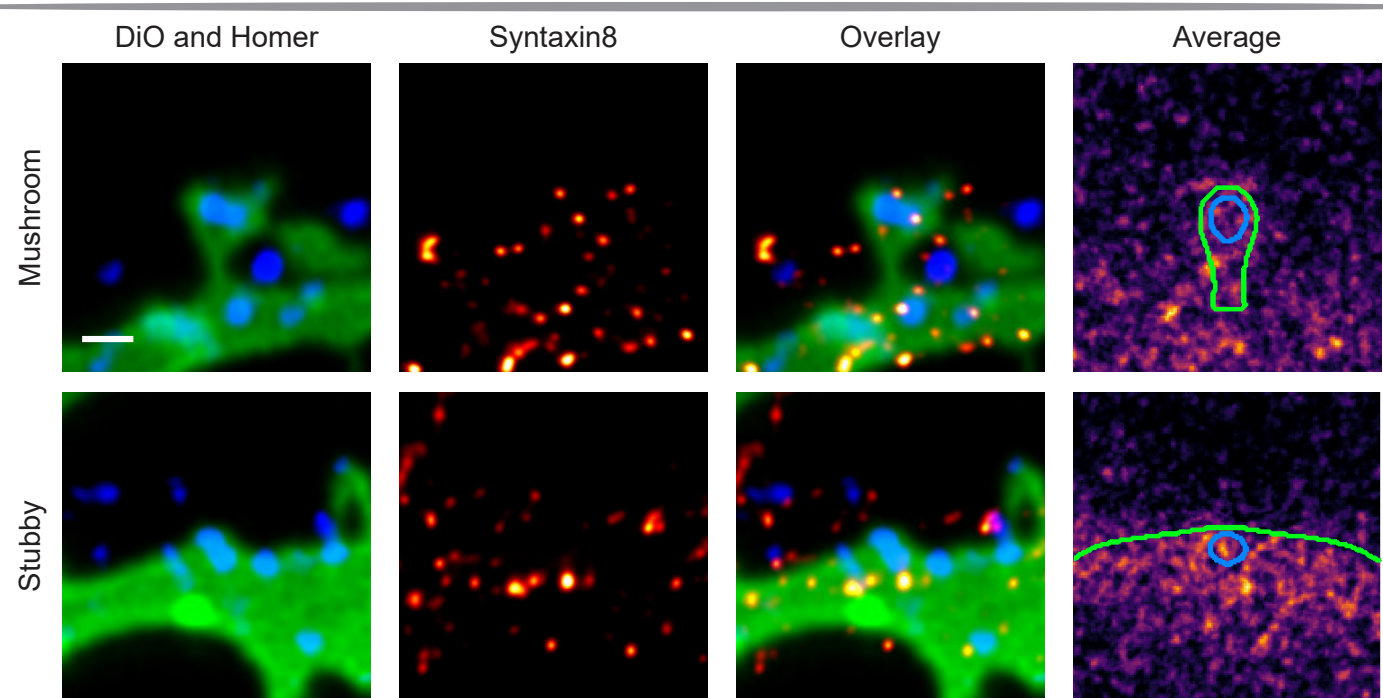
Wong et al., 1999, Mol. Biol. Cell.

Syntaxin8 (Gene: Stx8, Uniprot ID: Q9Z2Q7)

Known function: Qc SNARE, Late endosome fusion, Delivery of TrkA transport to PM

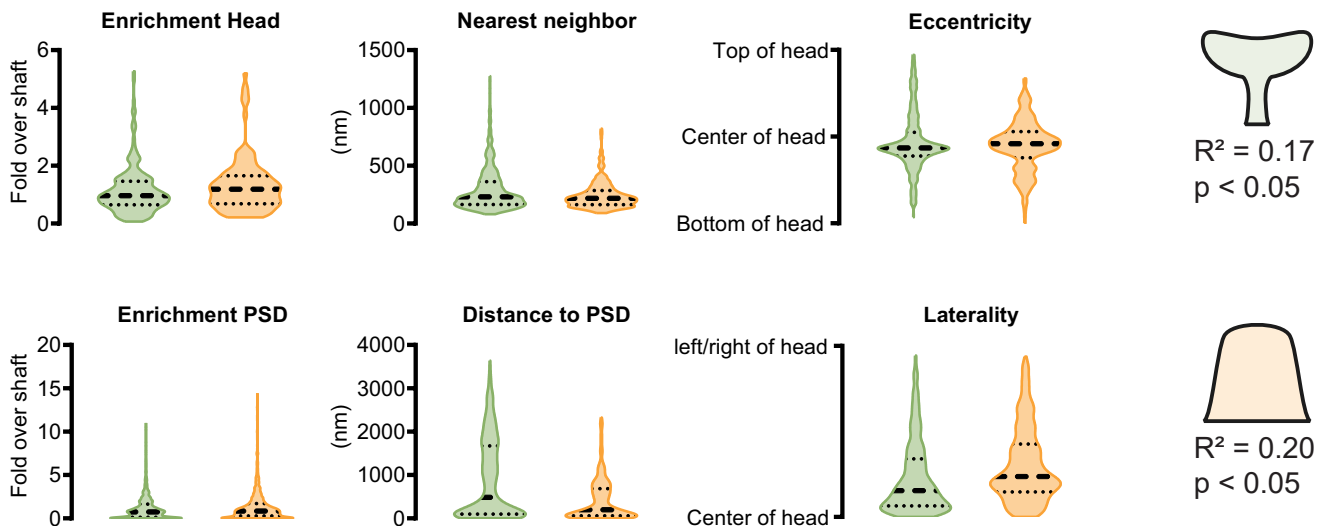
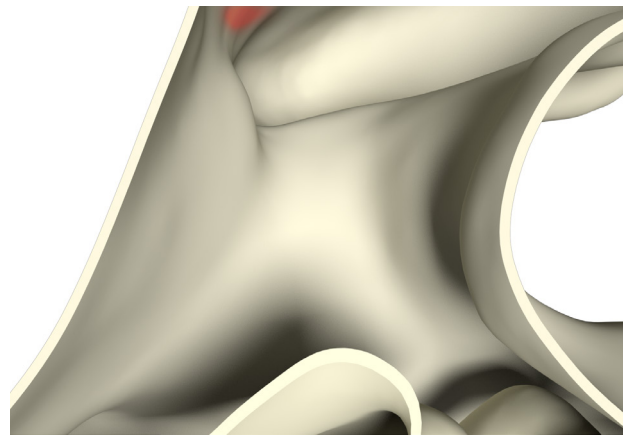
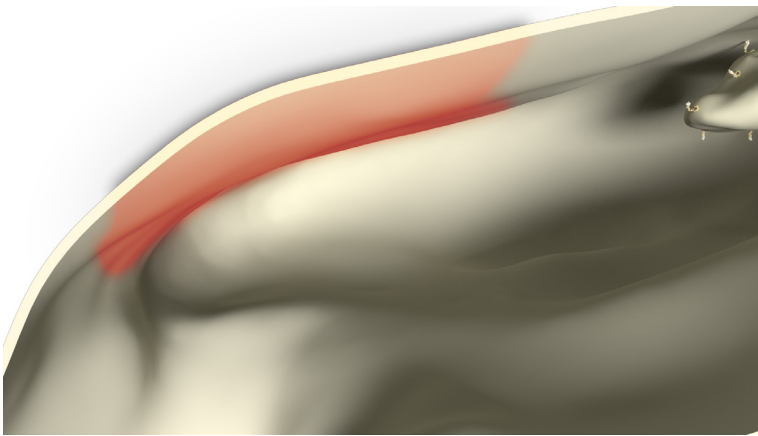
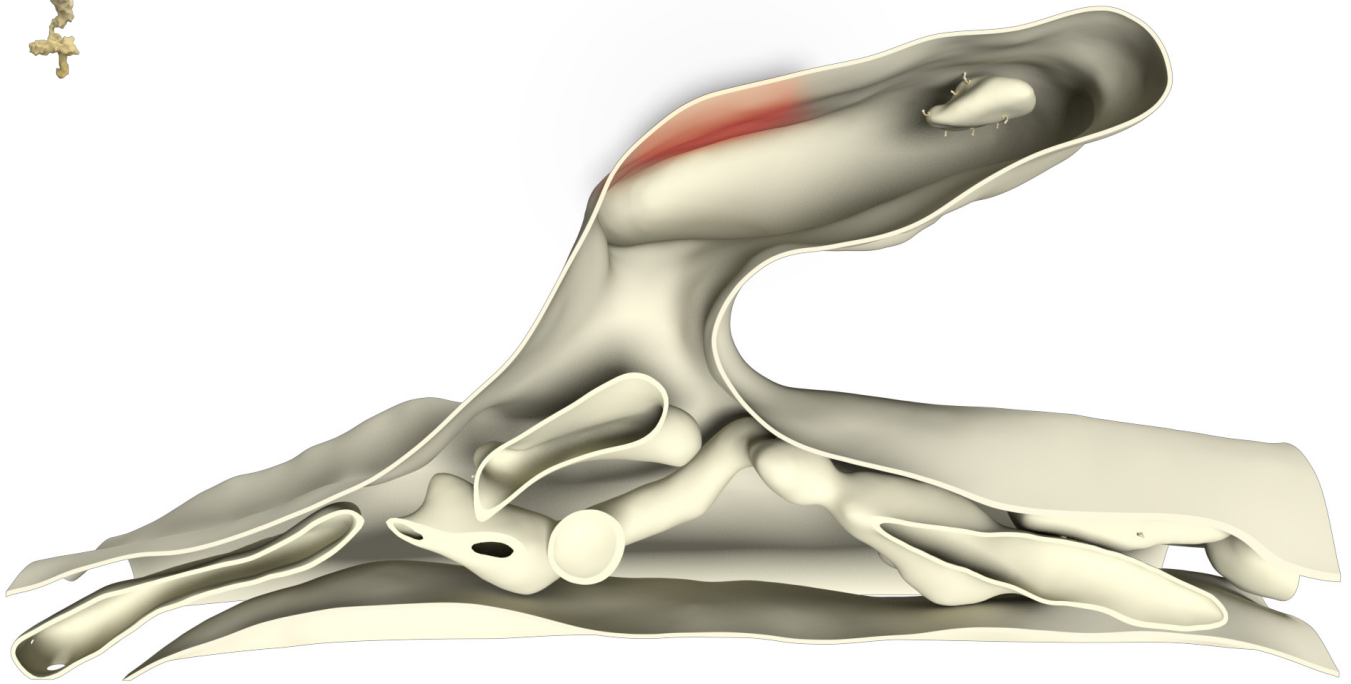
Known organization: Transmembrane protein, Also palmitoylated, On Golgi, early and late endosome

Known Interactions: None

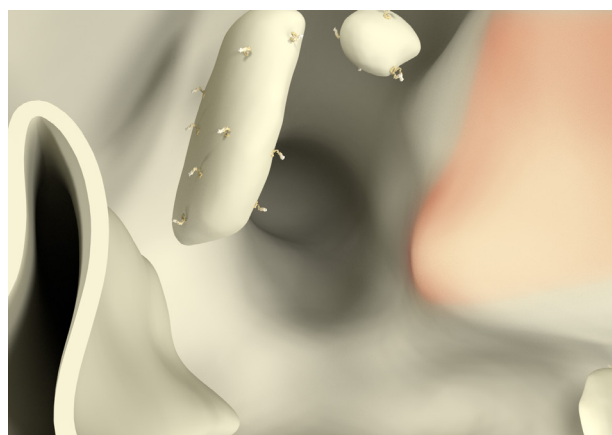
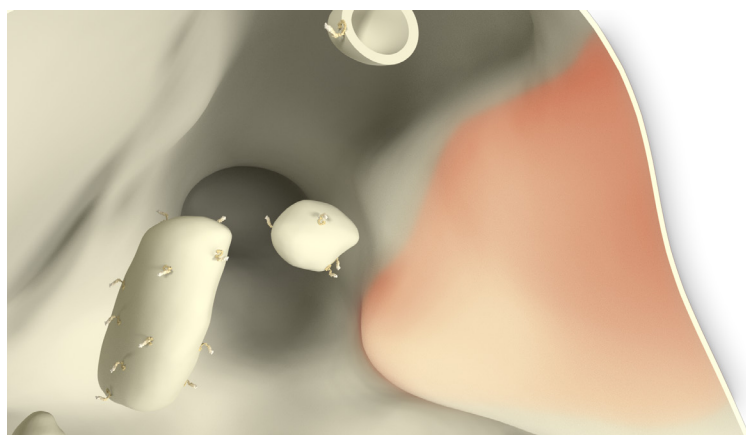
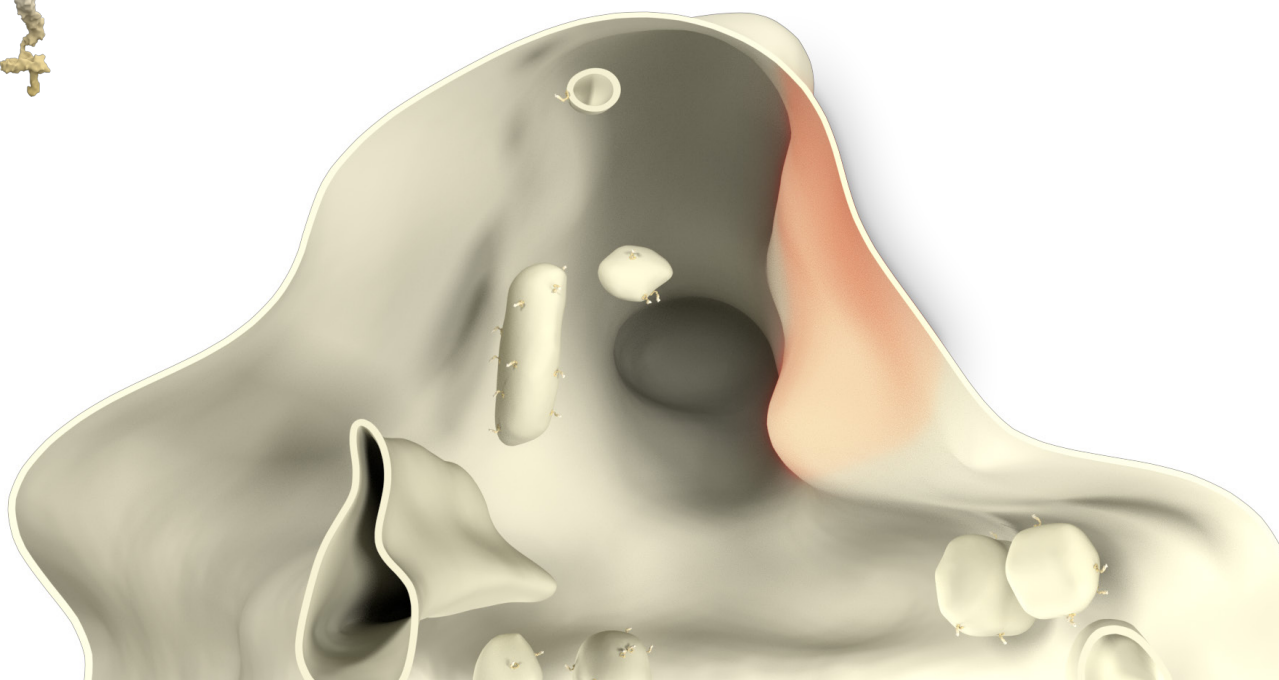


Whole cell copy number	736051.6 ± 89670.7	
Spine copy number	114.0 ± 34.5	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	85.0 ± 25.7	152.4 ± 46.0
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (µM)	1.1 ± 0.3	1.4 ± 0.4
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	85.0 ± 25.7	$0.0 \pm 0.0\%$	1.1 ± 0.3	0 ± 0.0
Stubby	152.4 ± 46.0	$0.0 \pm 0.0\%$	1.4 ± 0.4	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	85.0 ± 25.7	$0.0 \pm 0.0\%$	1.1 ± 0.3	0 ± 0.0
Stubby	152.4 ± 46.0	$0.0 \pm 0.0\%$	1.4 ± 0.4	0 ± 0.0



References

Antibody: Synaptic Systems 110 083

PDB Identifier: modified Syntaxin1

Literature:

Antonin et al., 2002, J. Biol. Chem.

Chen et al., 2014, J. Biol. Chem.

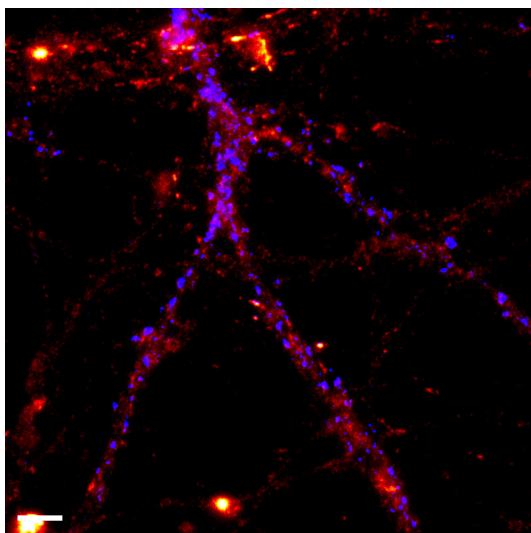
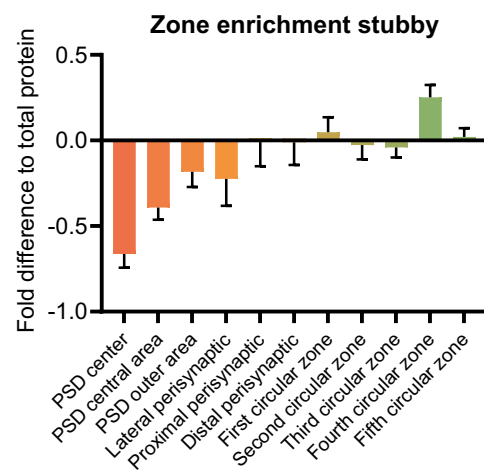
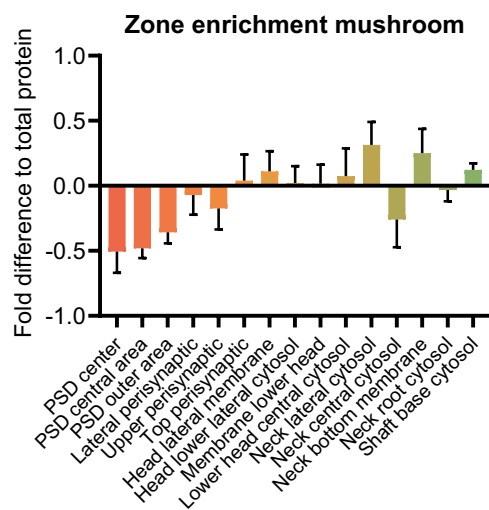
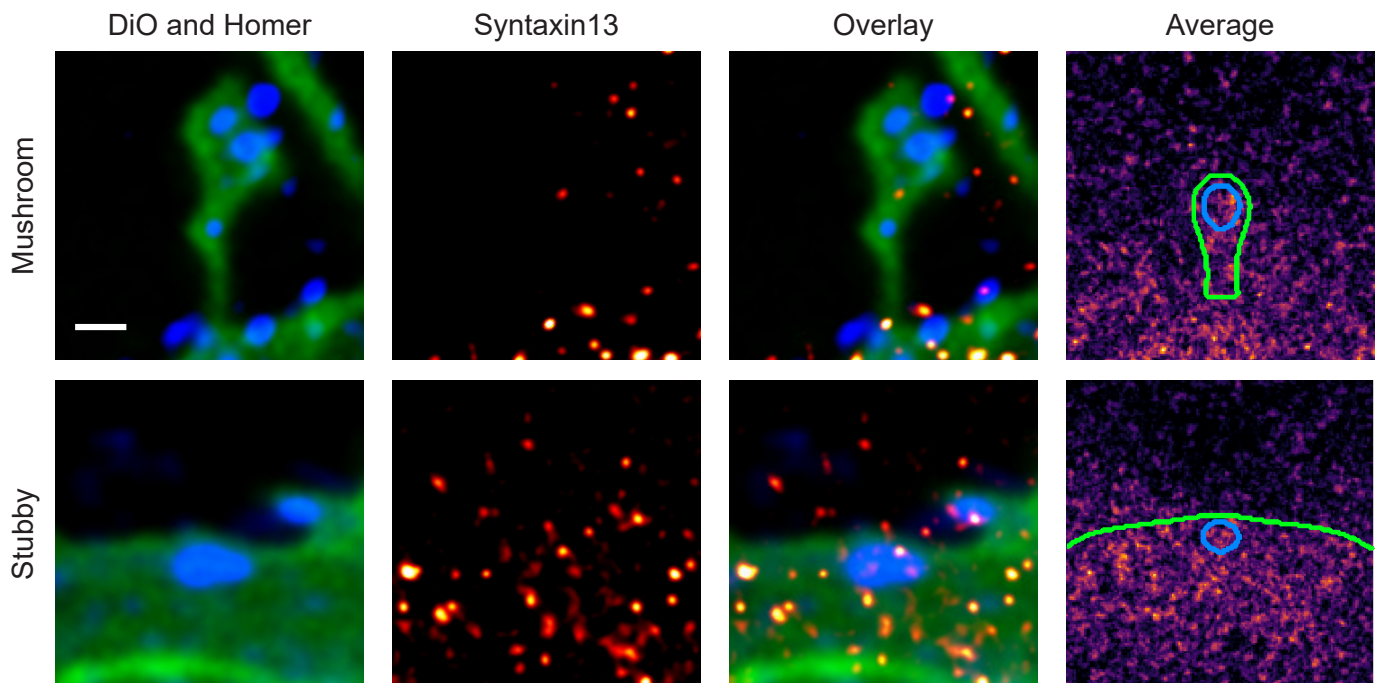
He and Linder, 2009, J. Lipid. Res.

Syntaxin13 (Syntaxin12, Gene: Stx12, Uniprot ID: G3V7P1)

Known function: Qa SNARE, Homotypic endosome fusion, Delivery of AMPAR to PM

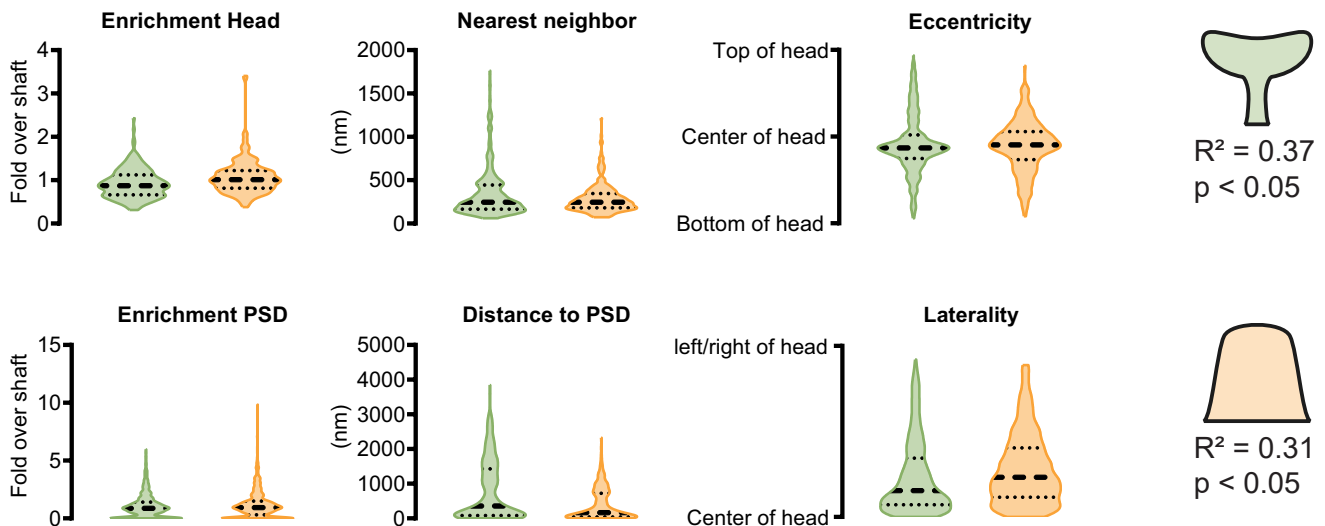
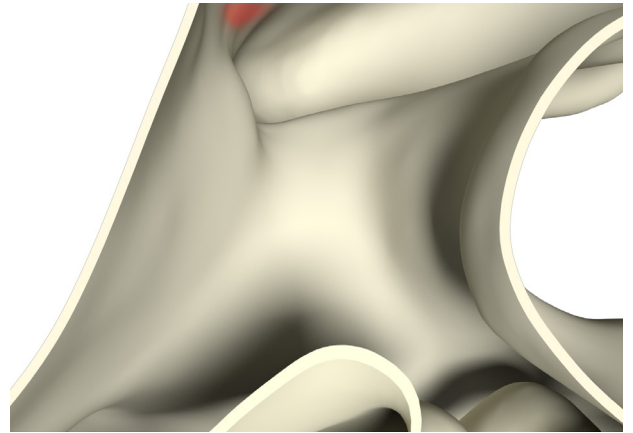
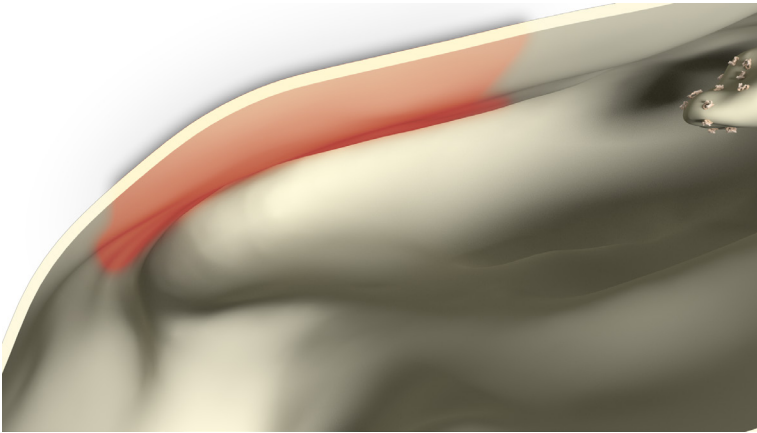
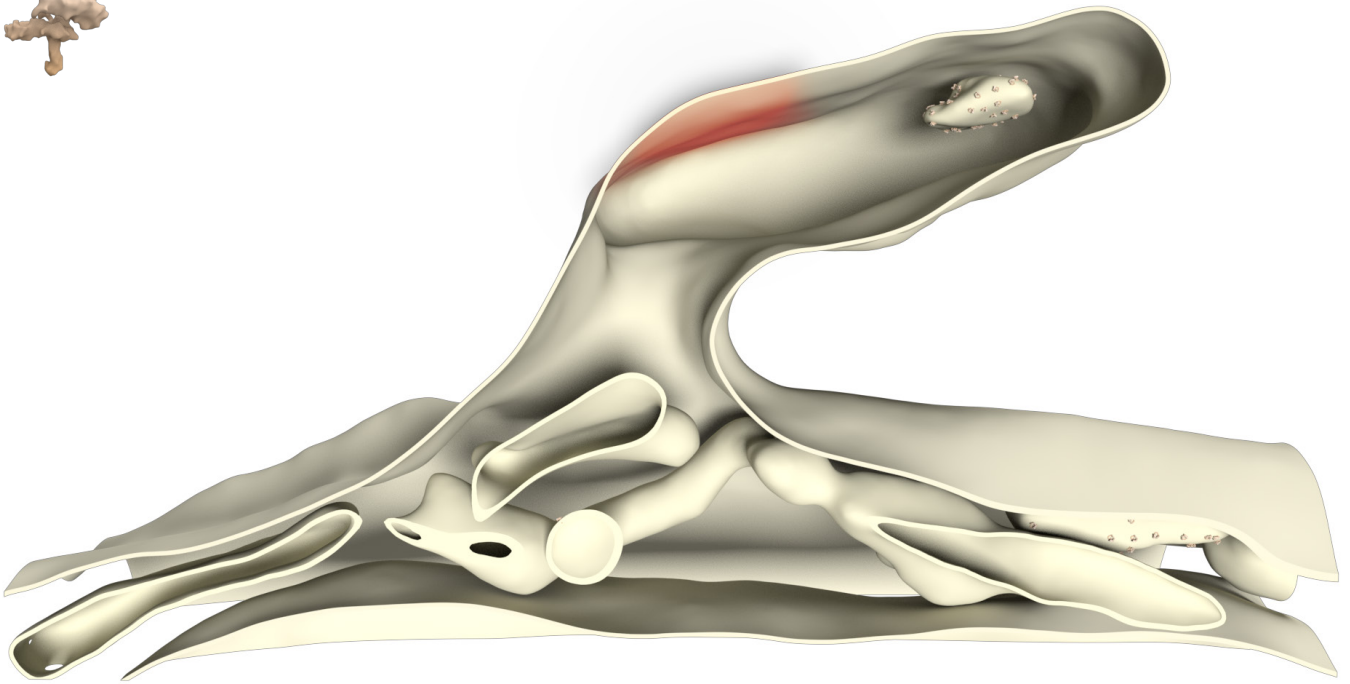
Known organization: Transmembrane protien, On early and sorting endosomes

Known Interactions: Syntaxin6, VAMP4, Vti1a

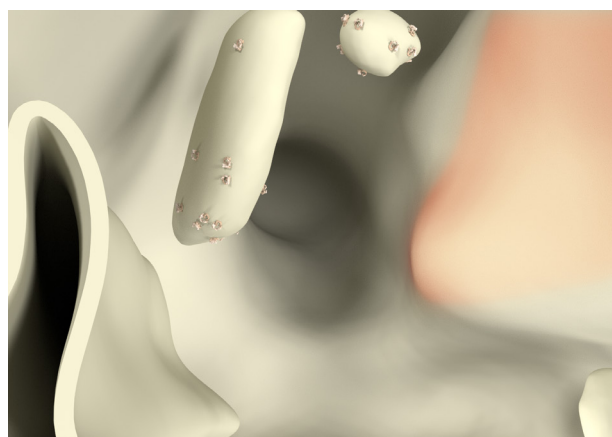
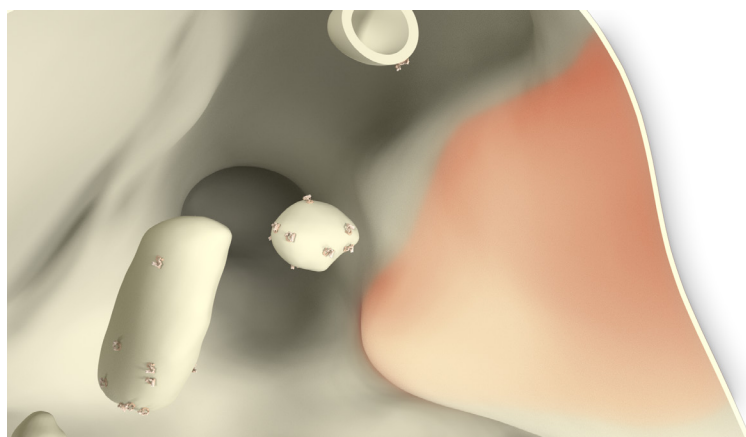
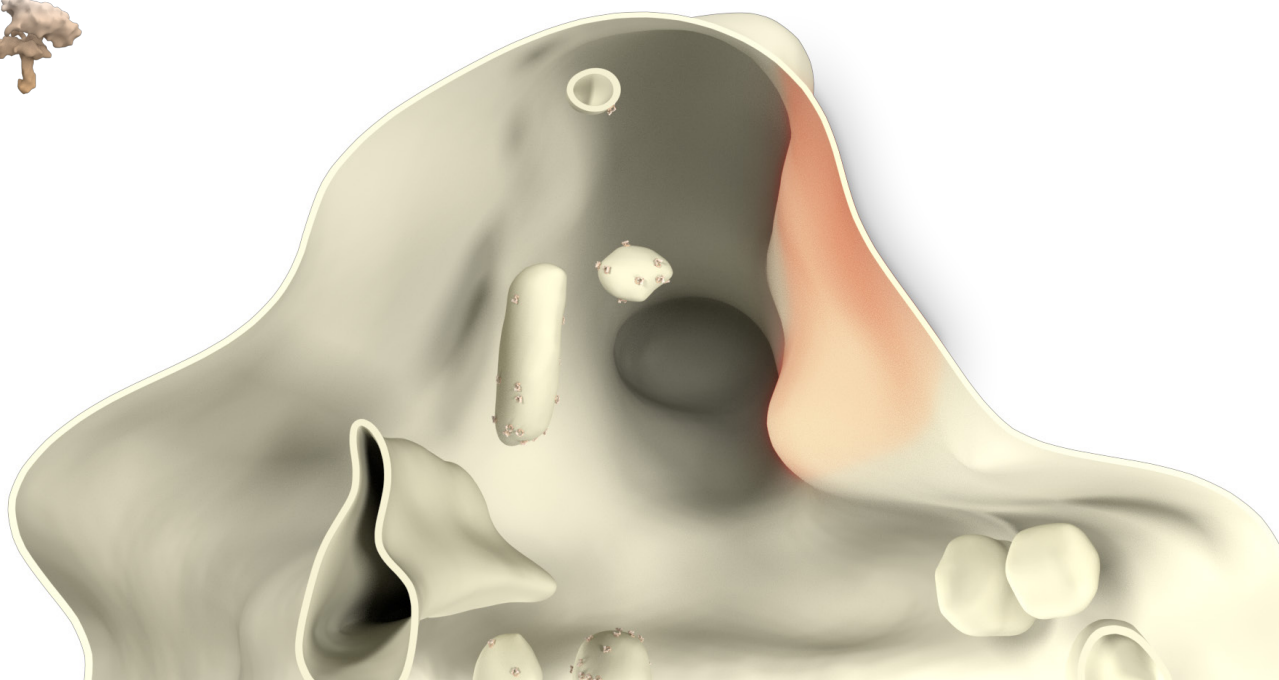


Whole cell copy number	3522048.0 ± 551593.1	
Spine copy number	455.7 ± 129.7	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	378.4 ± 107.7	529.7 ± 150.8
% of total protein	0.1 ± 0.0%	0.1 ± 0.0%
Molarity (μM)	4.8 ± 1.4	5.0 ± 1.4
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	378.4 ± 107.7	$0.1 \pm 0.0\%$	4.8 ± 1.4	0 ± 0.0
Stubby	529.7 ± 150.8	$0.1 \pm 0.0\%$	5.0 ± 1.4	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	378.4 ± 107.7	$0.1 \pm 0.0\%$	4.8 ± 1.4	0 ± 0.0
Stubby	529.7 ± 150.8	$0.1 \pm 0.0\%$	5.0 ± 1.4	0 ± 0.0



References

Antibody: Reinhardt Jahn laboratory cl. 151.1

PDB Identifier: modified Syntaxin1

Literature:

Aikawa et al., 2006, Mol. Biol. Cell.

Zwilling et al., 2007, EMBO J.

Antonin et al., 2002, J. Biol. Chem.

Brandhorst et al., 2006, Proc. Natl. Acad. Sci. U S A

Hirling et al., 2000, Eur. J. Neurosci.

Hong, 2005, Biochim. Biophys. Acta.

McBride et al., 1999, Cell

Park et al., 2004, Science

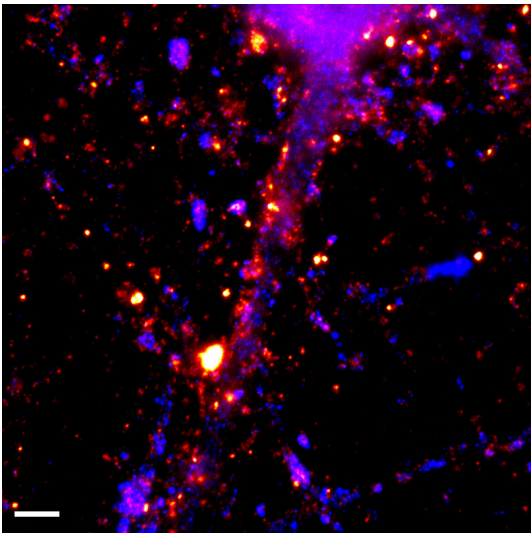
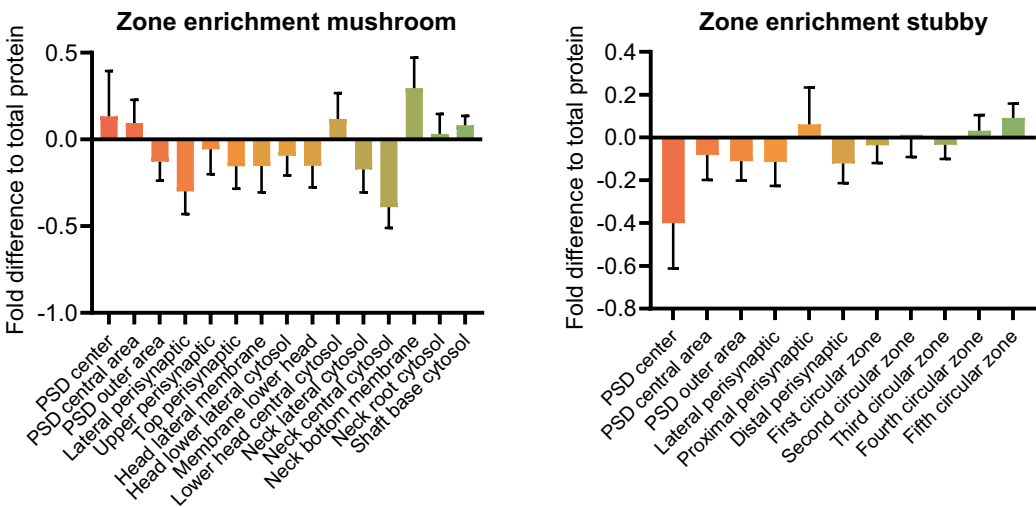
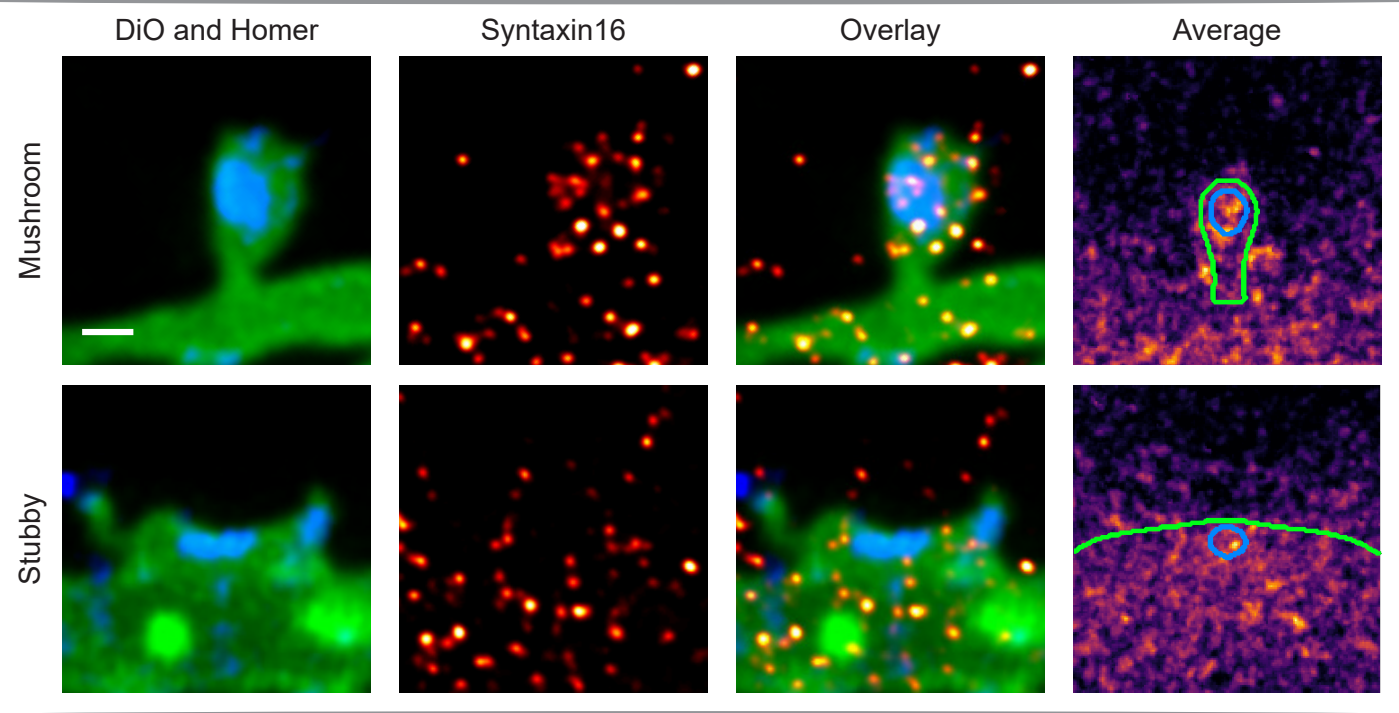
Petrini et al., 2009, Neuron

Syntaxin16 (Gene: Stx16, Uniprot ID: D3Z9R7)

Known function: Qa SNARE, Homotypic endosome fusion, Endosome-TGN transport, Important for dendritic protein traffic

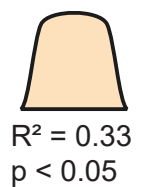
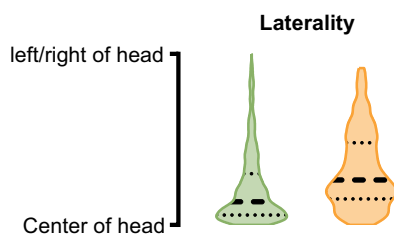
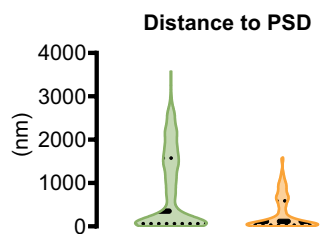
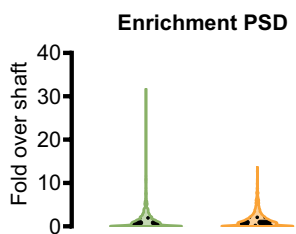
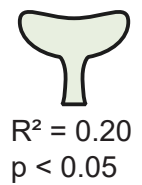
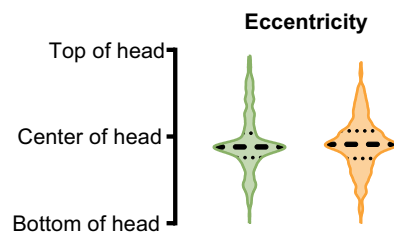
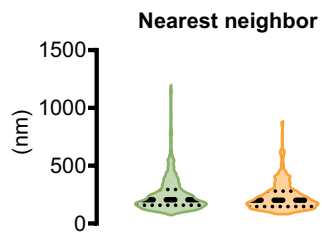
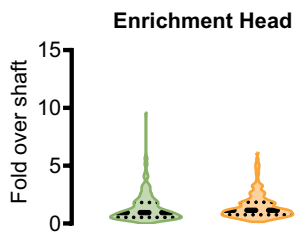
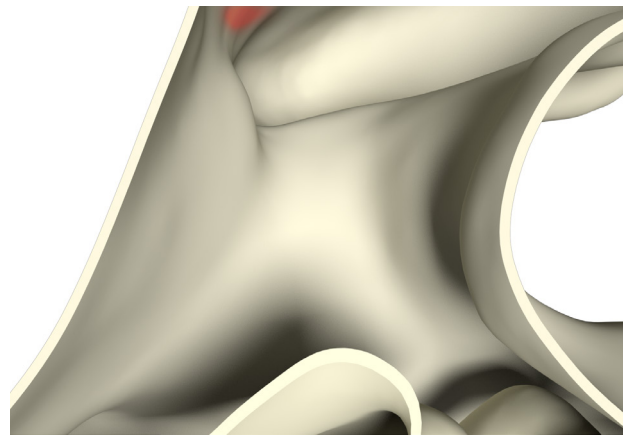
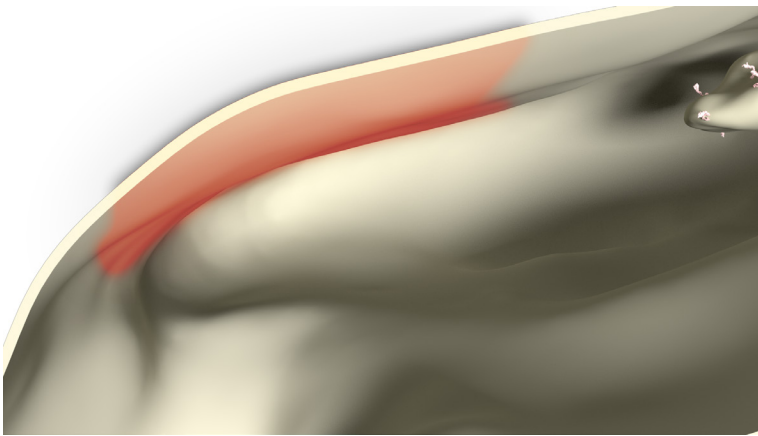
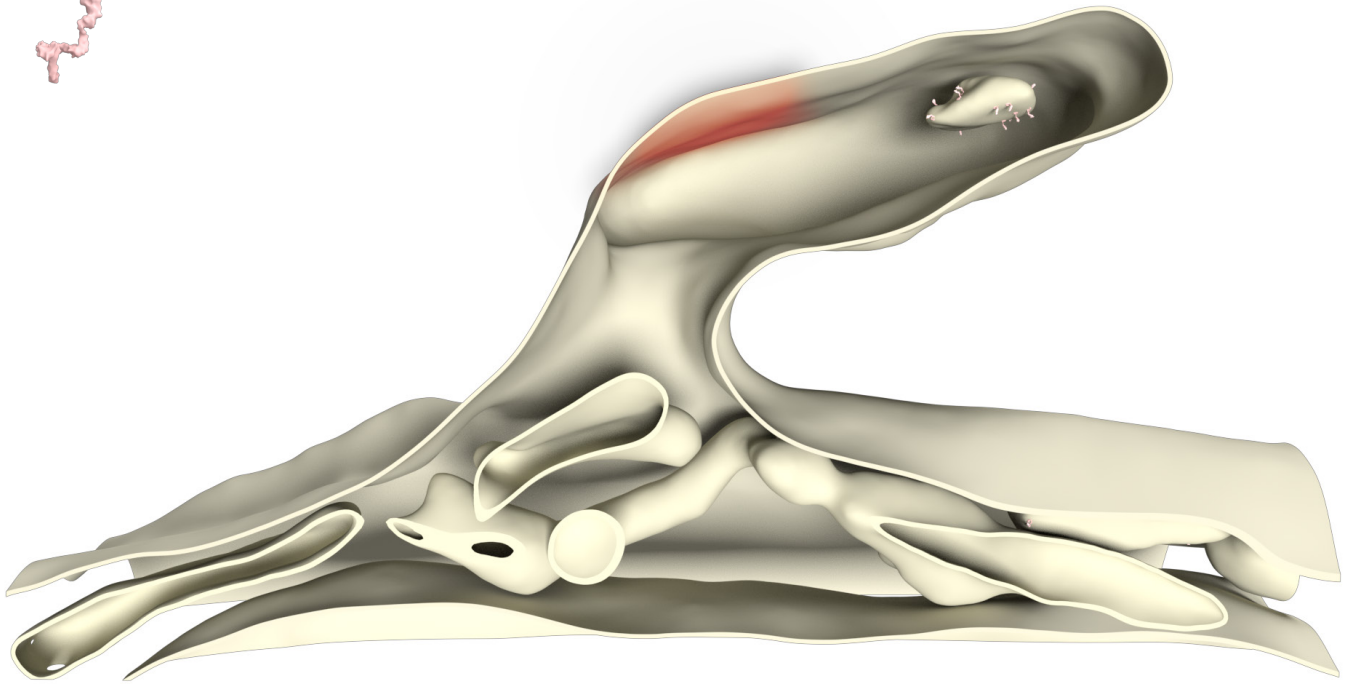
Known organization: Tail-anchored, On Endosomes, TGN

Known Interactions: Syntaxin6, VAMP4, Vti1a

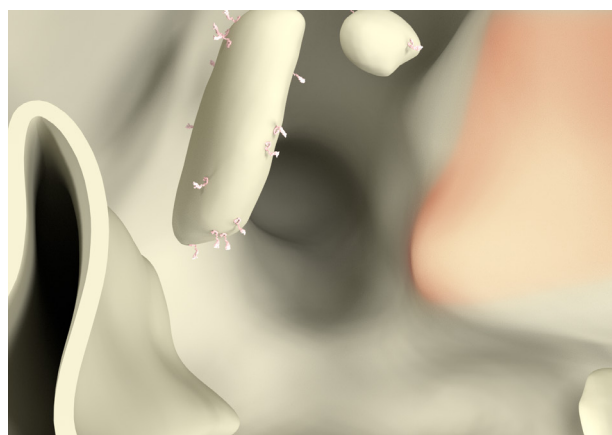
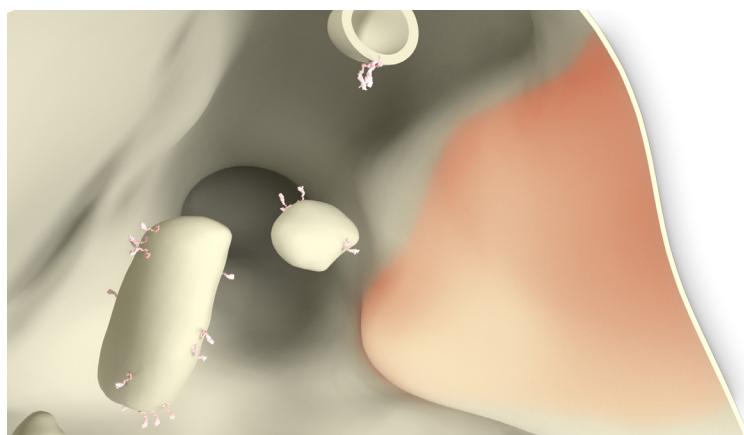
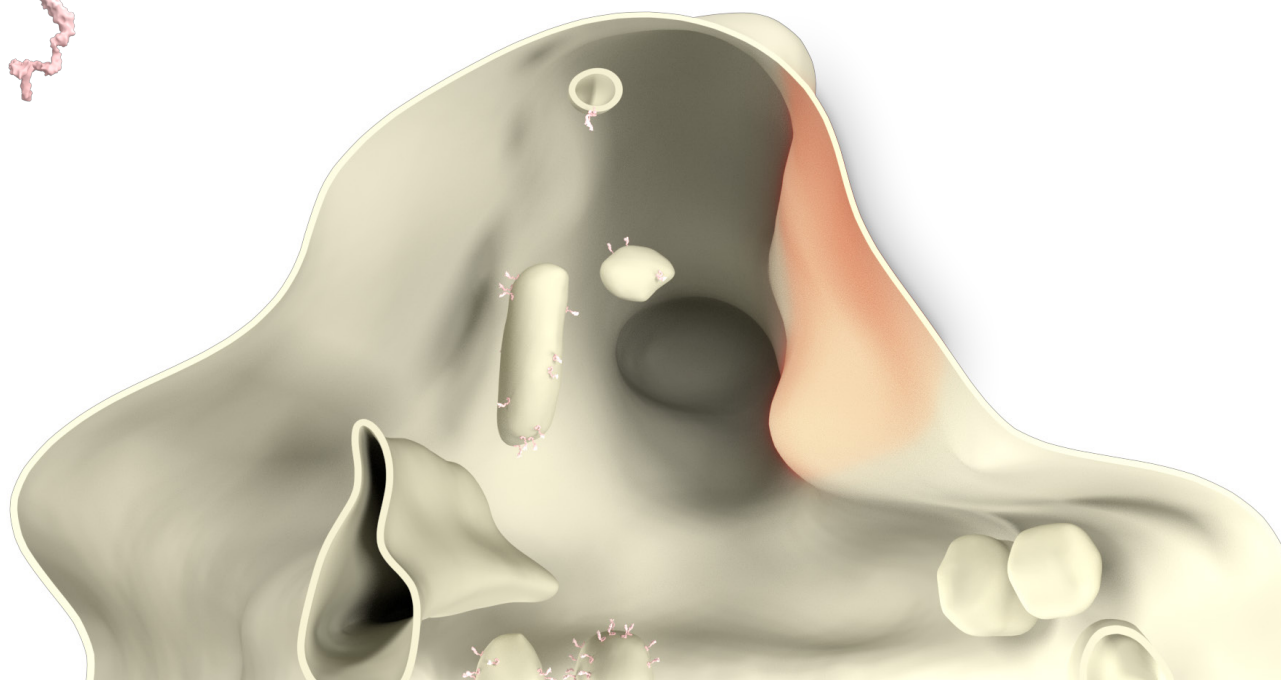


Whole cell copy number	184711.4 ± 33565.3	
Spine copy number	54.0 ± 13.0	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	45.7 ± 11.0	68.0 ± 16.4
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (µM)	0.6 ± 0.1	0.6 ± 0.2
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	45.7 ± 11.0	$0.0 \pm 0.0\%$	0.6 ± 0.1	0 ± 0.0
Stubby	68.0 ± 16.4	$0.0 \pm 0.0\%$	0.6 ± 0.2	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	45.7 ± 11.0	$0.0 \pm 0.0\%$	0.6 ± 0.1	0 ± 0.0
Stubby	68.0 ± 16.4	$0.0 \pm 0.0\%$	0.6 ± 0.2	0 ± 0.0



References

Antibody: Synaptic Systems 110 162

PDB Identifier: modified Syntaxin1

Literature:

Amessou et al., 2007, J. Cell. Sci.

Antonin et al., 2002, J. Biol. Chem.

Brandhorst et al., 2006, Proc. Natl. Acad. Sci. U S A

Chua and Tang, 2008, Mol. Membr. Biol.

Fischer von Mollard and Stevens, 1998, J. Biol.

Chem.

Ganley et al., 2008, J. Cell. Biol.

Mallard et al., 2002, J. Cell. Biol.

McBride et al., 1999, Cell

Shitara et al., 2013, Mol. Cell. Biochem.

Simonsen et al., 1998, Eur. J. Cell Biol.

Tang et al., 1998, Biochem. Biophys. Res. Commun.

Tang, 2008, Biochim. Biophys. Acta.

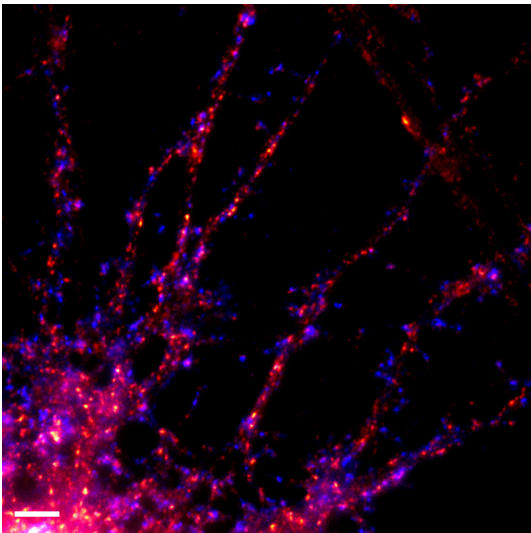
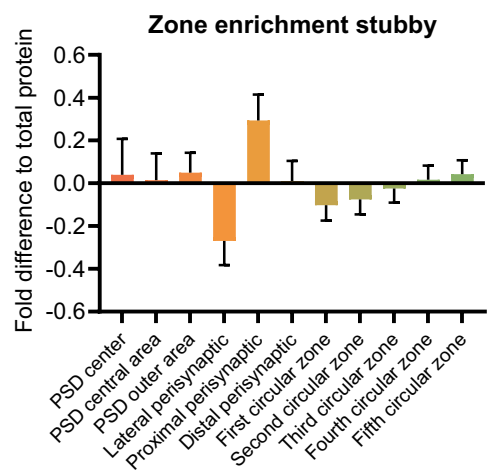
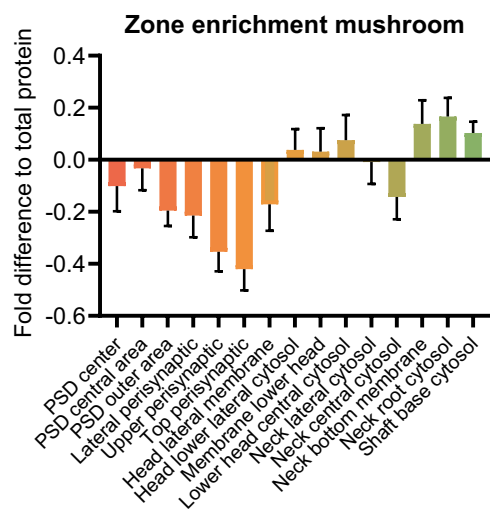
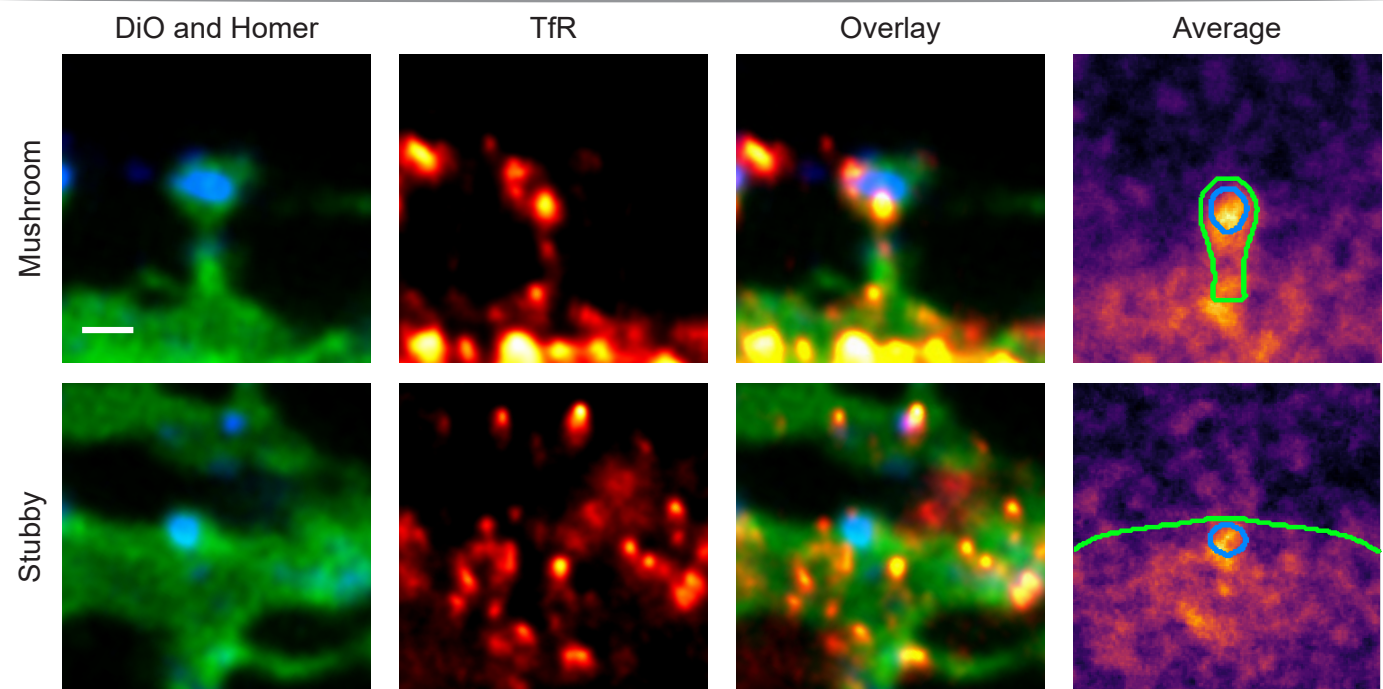
Zwilling et al., 2007, EMBO J.

Transferrin receptor (Gene: Tfrc , Uniprot ID: Q99376)

Known function: Iron uptake

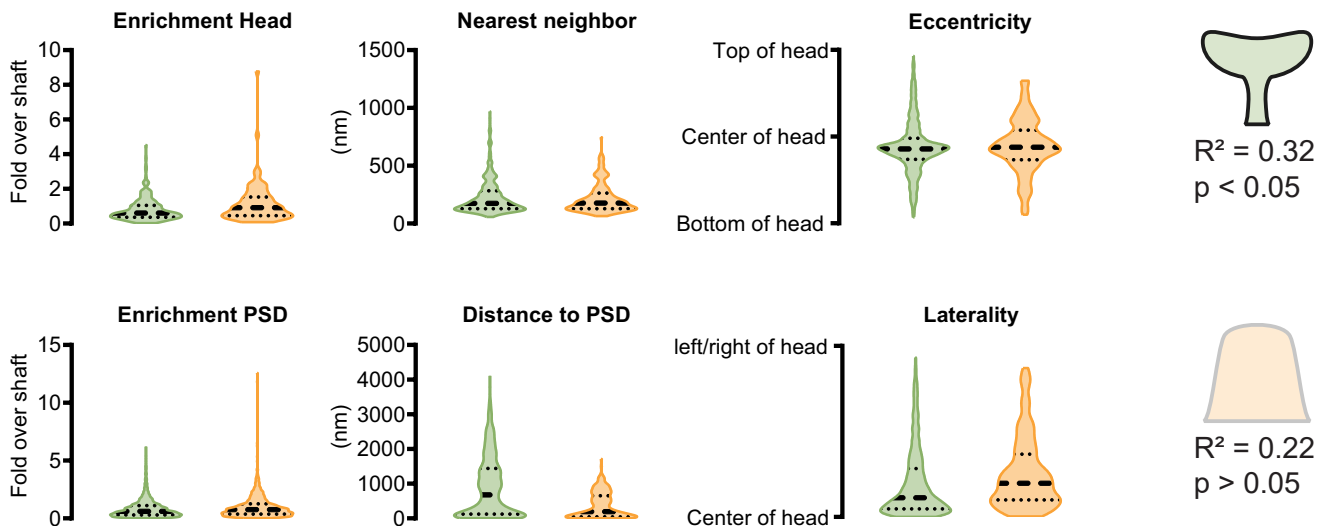
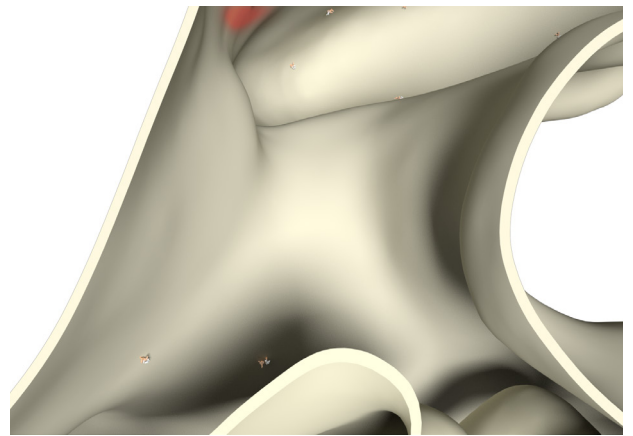
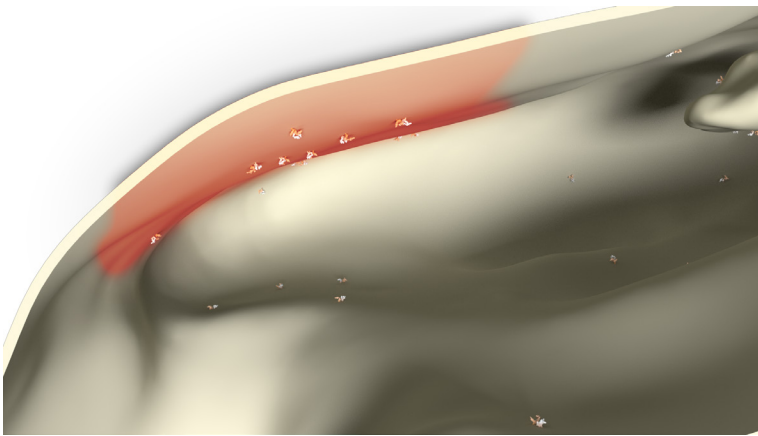
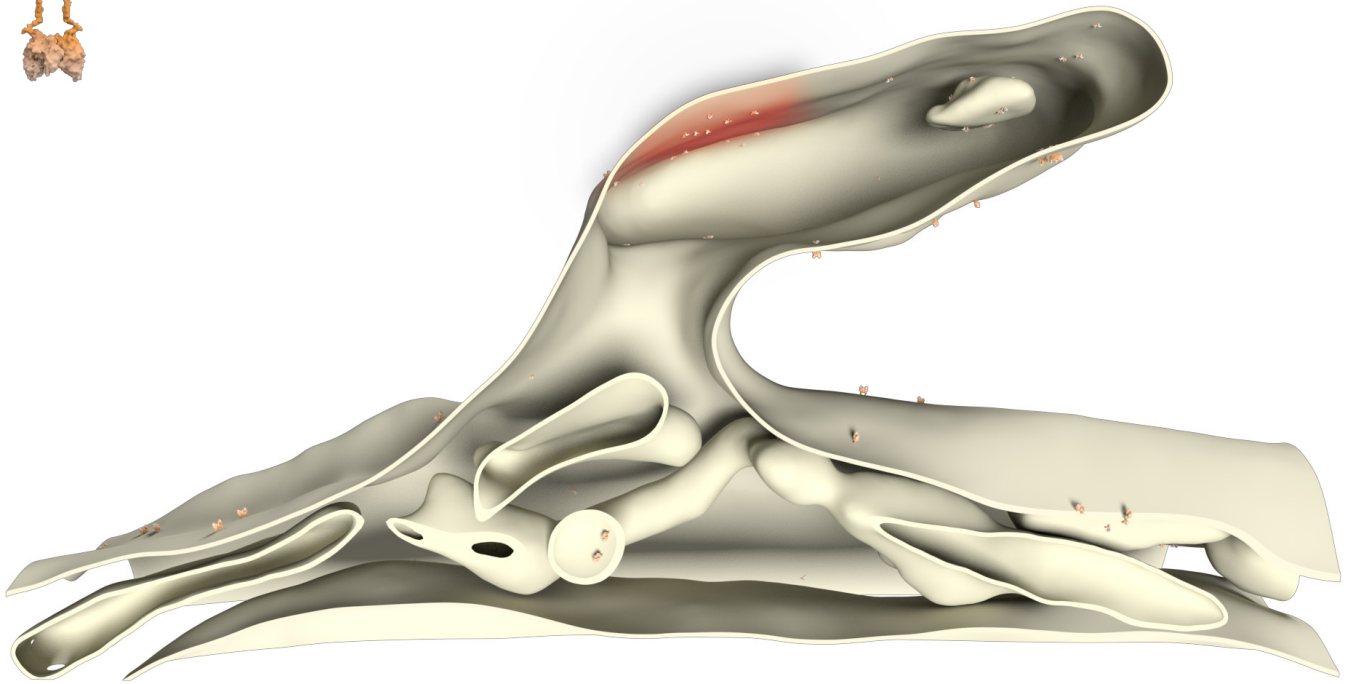
Known organization: Homodimerizes, on PM and endosomes

Known Interactions: None

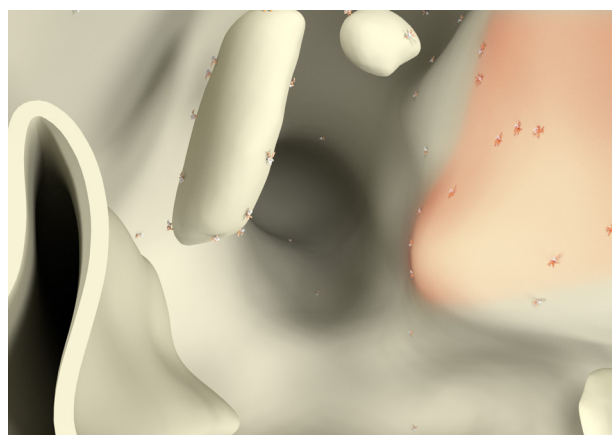
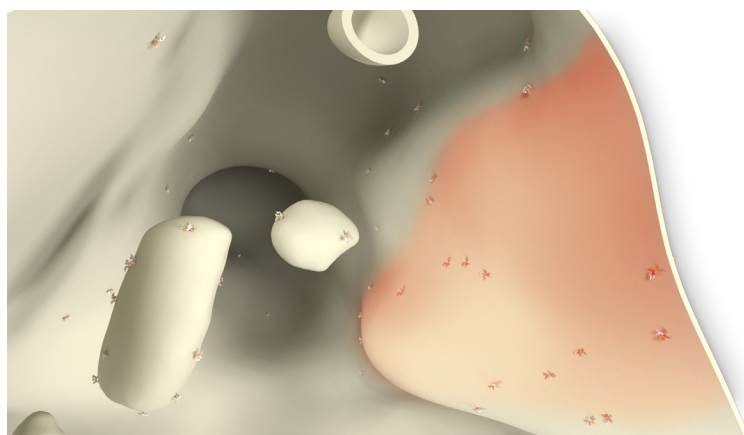
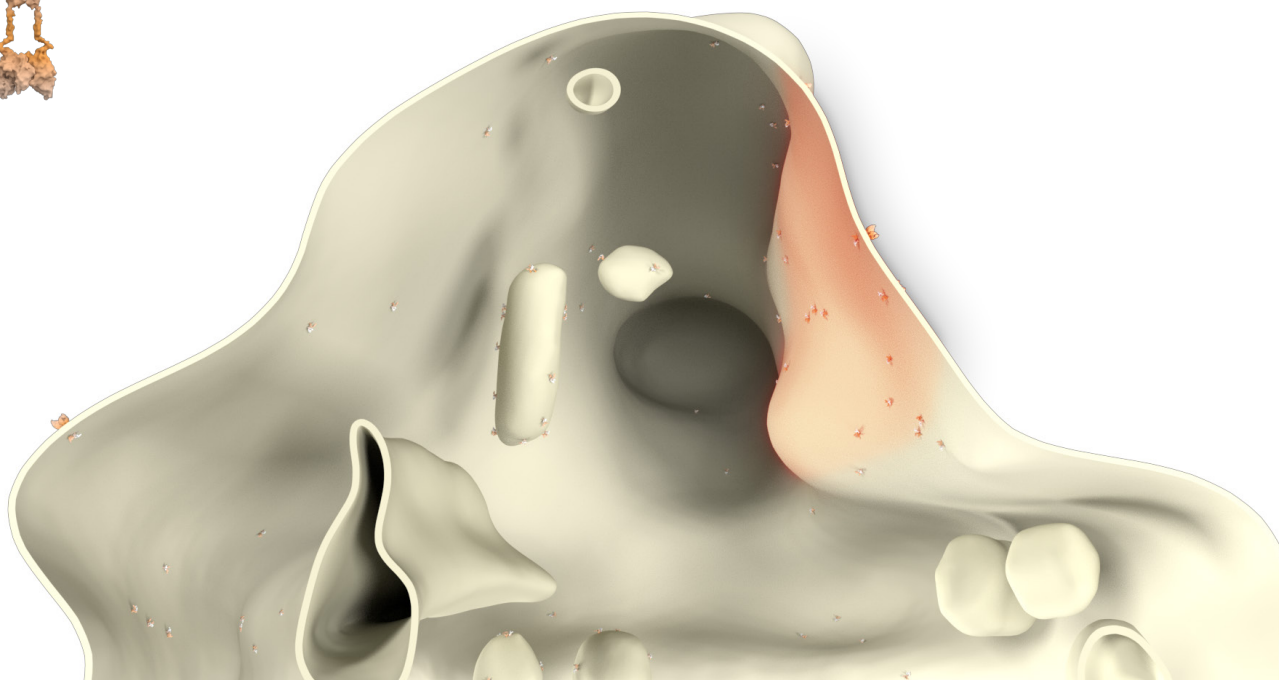


Whole cell copy number	840751.3 ± 93924.9	
Spine copy number	397.5 ± 79.4	
Function	Exo-/Endocytosis cofactors	
	Mushroom	Stubby
Spine copy number	368.3 ± 73.6	419.3 ± 83.8
% of total protein	0.2 ± 0.0%	0.2 ± 0.0%
Molarity (µM)	4.7 ± 0.9	4.0 ± 0.8
PSD copy number	53 ± 10.6	63 ± 12.6
% in PSD	14.4 ± 2.9%	15.0 ± 3.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	368.3 ± 73.6	$0.2 \pm 0.0\%$	4.7 ± 0.9	53 ± 10.6
Stubby	419.3 ± 83.8	$0.2 \pm 0.0\%$	4.0 ± 0.8	63 ± 12.6



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	368.3 ± 73.6	$0.2 \pm 0.0\%$	4.7 ± 0.9	53 ± 10.6
Stubby	419.3 ± 83.8	$0.2 \pm 0.0\%$	4.0 ± 0.8	63 ± 12.6



References

Antibody: Abcam ab84036

PDB Identifier: 2nsu, 3s9n

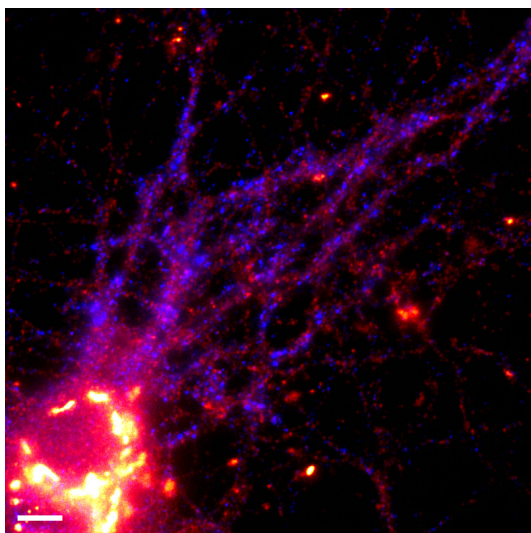
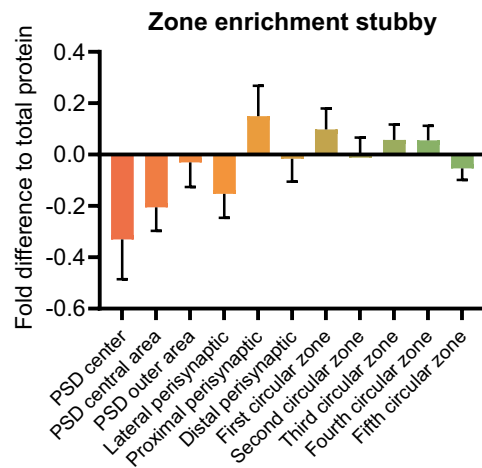
Literature:

Chi et al., 2006, J. Proteome Res.

Qian et al., 2002, Pharmacol. Rev.

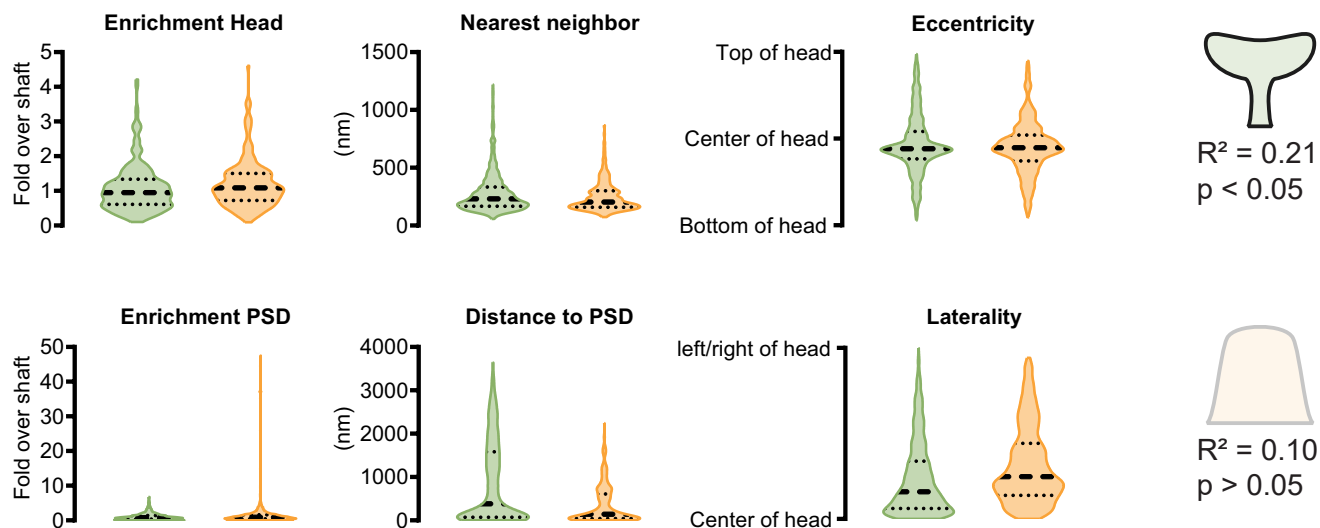
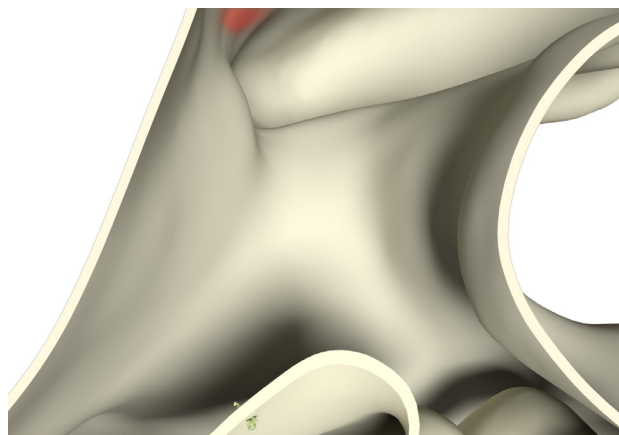
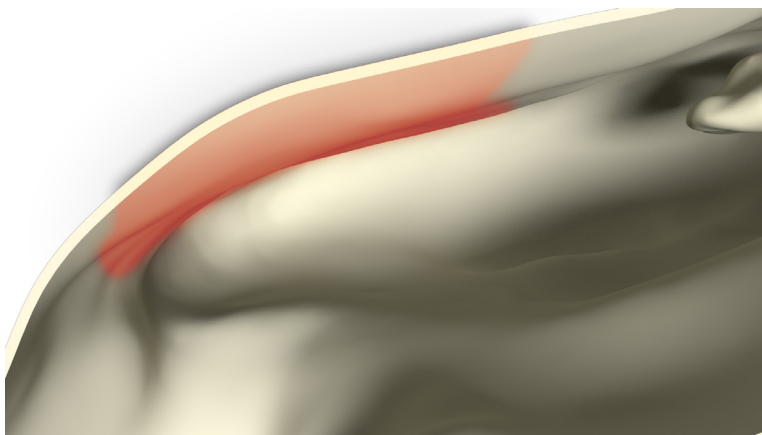
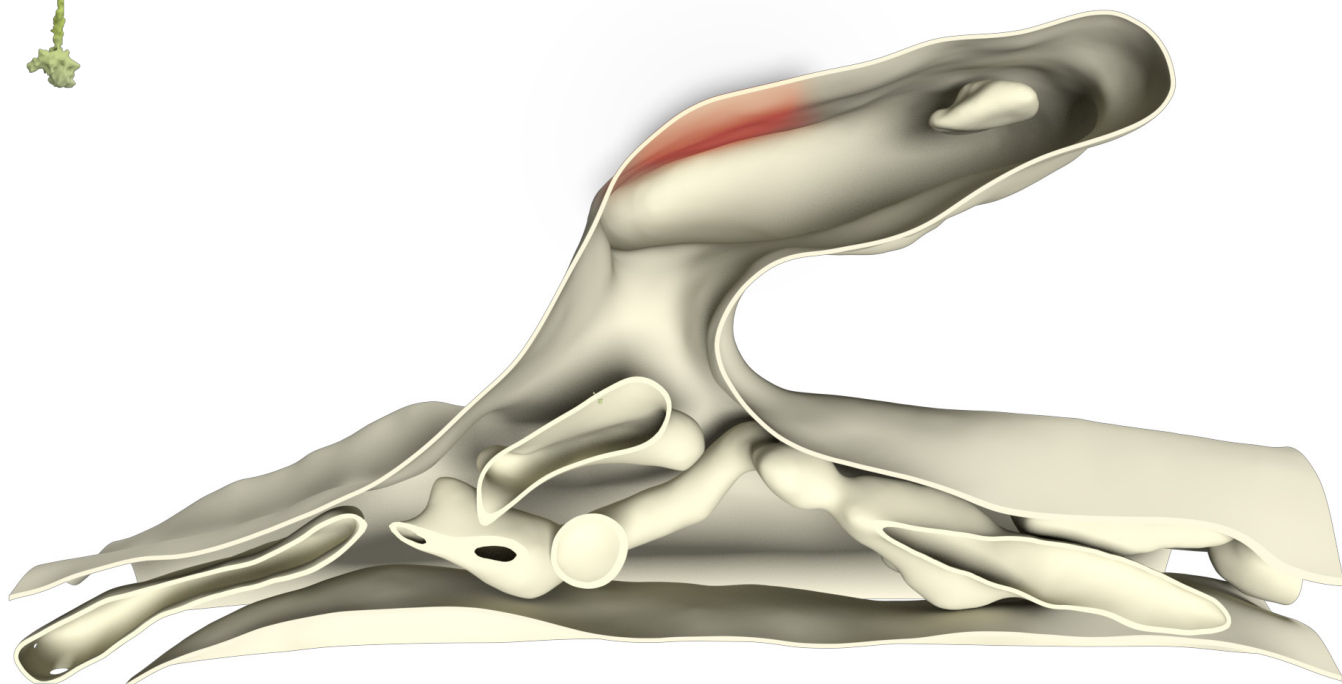
Rothenberger et al., 1987, Cell

Known Interactions: None

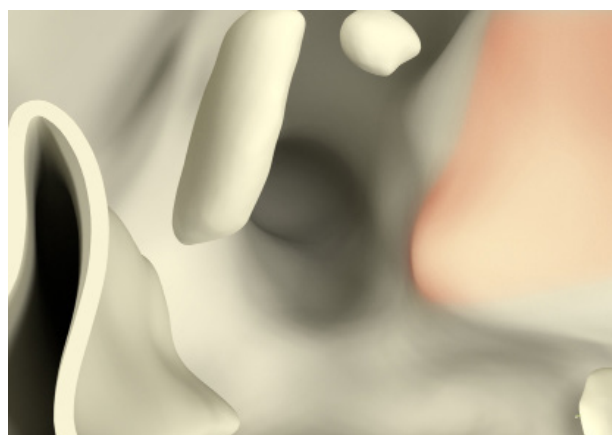
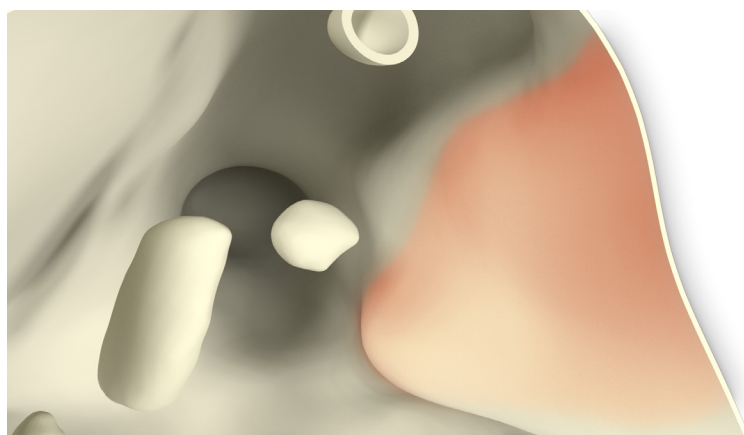
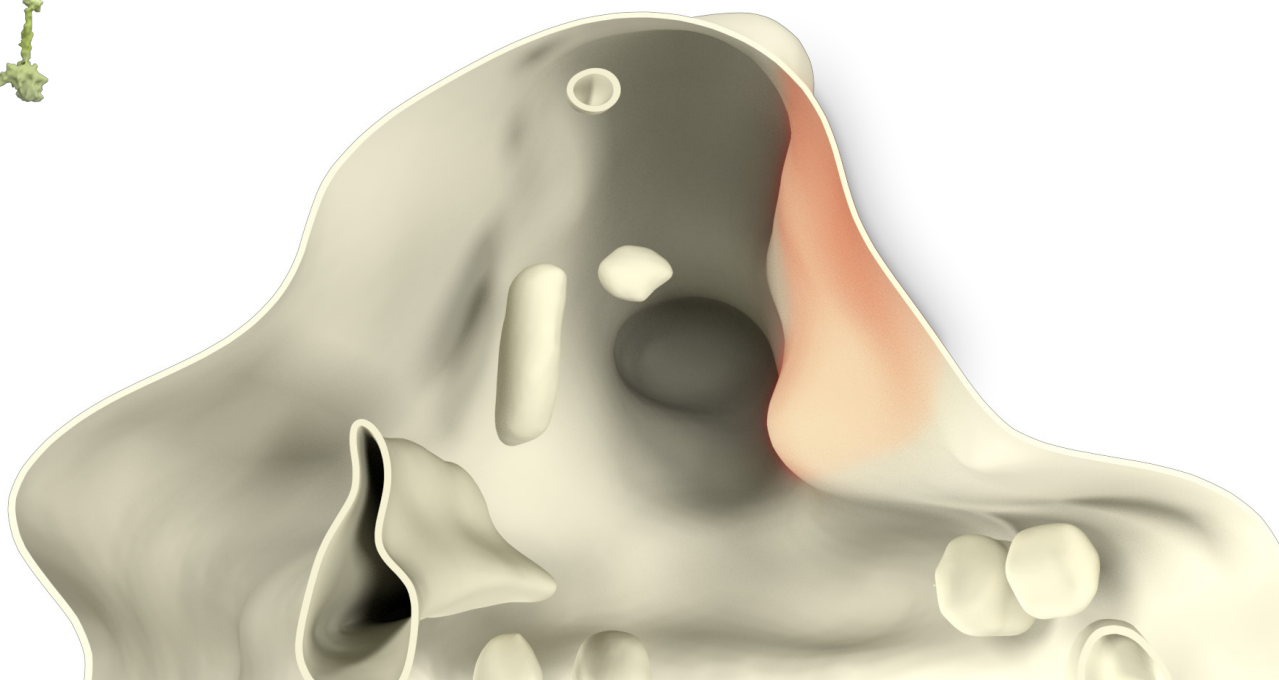


Whole cell copy number	63527.0 ± 8730.4	
Spine copy number	1.4 ± 1.7	
Function	Organelle	
	Mushroom	Stubby
Spine copy number	1.2 ± 1.4	1.6 ± 1.9
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	0.0 ± 0.0	0.0 ± 0.0
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1.2 ± 1.4	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	1.6 ± 1.9	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	1.2 ± 1.4	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0
Stubby	1.6 ± 1.9	$0.0 \pm 0.0\%$	0.0 ± 0.0	0 ± 0.0



References

Antibody: Sigma Aldrich T9826

Literature:

Gardiol et al., 1999, J. Neurosci.

Luzio et al., 1990, Biochem. J.

Reaves et al., 1993, Mol. Biol. Cell.

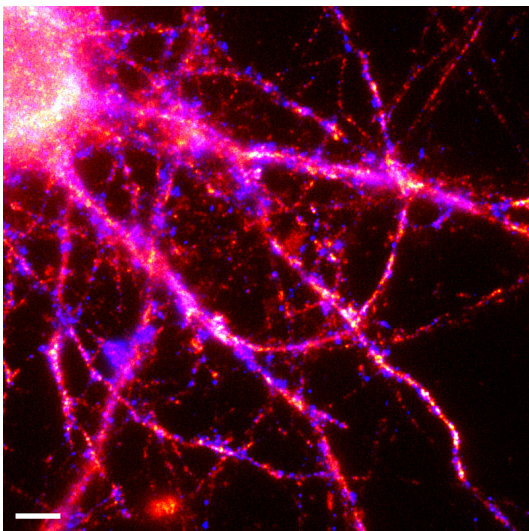
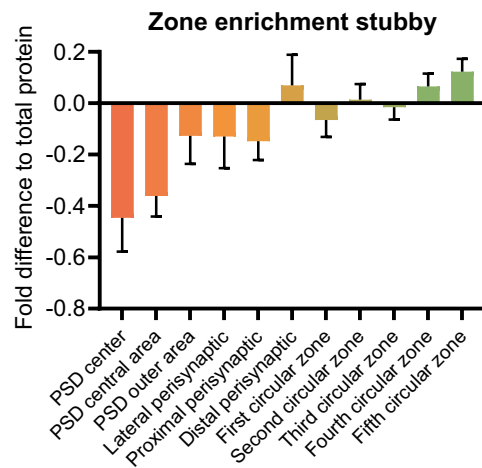
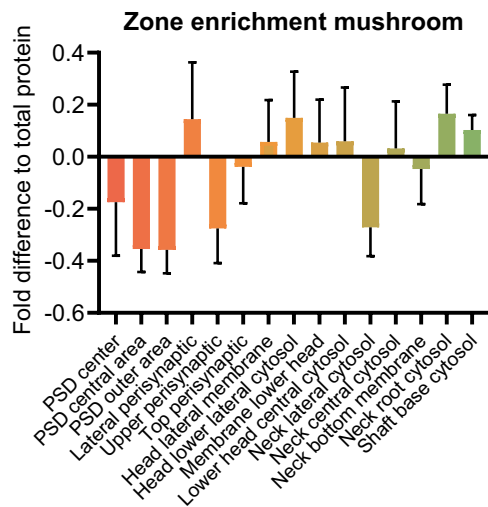
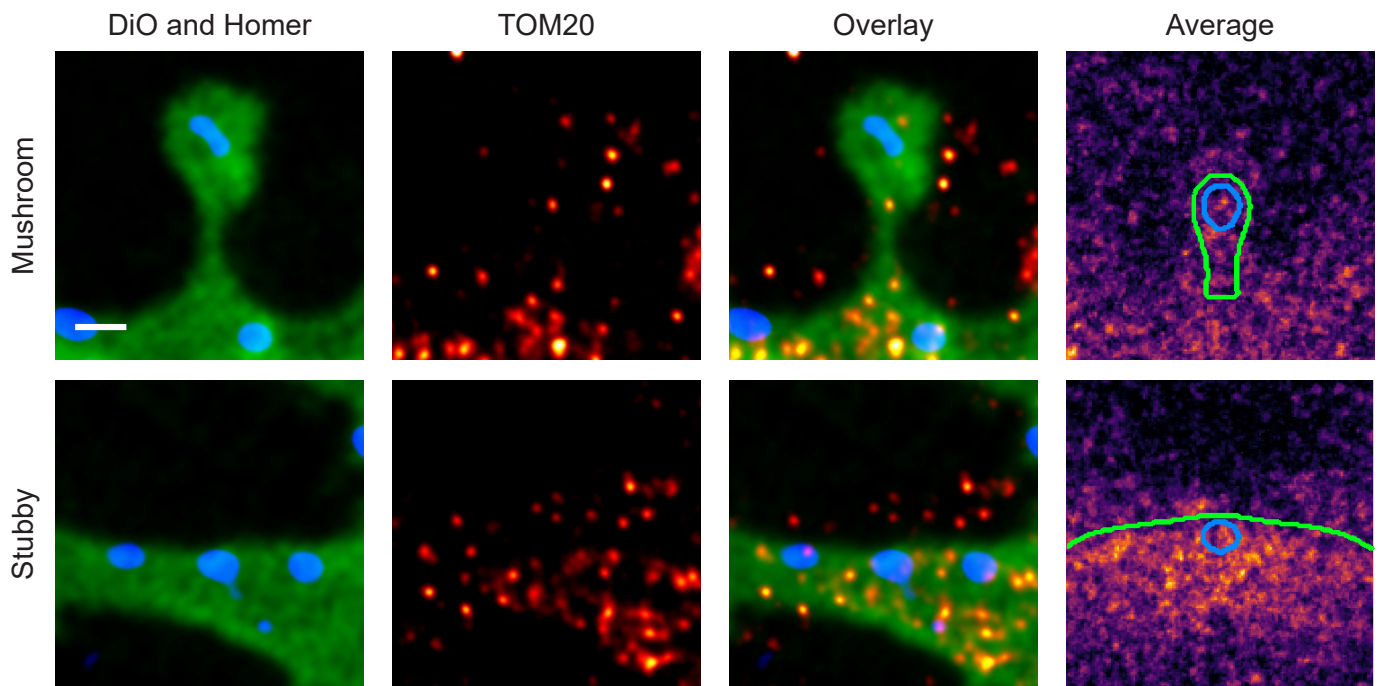
Structure: Modelled with I-TASSER

TOM20 (Gene: Tomm20, Uniprot ID: Q62760)

Known function: Part of the translocase of the outer mitochondrial membrane, Recognizes presequence of preproteins

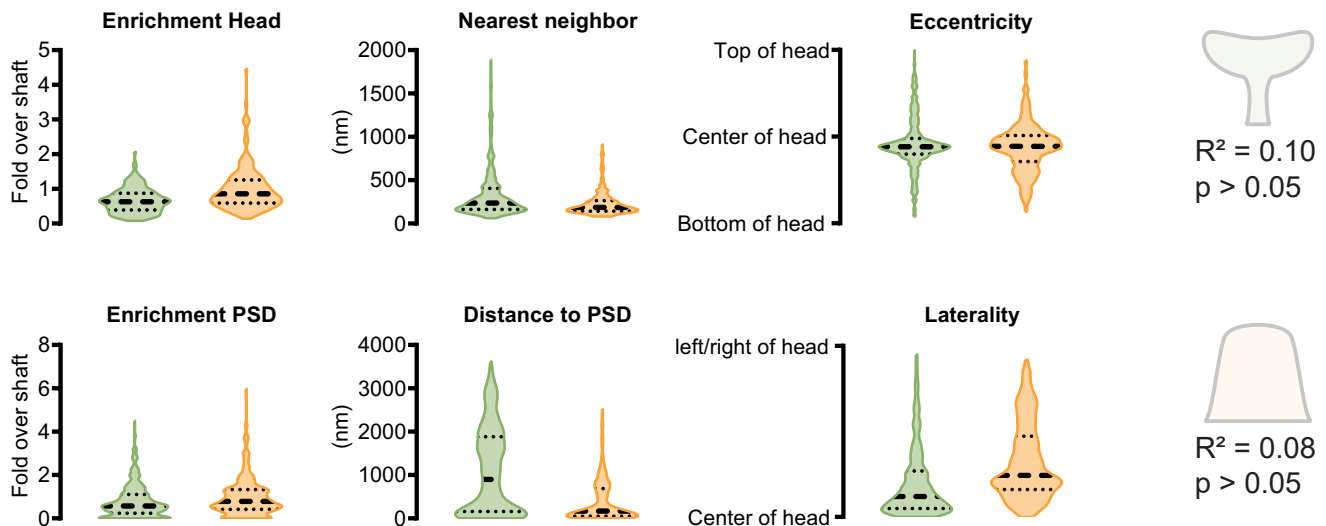
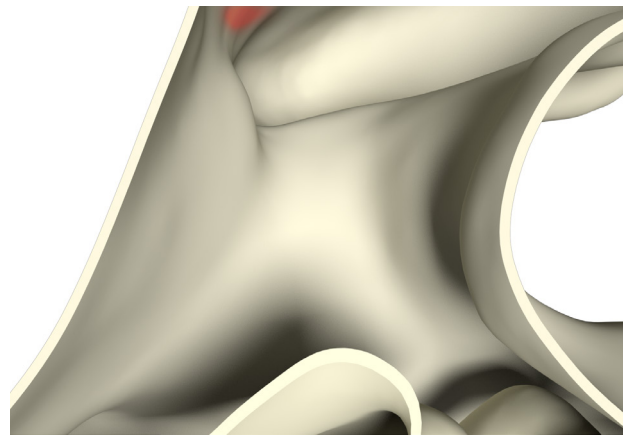
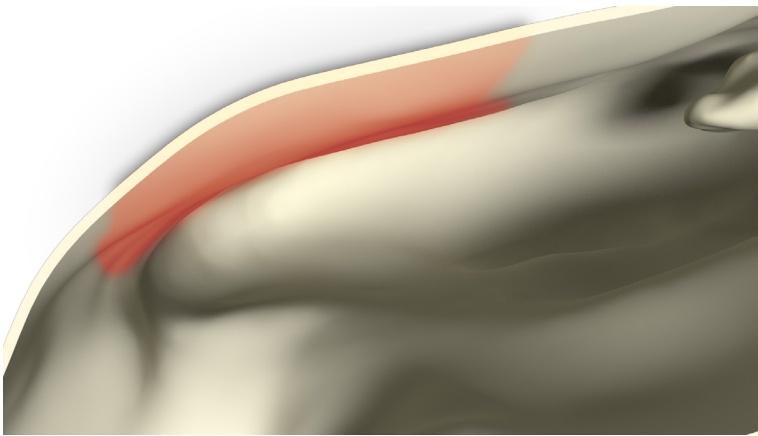
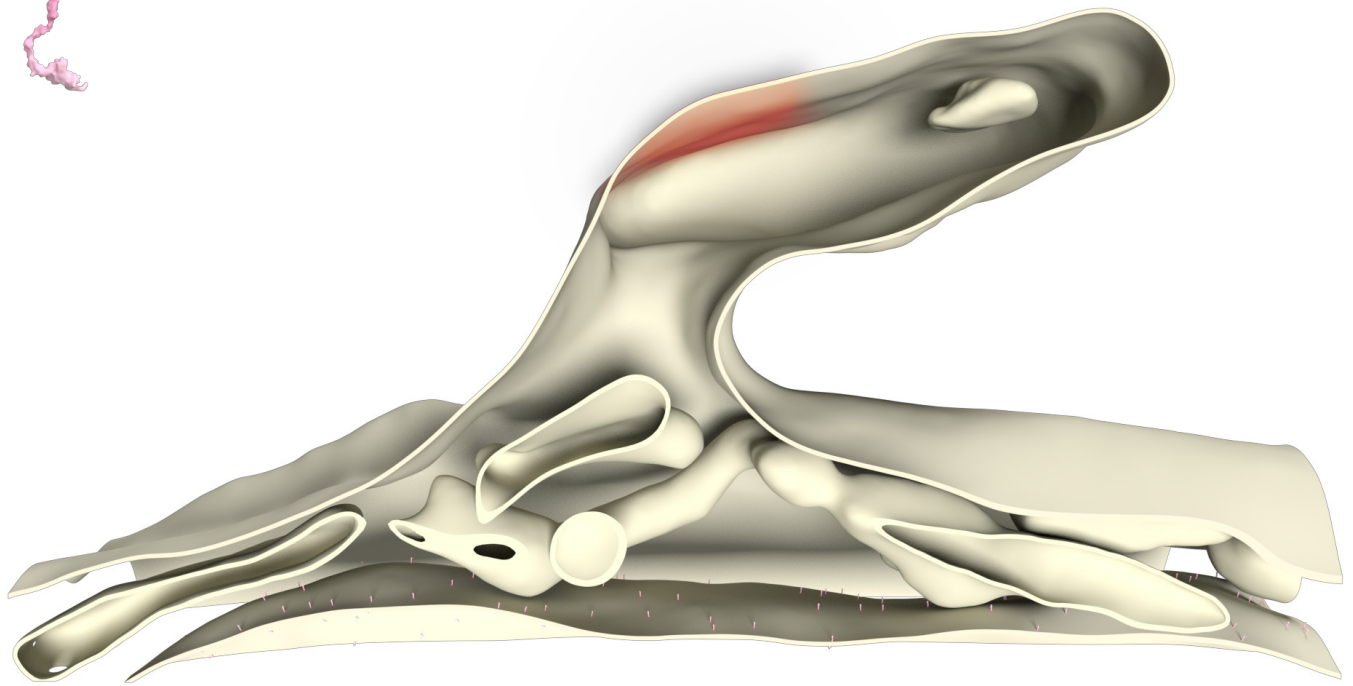
Known organization: Transmembrane protein, Mitochondrion, Forms clusters

Known Interactions: None

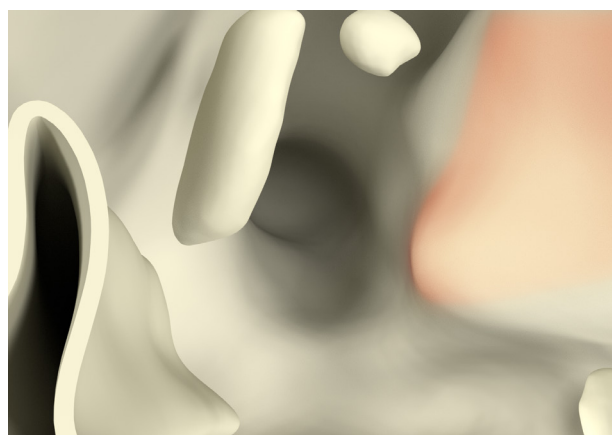
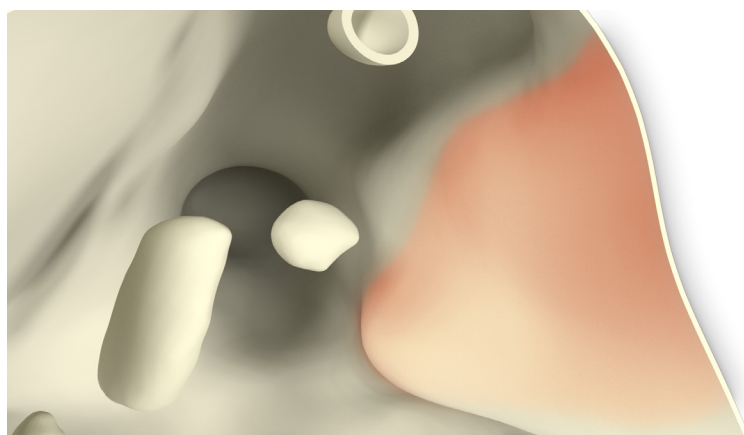
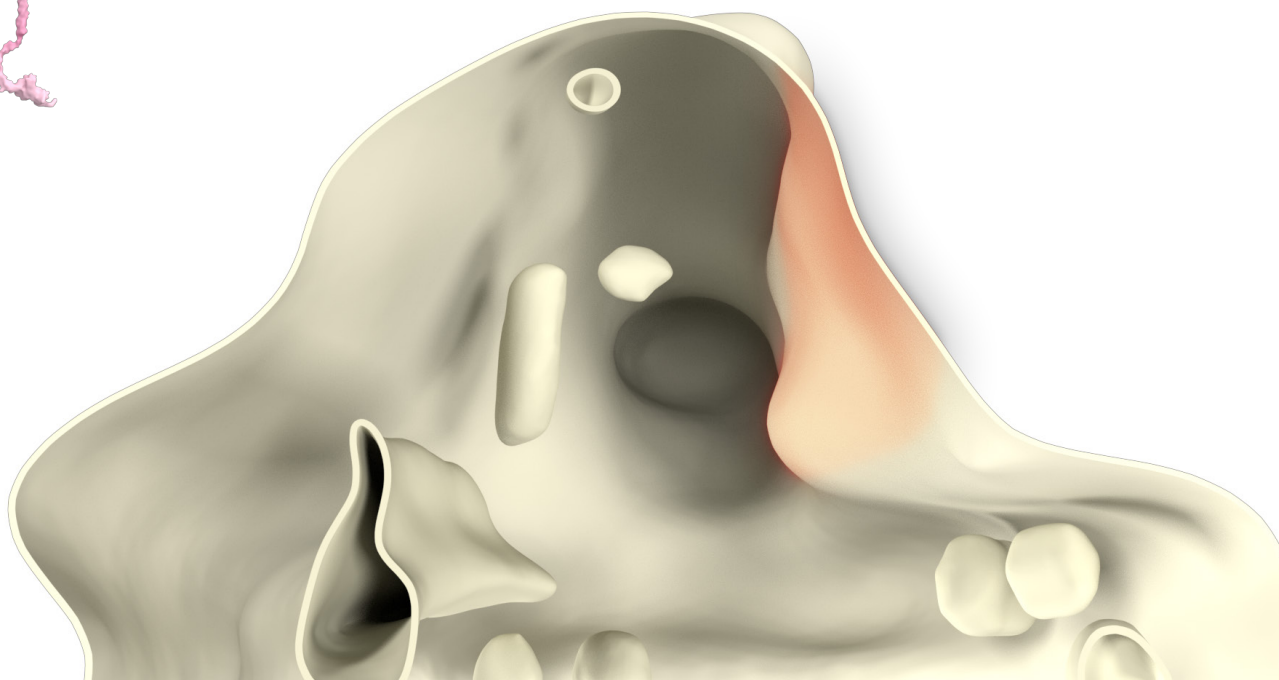


Whole cell copy number	5717233.5 ± 1289921.8	
Spine copy number	406.8 ± 224.3	
Function	Organelle	
	Mushroom	Stubby
Spine copy number	281.6 ± 155.3	544.3 ± 300.1
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	3.6 ± 2.0	5.1 ± 2.8
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	281.6 ± 155.3	$0.0 \pm 0.0\%$	3.6 ± 2.0	0 ± 0.0
Stubby	544.3 ± 300.1	$0.0 \pm 0.0\%$	5.1 ± 2.8	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	281.6 ± 155.3	$0.0 \pm 0.0\%$	3.6 ± 2.0	0 ± 0.0
Stubby	544.3 ± 300.1	$0.0 \pm 0.0\%$	5.1 ± 2.8	0 ± 0.0



References

Antibody: Sigma Aldrich WH0009804M1

PDB Identifier: 1om2

Literature:

Donnert et al., 2007, Biophys. J.

Saitoh et al., 2007, EMBO J.

Söllner et al., 1989, Cell

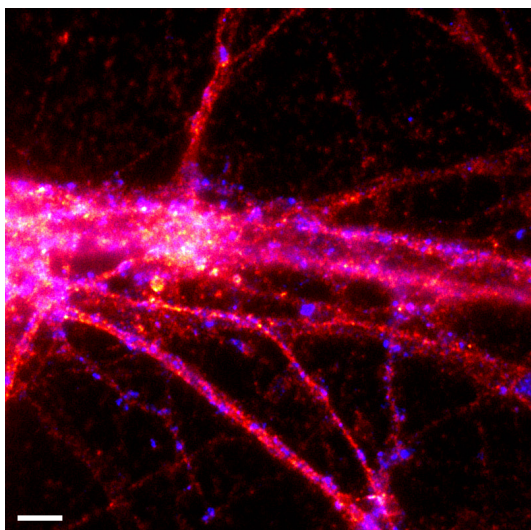
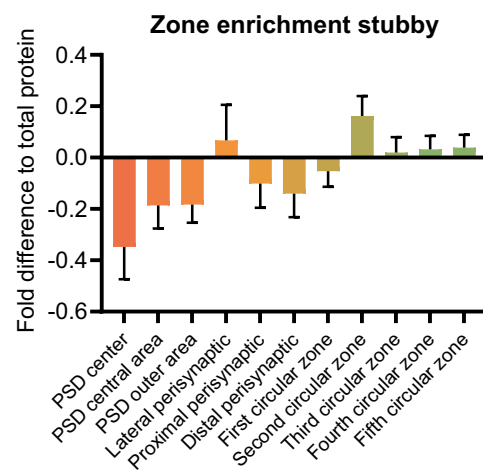
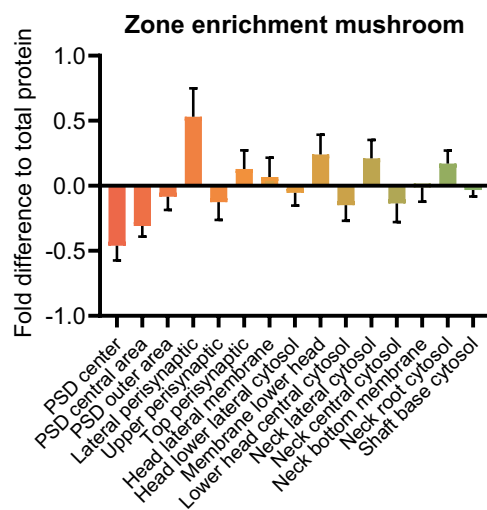
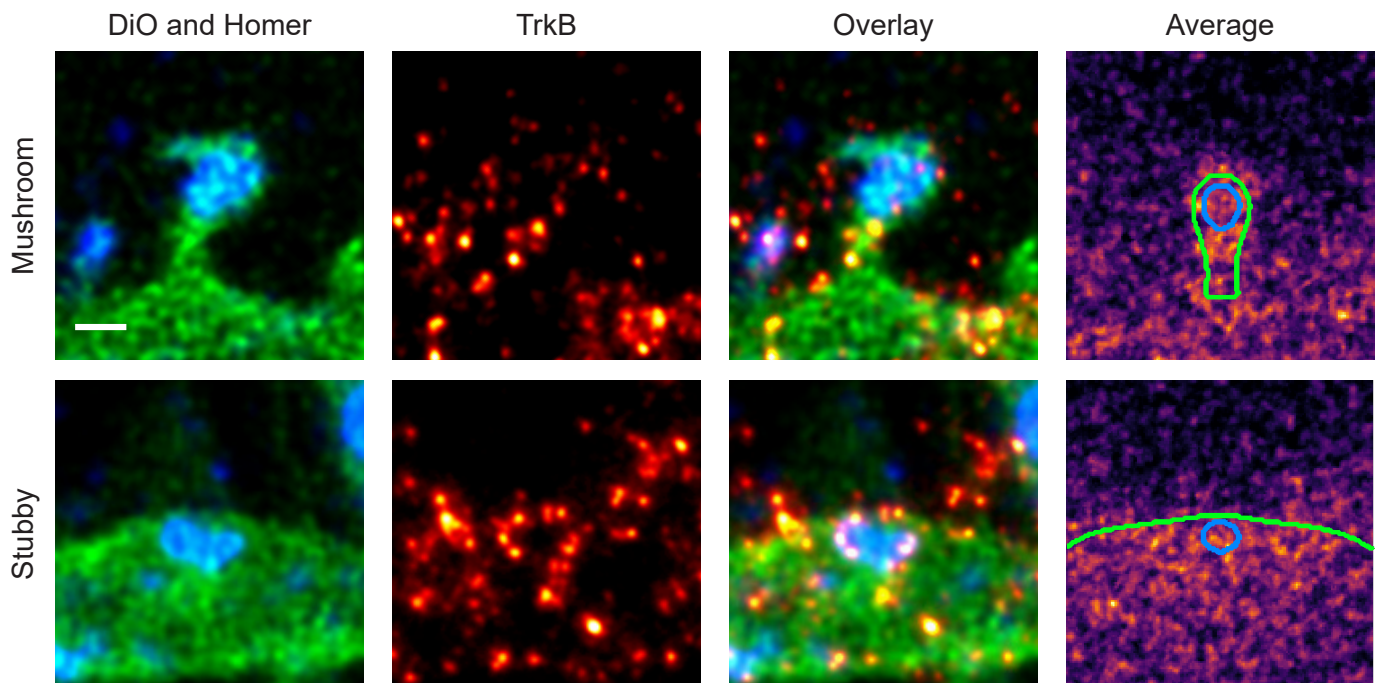
Wurm et al., 2011, Proc. Natl. Acad. Sci. U S A

TrkB (Gene: Ntrk2, Uniprot ID: Q63604)

Known function: Activates PI3K, PLC and MAP/ERK pathways, Important for dendritic growth, spine maturation and LTP

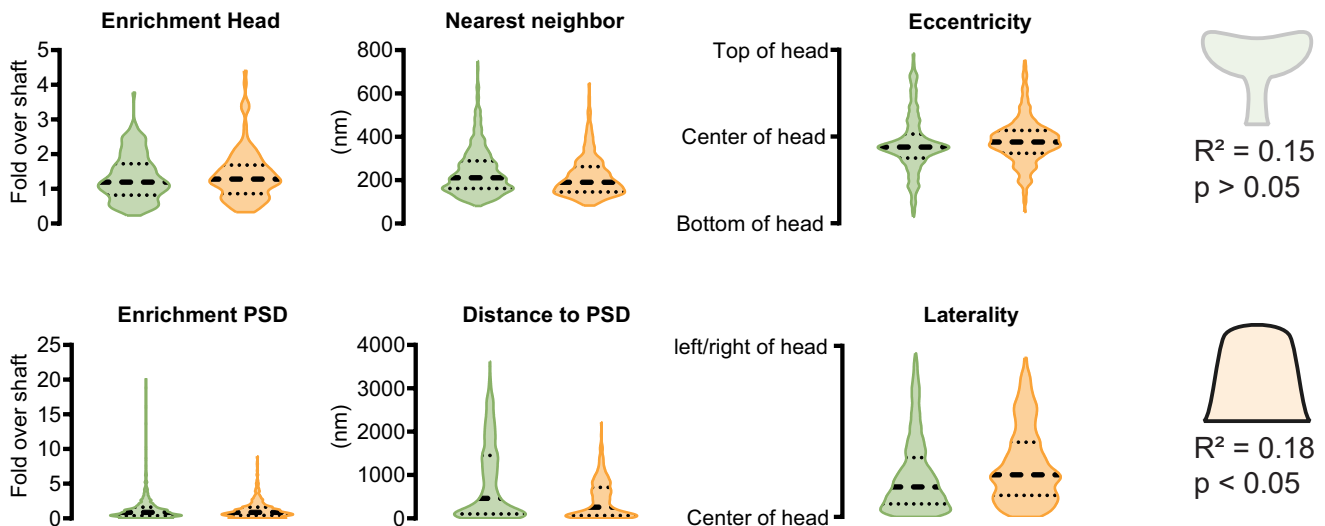
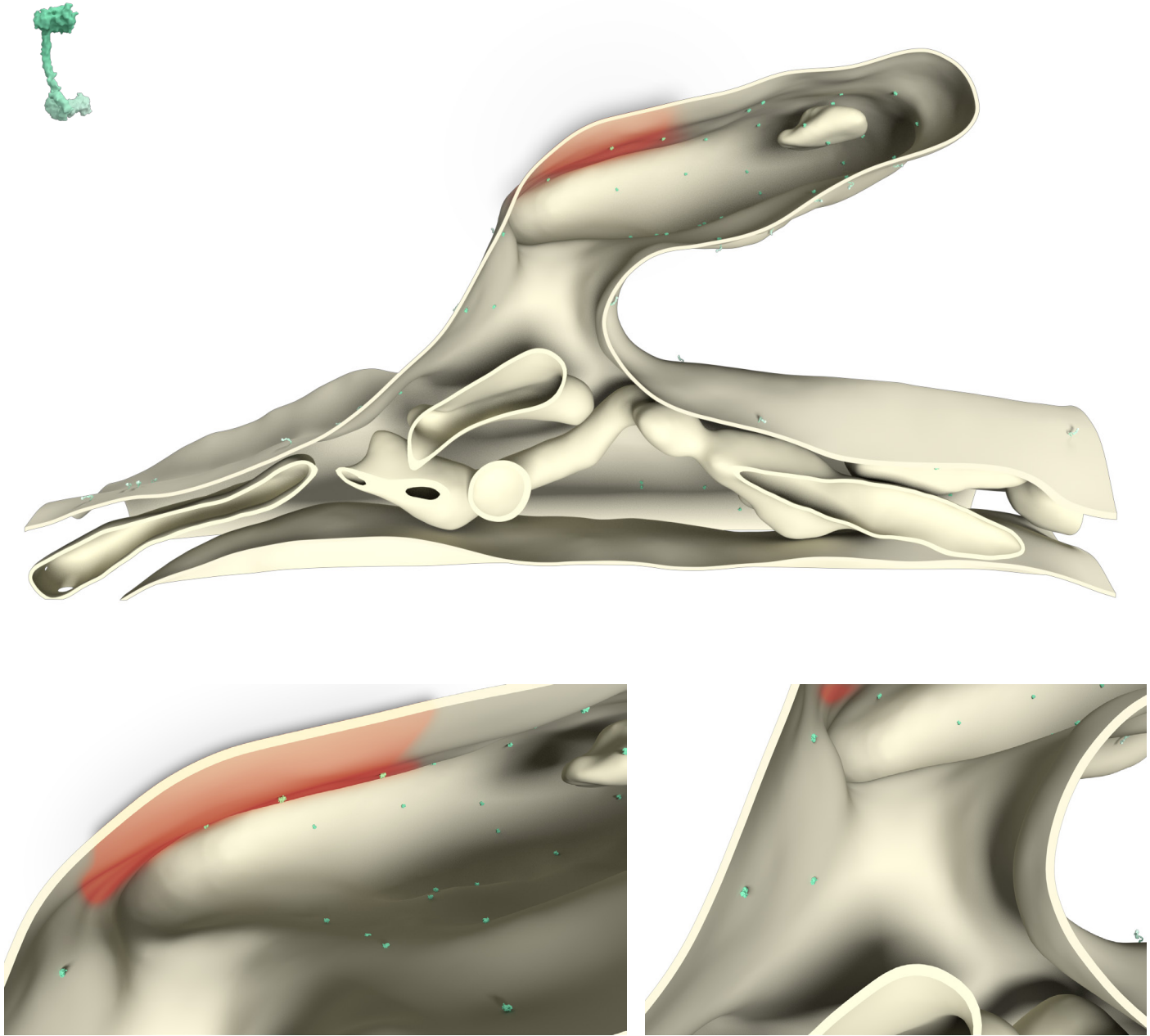
Known organization: Transmembrane protein, Forms small clusters

Known Interactions: BDNF, LNGFR

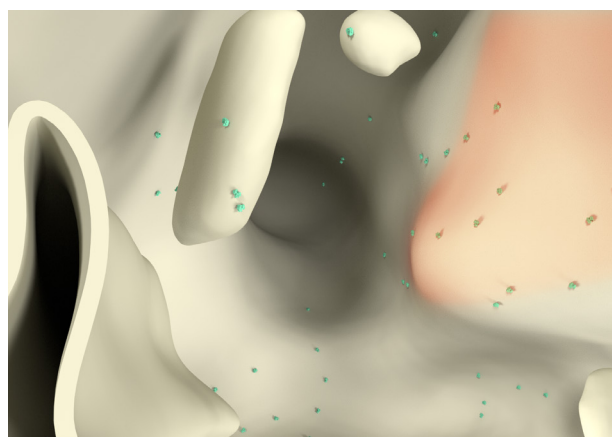
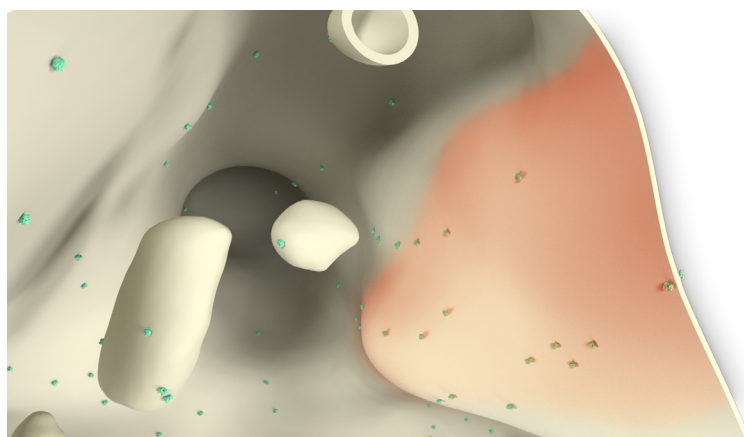
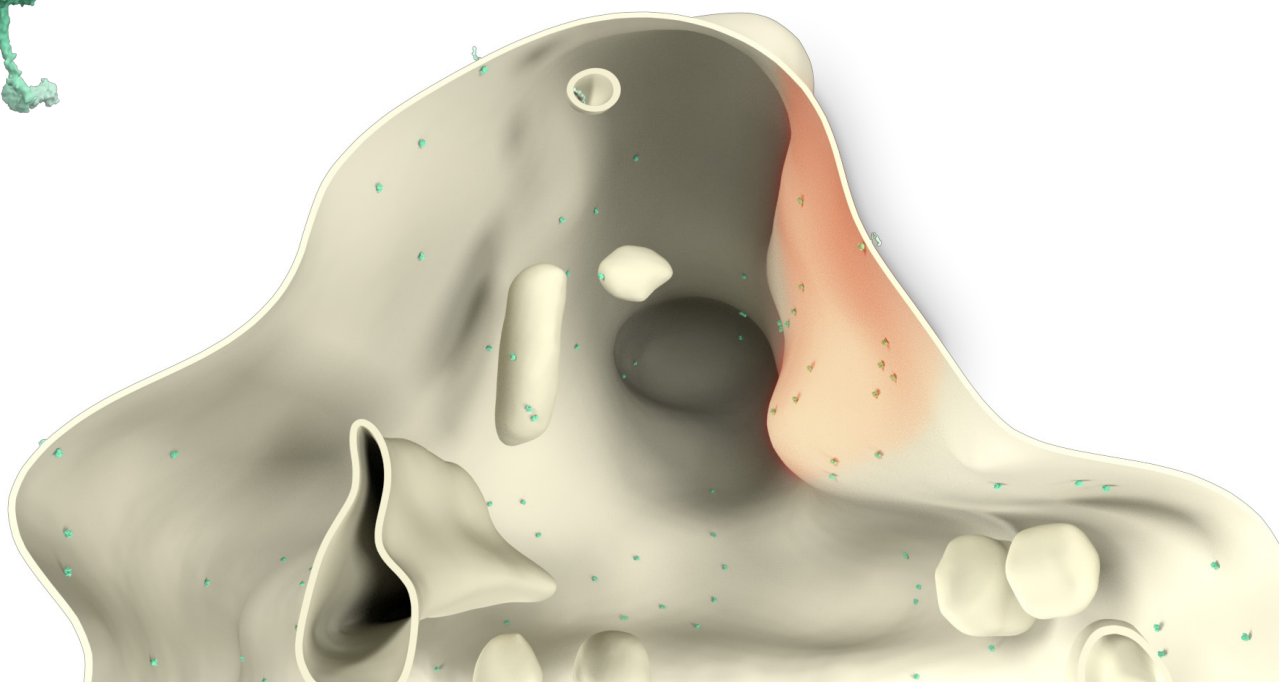


Whole cell copy number	117879.1 ± 32346.3	
Spine copy number	141.5 ± 52.9	
Function	Receptor	
	Mushroom	Stubby
Spine copy number	124.3 ± 46.5	140.2 ± 52.4
% of total protein	0.1 ± 0.0%	0.1 ± 0.0%
Molarity (μM)	1.6 ± 0.6	1.3 ± 0.5
PSD copy number	15 ± 5.6	14 ± 5.2
% in PSD	12.1 ± 4.5%	10.0 ± 3.7%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	124.3 ± 46.5	$0.1 \pm 0.0\%$	1.6 ± 0.6	15 ± 5.6
Stubby	140.2 ± 52.4	$0.1 \pm 0.0\%$	1.3 ± 0.5	14 ± 5.2



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	124.3 ± 46.5	$0.1 \pm 0.0\%$	1.6 ± 0.6	15 ± 5.6
Stubby	140.2 ± 52.4	$0.1 \pm 0.0\%$	1.3 ± 0.5	14 ± 5.2



References

Antibody: Abcam ab33655

PDB Identifier: 1hcf, 1www, 4asz

Literature:

Angelov and Angelova, 2017, Nanoscale

Bibel et al., 1999, EMBO J.

Gomes et al., 2006, J. Neurosci.

Gorski et al., 2003, J. Neurosci.

Kang and Schuman, 1995, Science

Soppet et al., 1991, Cell

Tanaka et al., 1997, J. Neurosci.

Wirth et al., 2003, Development

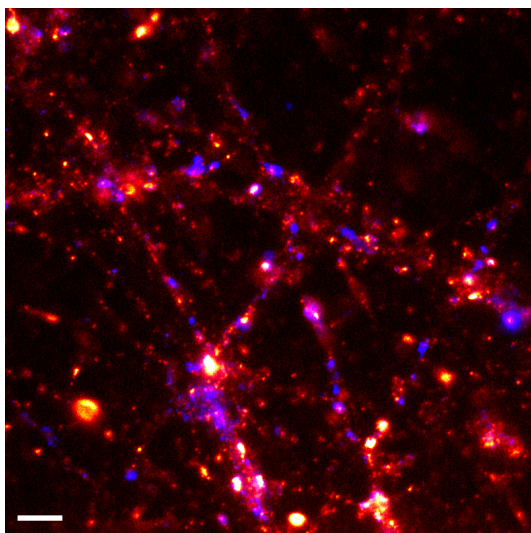
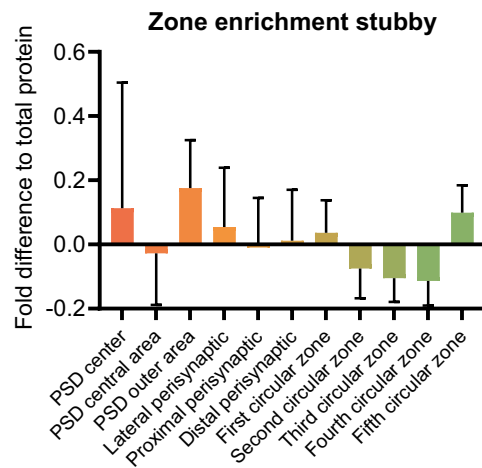
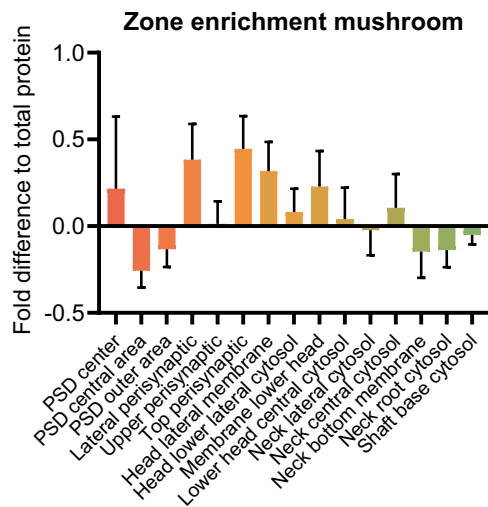
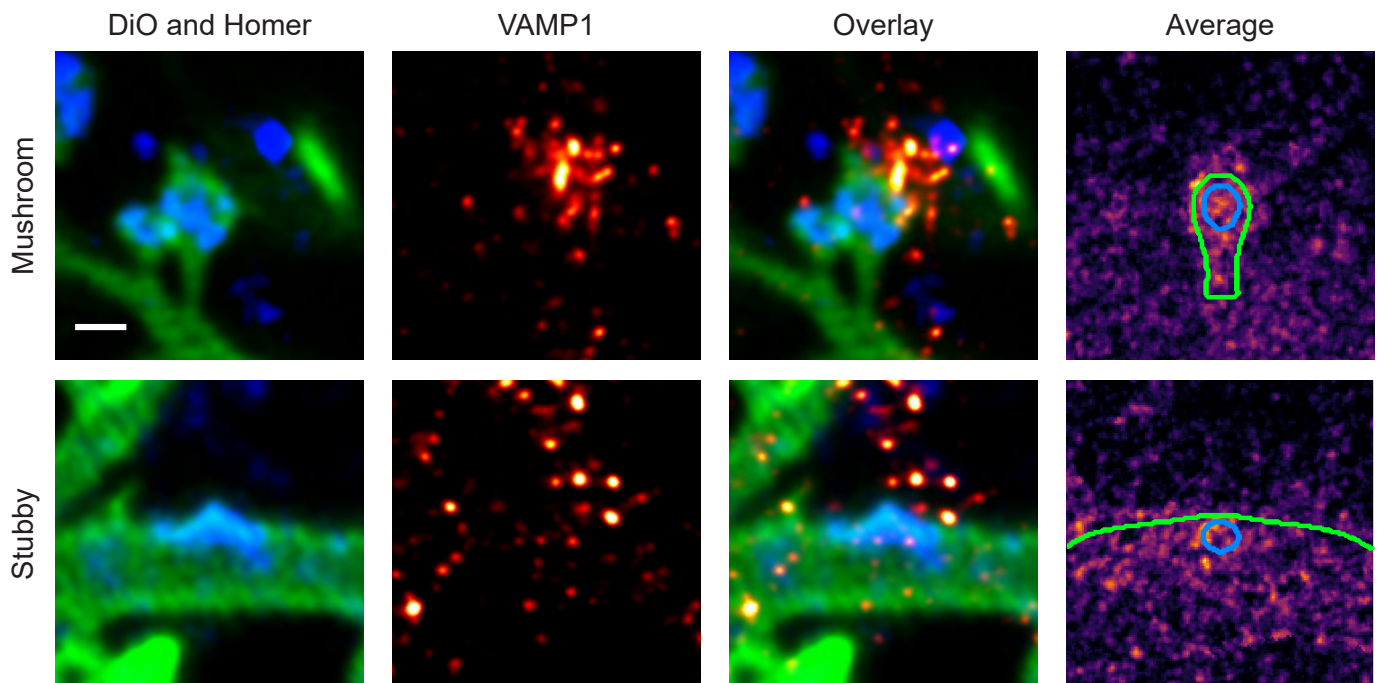
Xu et al., 2000, J. Neurosci.

VAMP1 (Synaptobrevin1, Gene: Vamp1, Uniprot ID: Q63666)

Known function: R-SNARE, SV release, Delivery of NMDAR to PM

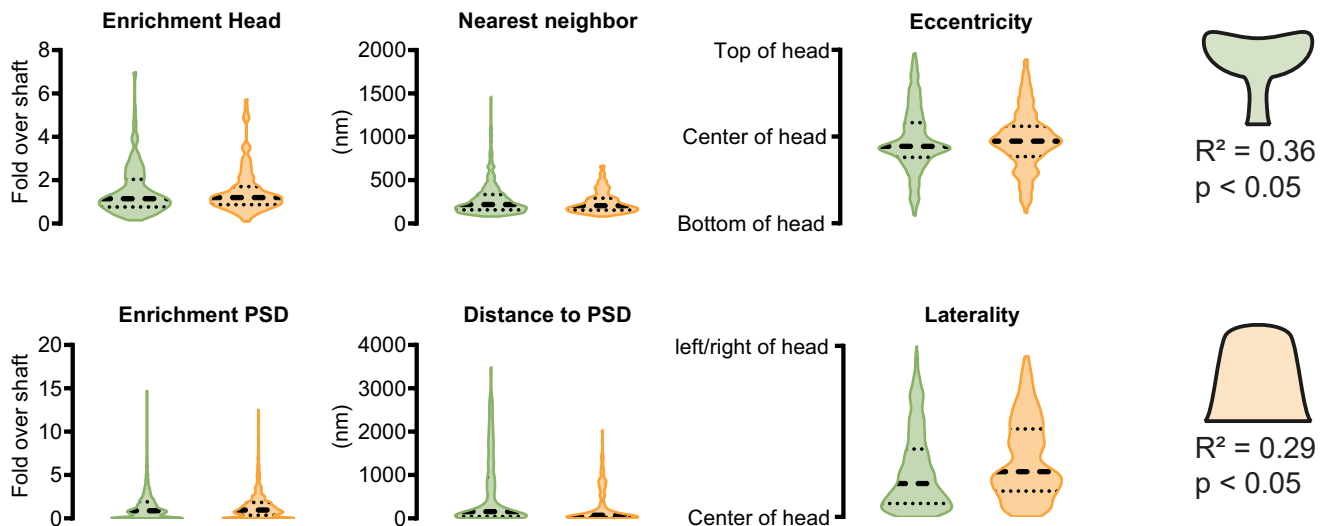
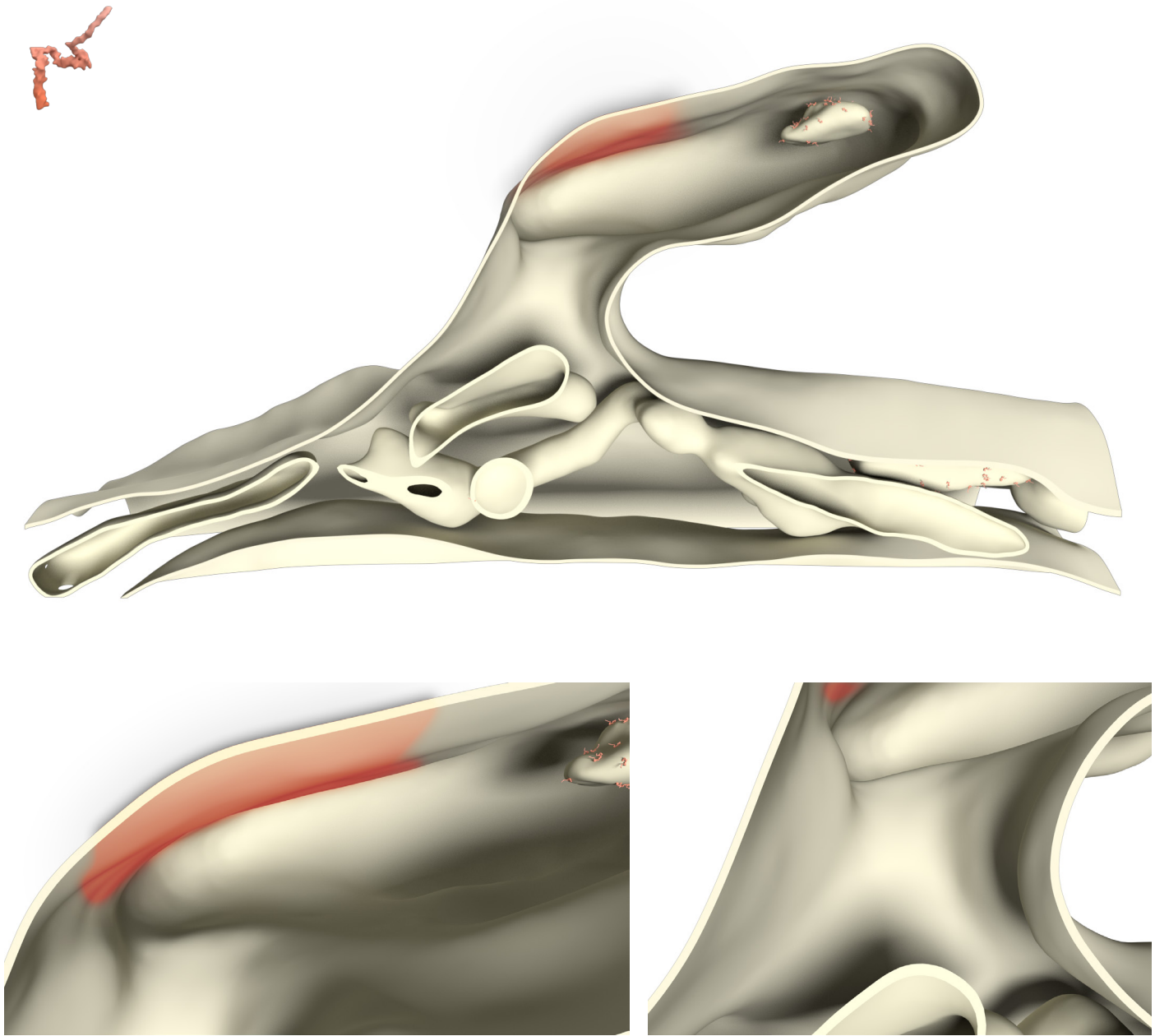
Known organization: Transmembrane protein, On SV and secretory vesicles

Known Interactions: Syntaxin1, Syntaxin4, SNAP25

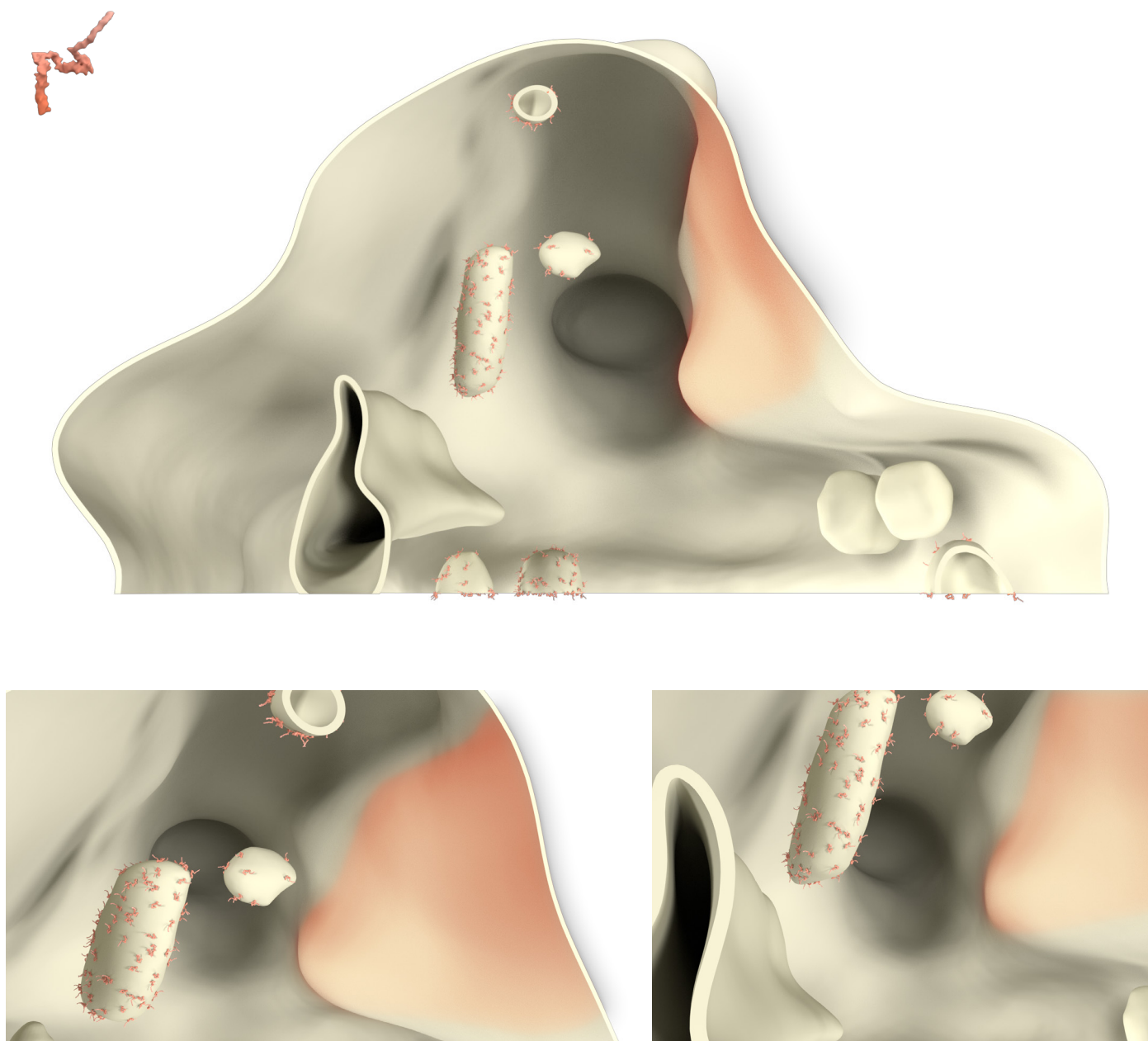


Whole cell copy number	2485719.9 ± 722352.8	
Spine copy number	363.4 ± 134.4	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	334.3 ± 123.6	447.7 ± 165.6
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	4.2 ± 1.6	4.2 ± 1.6
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	334.3 ± 123.6	$0.0 \pm 0.0\%$	4.2 ± 1.6	0 ± 0.0
Stubby	447.7 ± 165.6	$0.0 \pm 0.0\%$	4.2 ± 1.6	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	334.3 ± 123.6	$0.0 \pm 0.0\%$	4.2 ± 1.6	0 ± 0.0
Stubby	447.7 ± 165.6	$0.0 \pm 0.0\%$	4.2 ± 1.6	0 ± 0.0



References

Antibody: Synaptic Systems 104 002

PDB Identifier: modified VAMP2

Literature:

Calakos et al., 1994, Science

Gu and Huganir, 2016, Proc. Natl. Acad. Sci. U S A

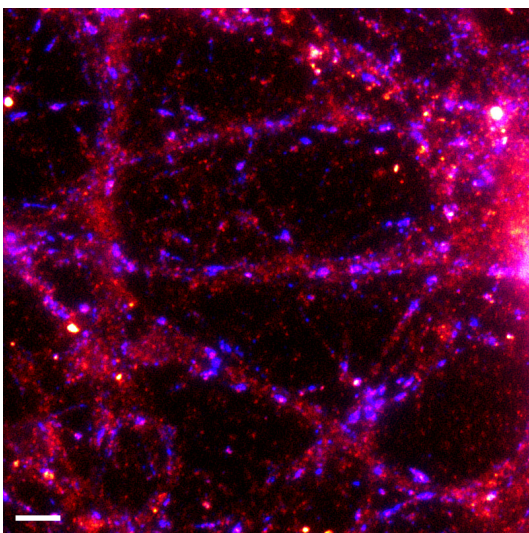
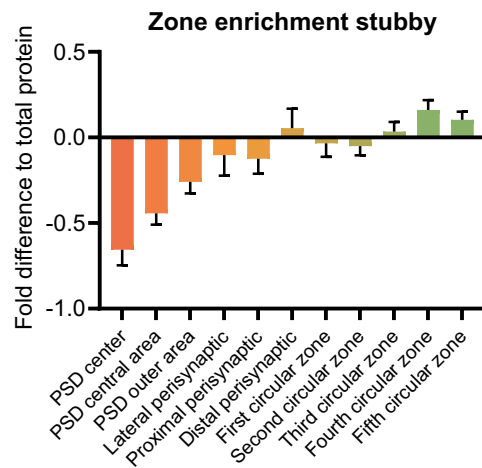
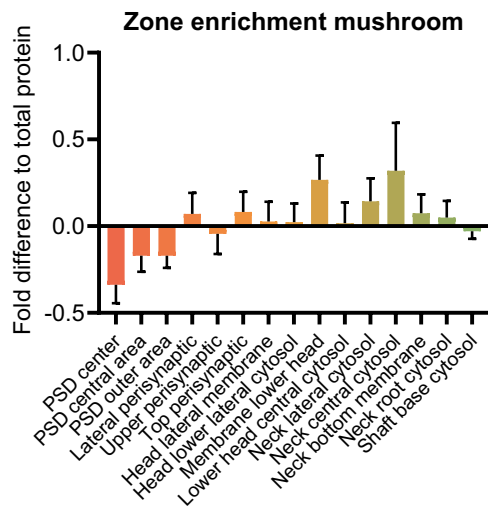
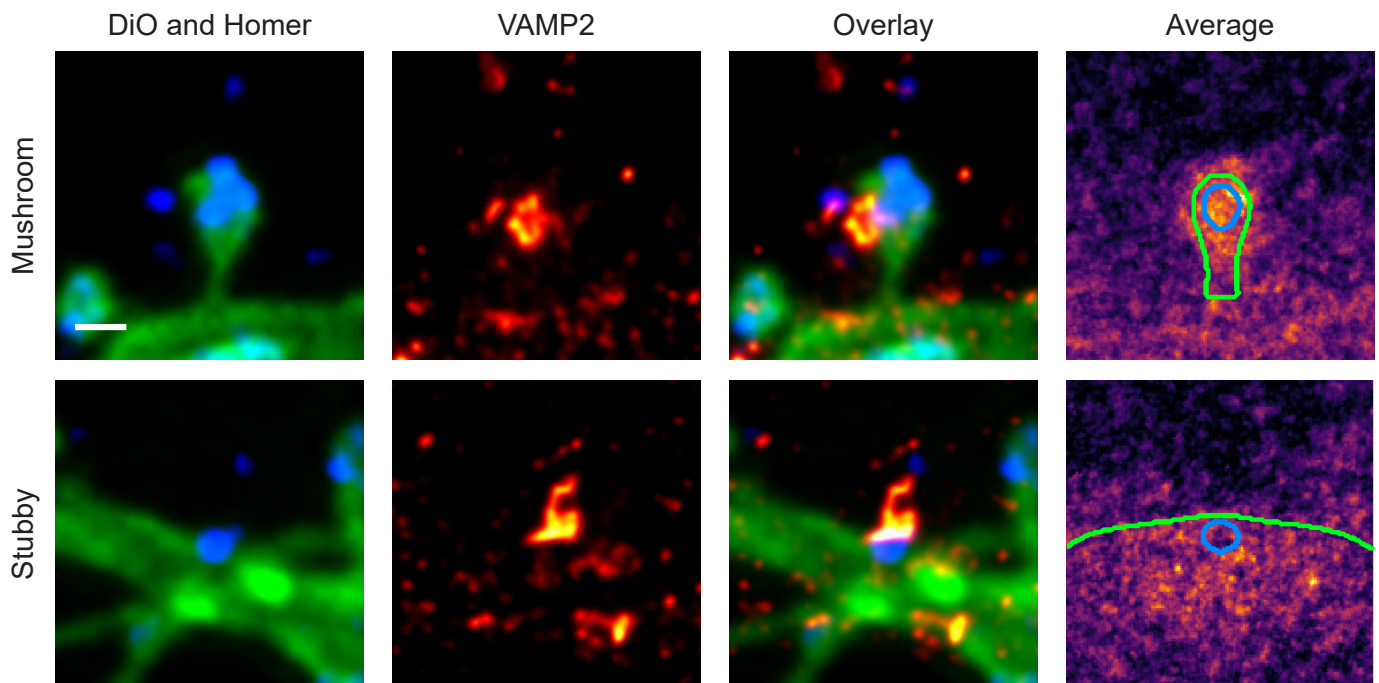
Trimble et al., 1988, Proc. Natl. Acad. Sci. U S A

VAMP2 (Synaptobrevin2, Gene: Vamp2, Uniprot ID: P63045)

Known function: R SNARE, SV release, Delivery of AMPAR and GABAAR to PM

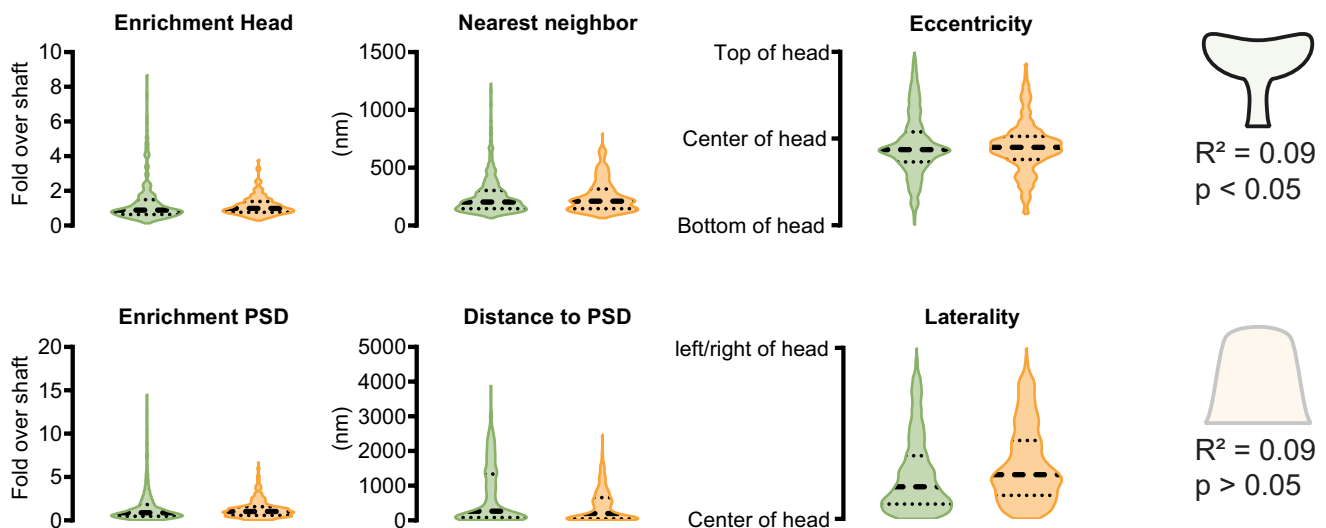
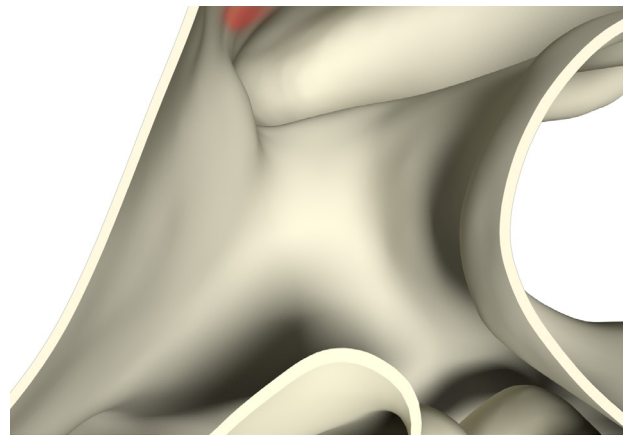
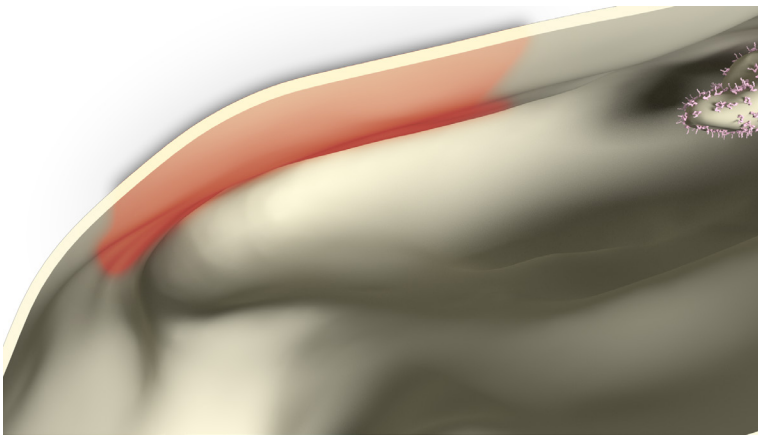
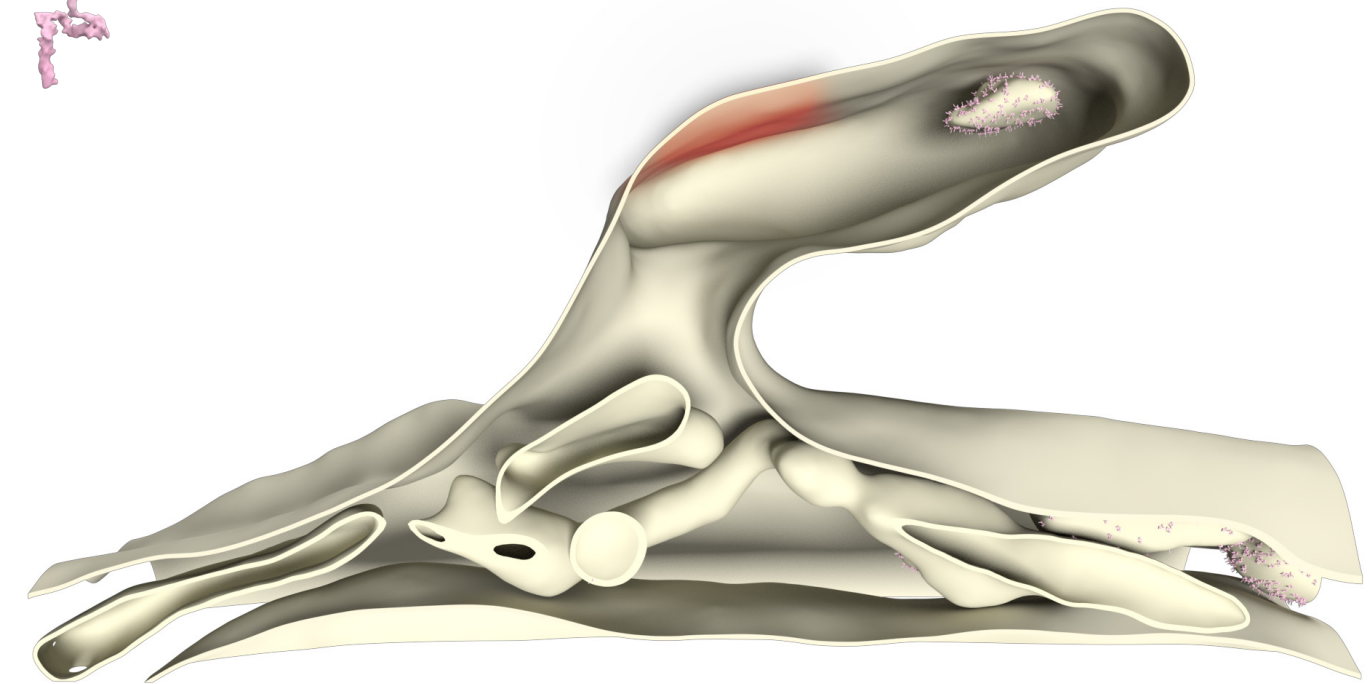
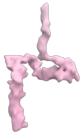
Known organization: Transmembrane protein, On SV and small postsynaptic vesicles close to PSD

Known Interactions: Syntaxin1, Syntaxin4, SNAP25, Synaptotagmin1, CDC42

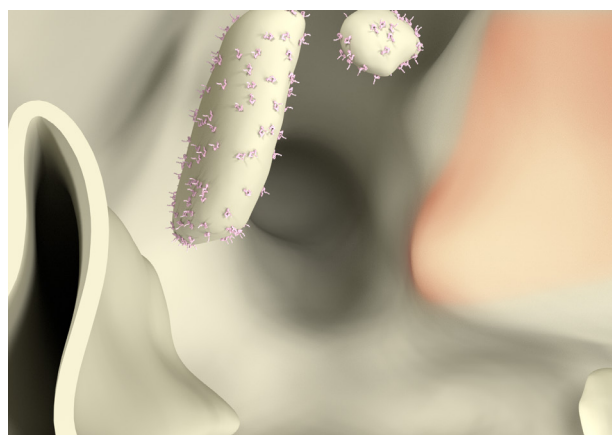
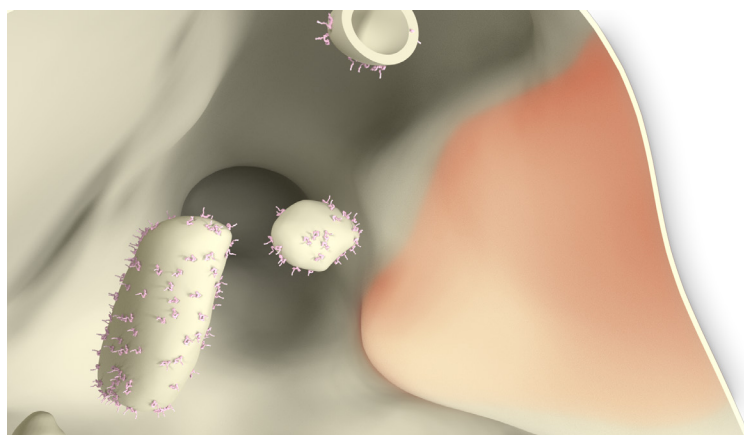
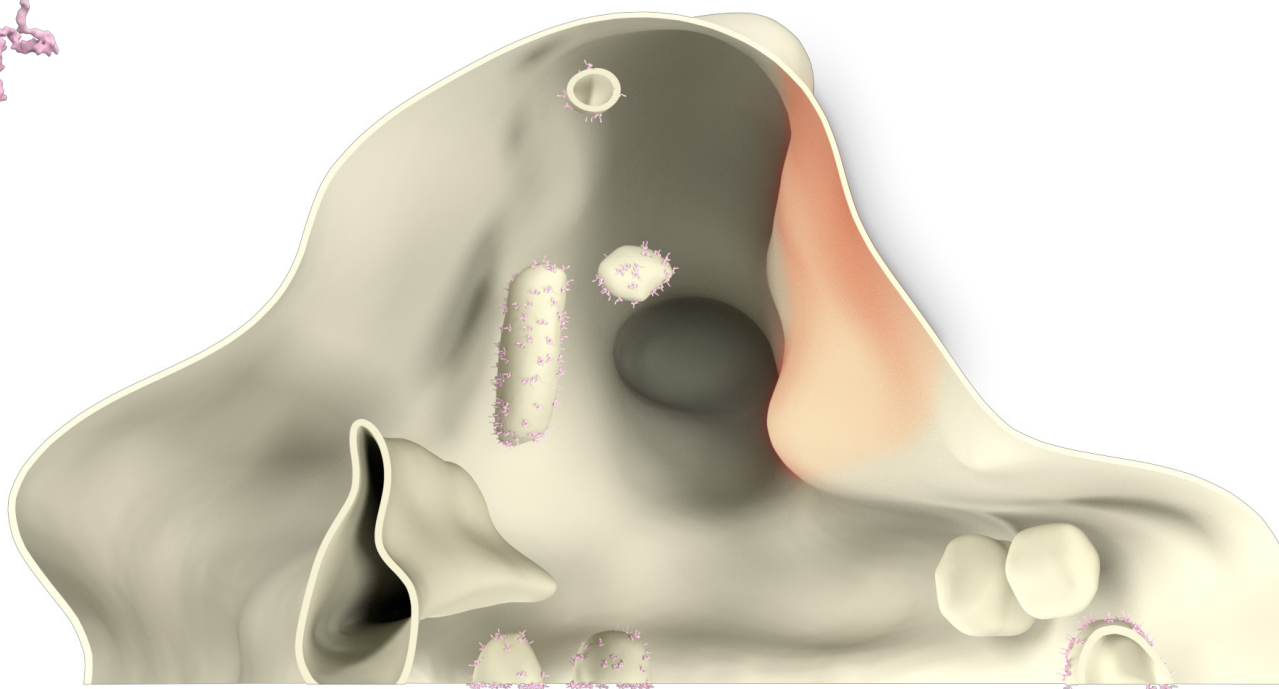
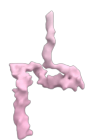


Whole cell copy number	18720616.2 ± 8591610.7	
Spine copy number	2045.0 ± 1165.3	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	2050.9 ± 1168.7	2134.7 ± 1216.4
% of total protein	0.1 ± 0.1%	0.1 ± 0.1%
Molarity (μM)	26.0 ± 14.8	20.2 ± 11.5
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	2050.9 ± 1168.7	$0.1 \pm 0.1\%$	26.0 ± 14.8	0 ± 0.0
Stubby	2134.7 ± 1216.4	$0.1 \pm 0.1\%$	20.2 ± 11.5	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	2050.9 ± 1168.7	$0.1 \pm 0.1\%$	26.0 ± 14.8	0 ± 0.0
Stubby	2134.7 ± 1216.4	$0.1 \pm 0.1\%$	20.2 ± 11.5	0 ± 0.0



References

Antibody: Synaptic Systems 104 211

PDB Identifier: 2kog

Literature:

Calakos et al., 1994, Science

Gu et al., 2016, Proc. Natl. Acad. Sci. U S A

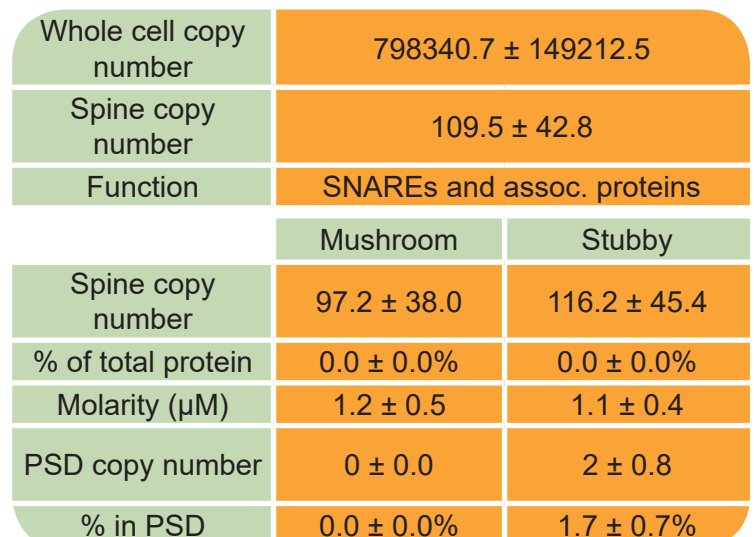
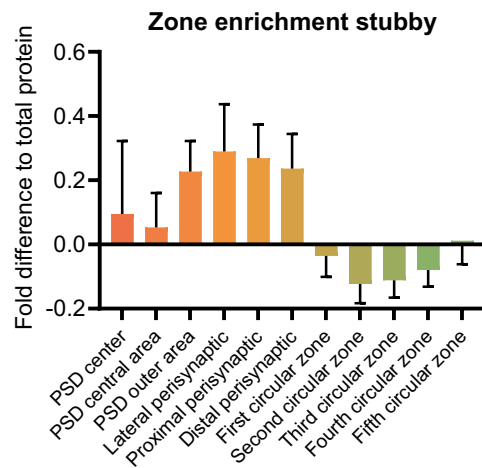
Hu et al., 2002, Nature

Hussain and Davanger, 2015, PLoS One

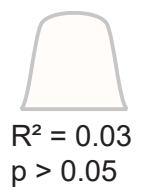
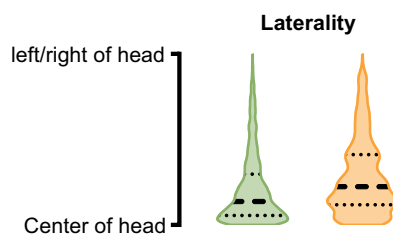
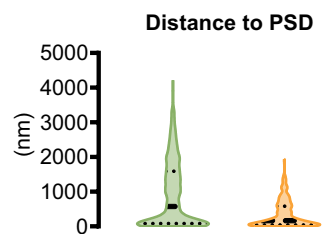
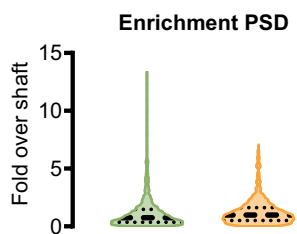
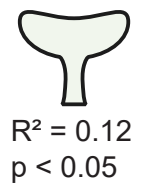
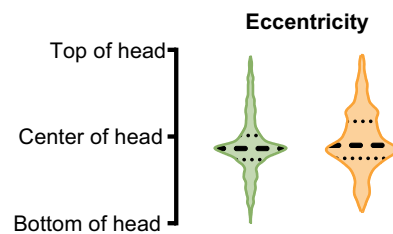
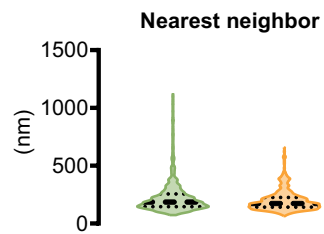
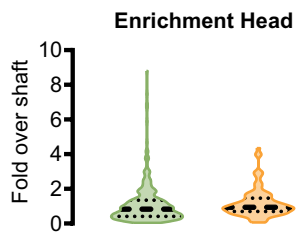
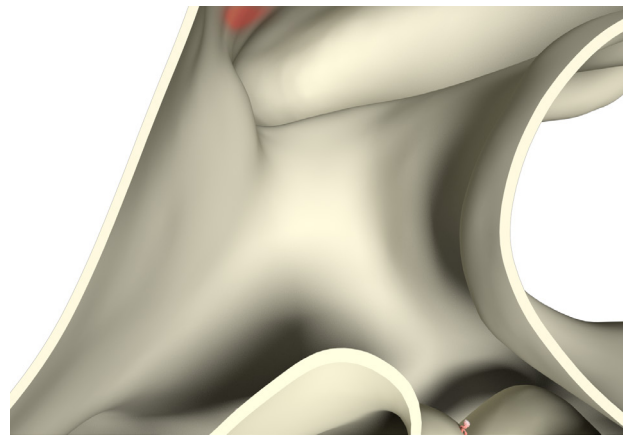
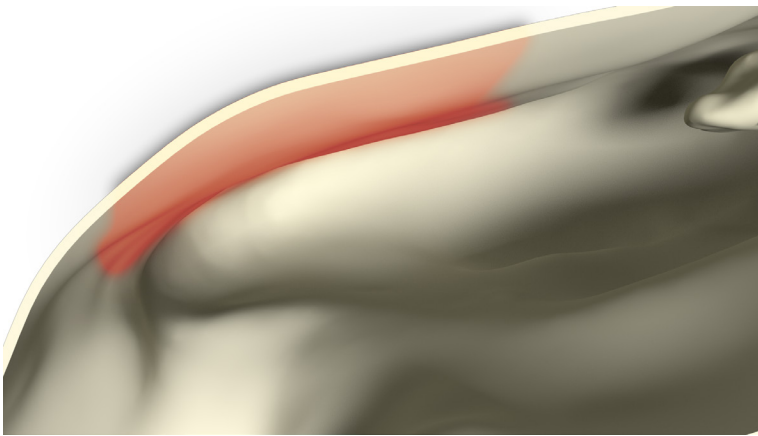
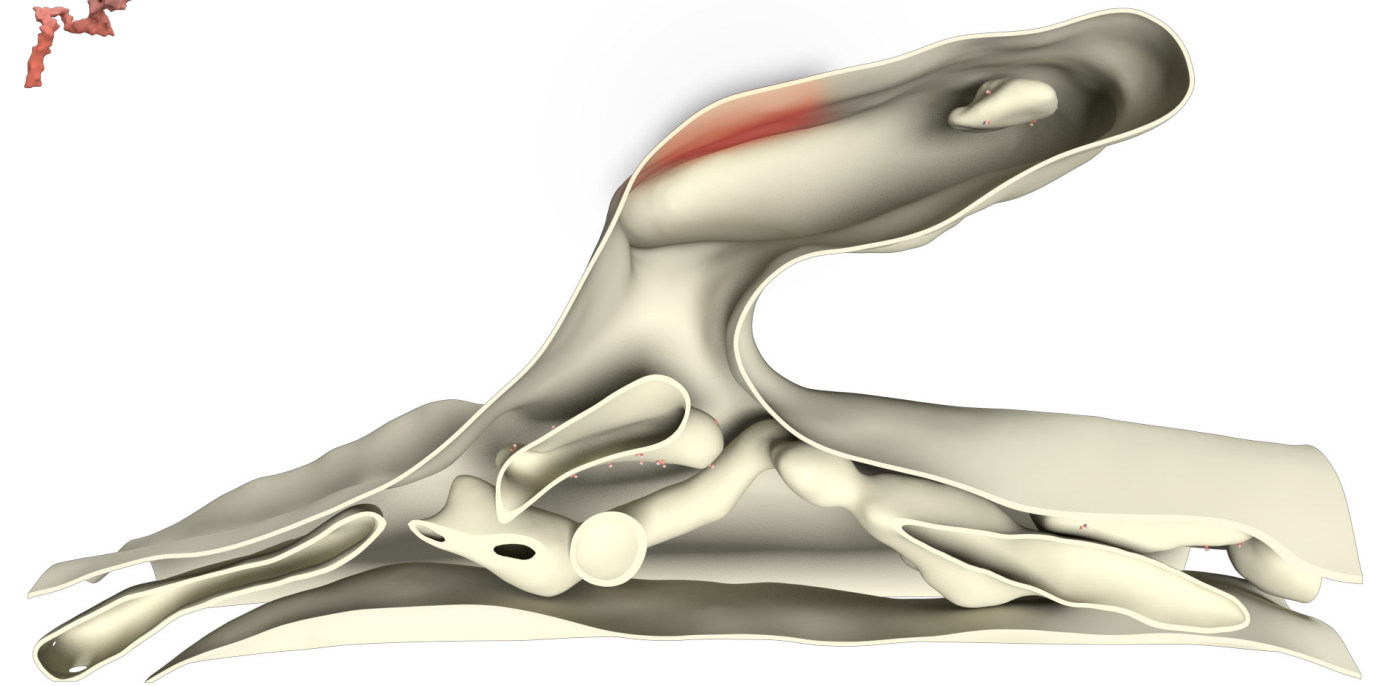
Jurado et al., 2013, Neuron

Nevins and Thurmond, 2005, J. Biol. Chem.

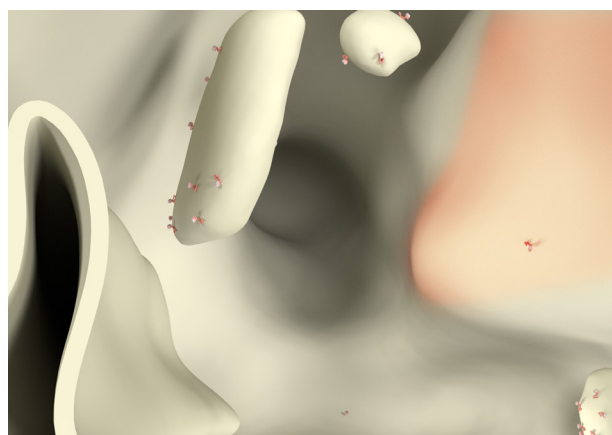
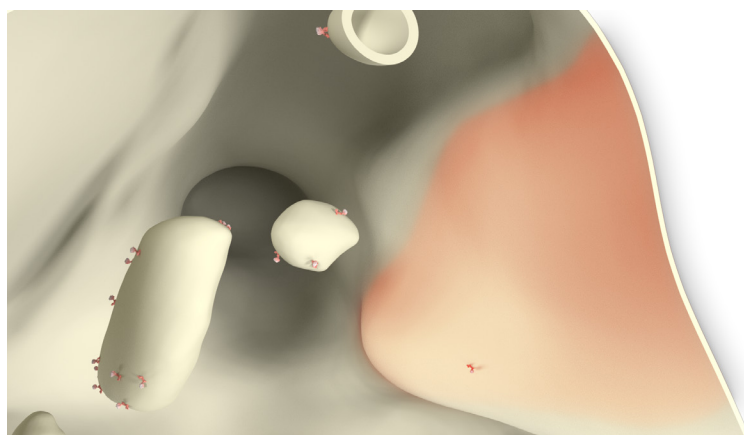
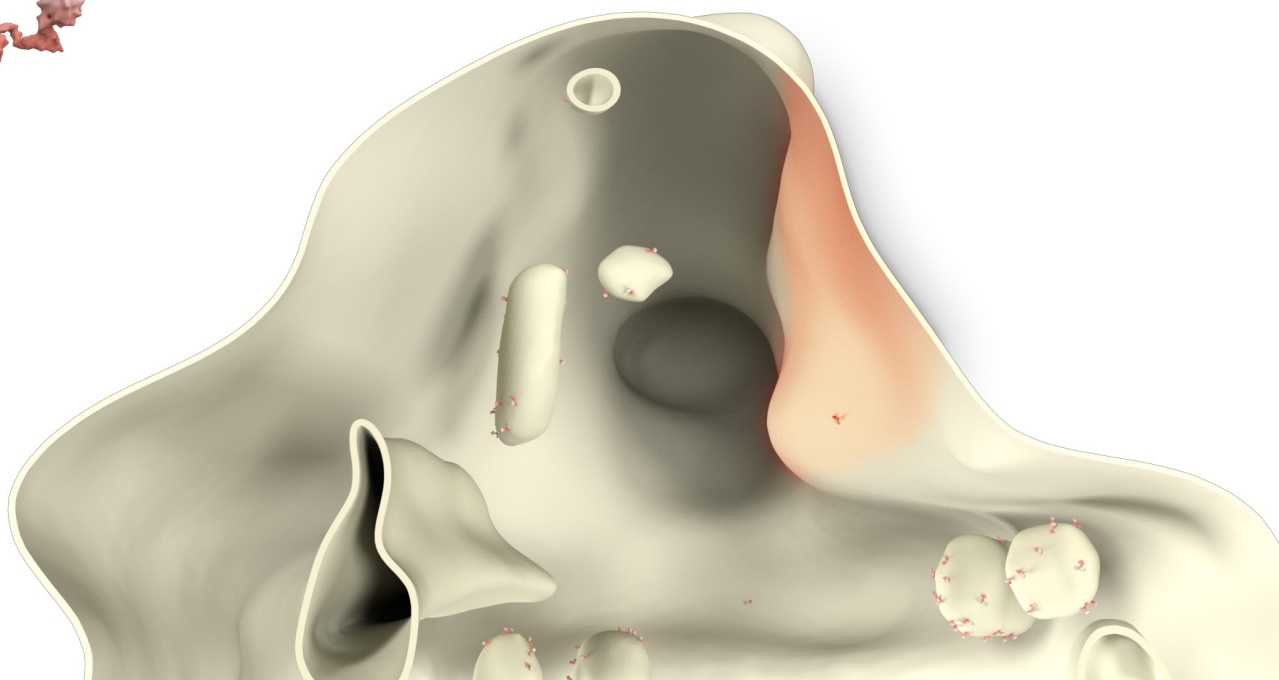
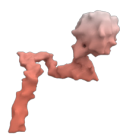
Known Interactions: Syntaxin1, Syntaxin4, SNAP23, SNAP25



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	97.2 ± 38.0	$0.0 \pm 0.0\%$	1.2 ± 0.5	0 ± 0.0
Stubby	116.2 ± 45.4	$0.0 \pm 0.0\%$	1.2 ± 0.5	2 ± 0.8



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	97.2 ± 38.0	$0.0 \pm 0.0\%$	1.2 ± 0.5	0 ± 0.0
Stubby	116.2 ± 45.4	$0.0 \pm 0.0\%$	1.2 ± 0.5	2 ± 0.8



References

Antibody: Abcam ab68776

PDB Identifier: 2dmw

Literature:

Advani et al., 1999, J. Cell. Biol.

Alberts et al., 2003, Mol. Biol. Cell.

Martinez-Arca et al., 2003, Proc. Natl. Acad. Sci. U S A

Rao et al., 2004, J. Biol. Chem.

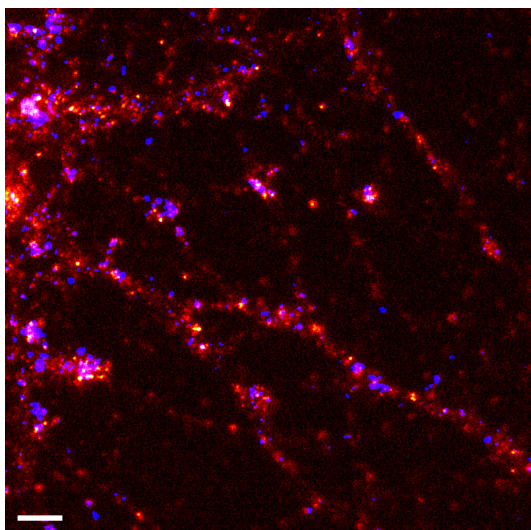
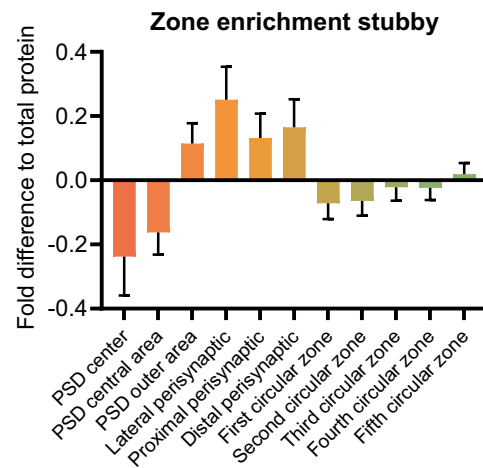
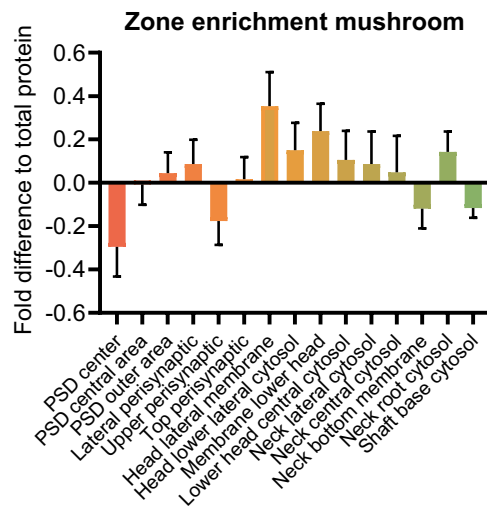
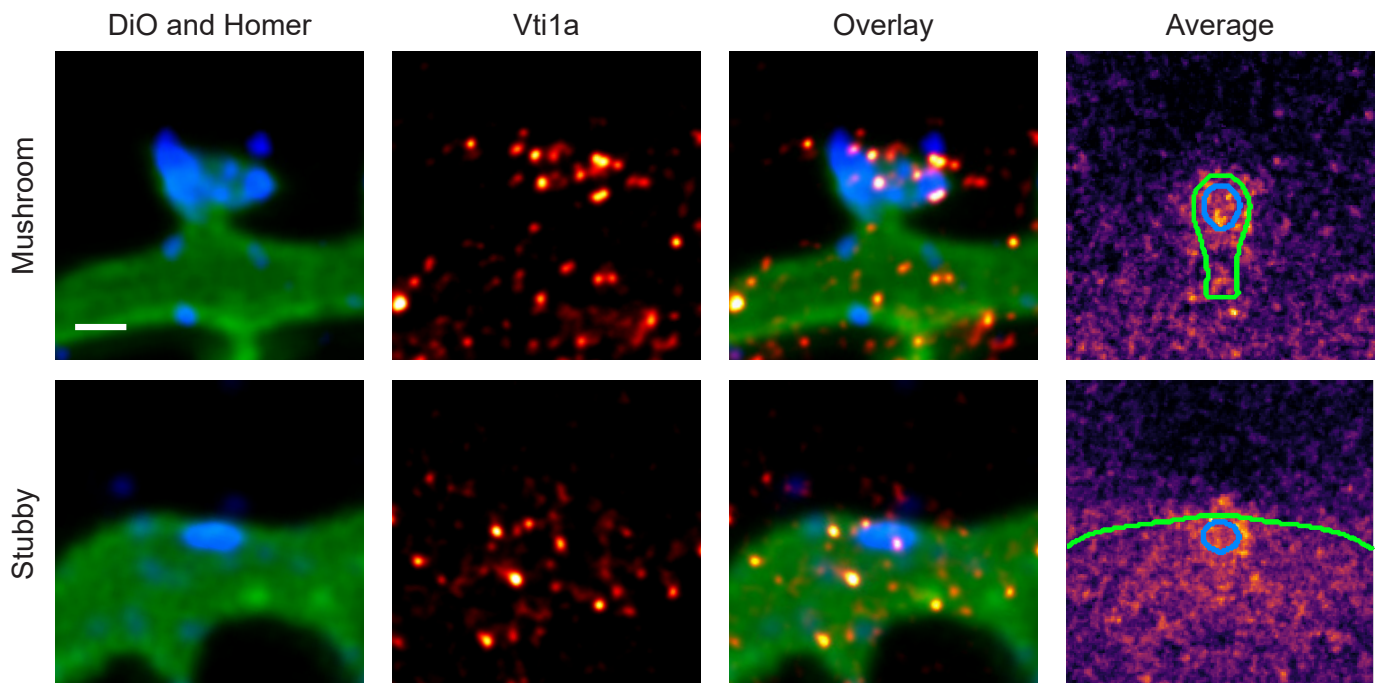
Scheuber et al., 2006, Proc. Natl. Acad. Sci. U S A

Vti1a (Vti1l2, Gene: Vti1a, Uniprot ID: Q9JI51)

Known function: Qb SNARE, Endosome-TGN transport, Homotypic endosome fusion

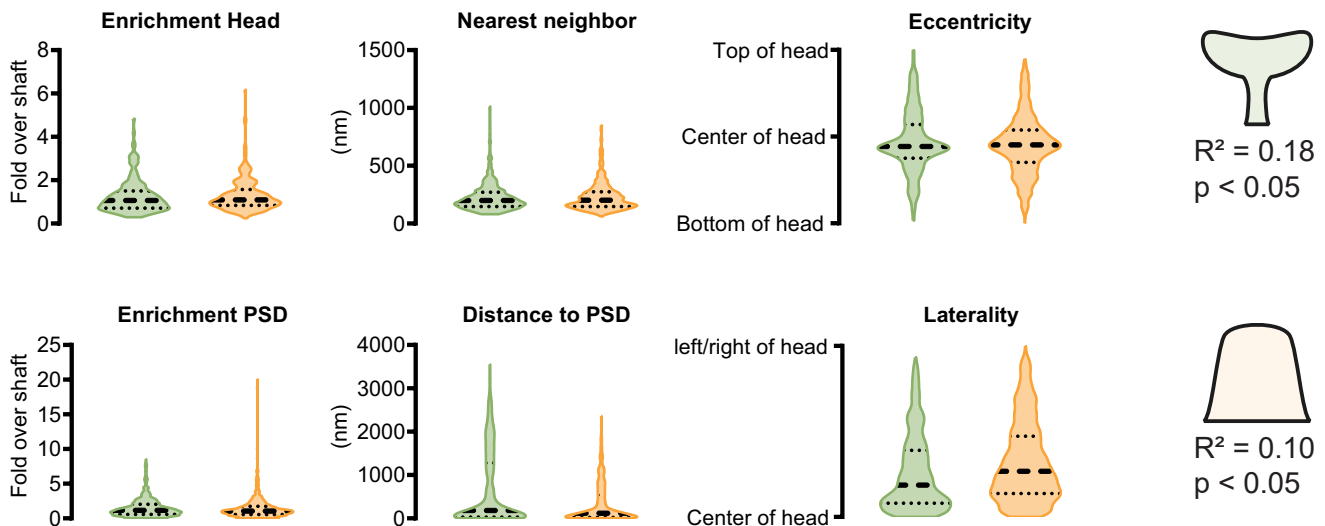
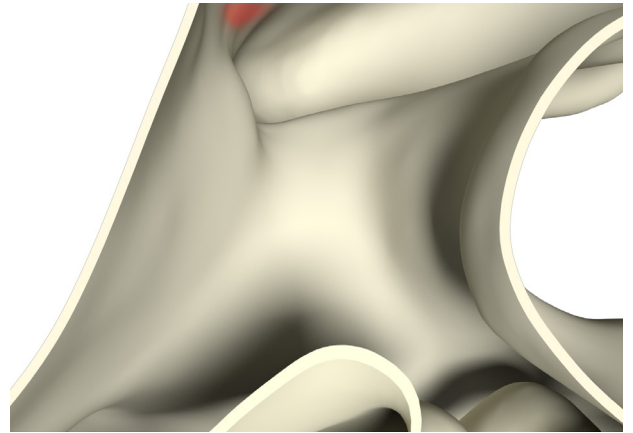
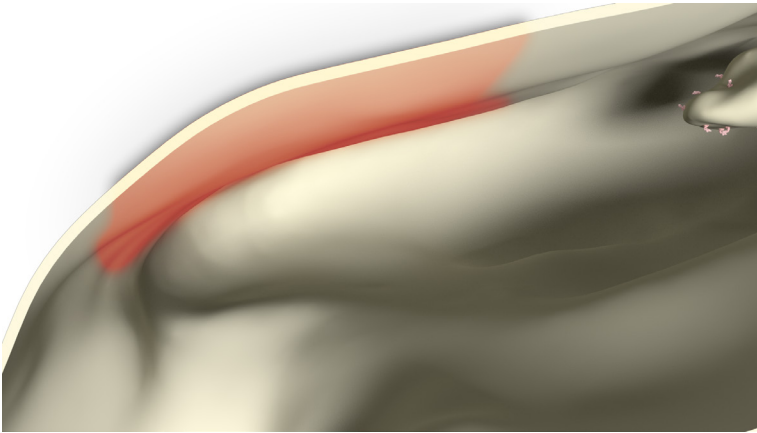
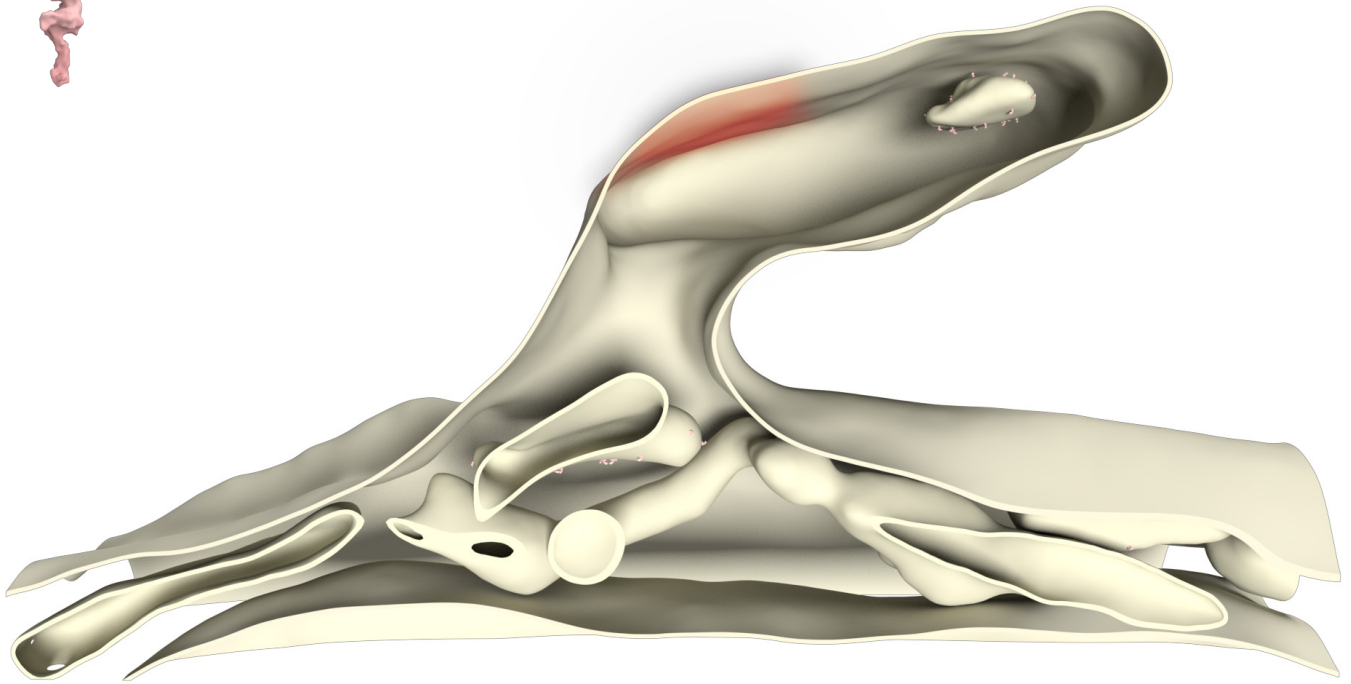
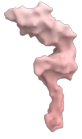
Known organization: Transmembrane protein, On endosomes, TGN, SV, CCV

Known Interactions: Syntaxin6, Syntaxin16, VAMP4

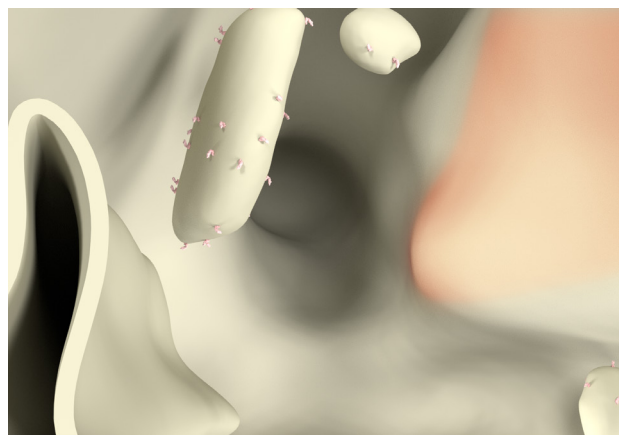
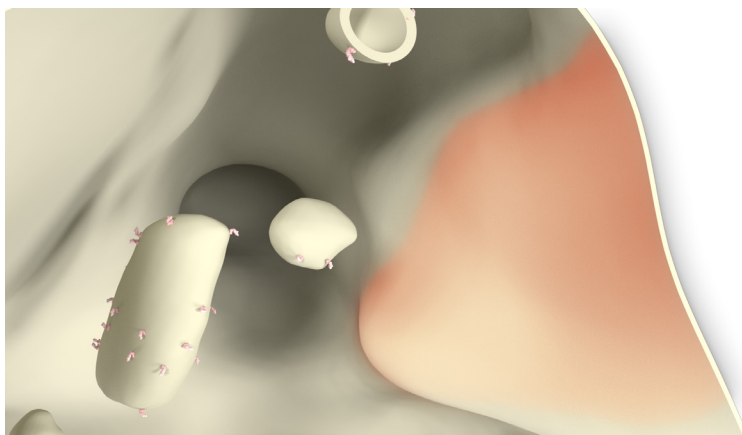
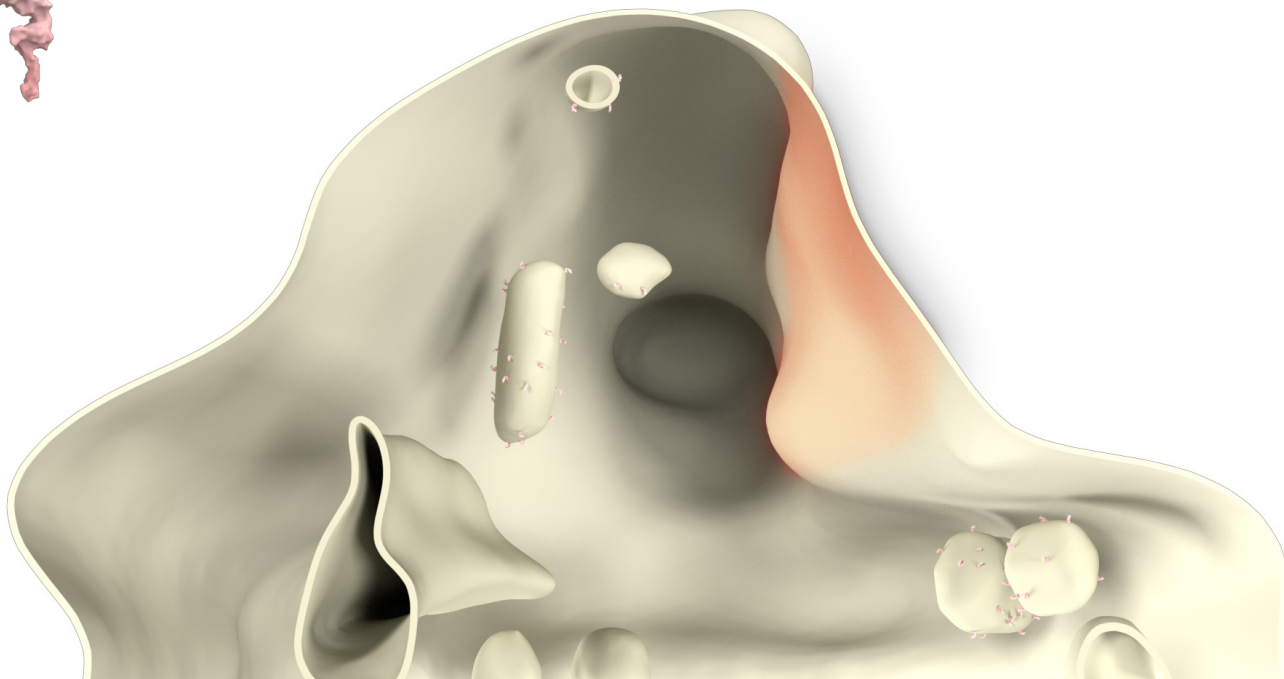


Whole cell copy number	952127.0 ± 557332.5	
Spine copy number	119.4 ± 75.5	
Function	SNAREs and assoc. proteins	
	Mushroom	Stubby
Spine copy number	104.6 ± 66.2	142.4 ± 90.1
% of total protein	0.0 ± 0.0%	0.0 ± 0.0%
Molarity (μM)	1.3 ± 0.8	1.3 ± 0.9
PSD copy number	0 ± 0.0	0 ± 0.0
% in PSD	0.0 ± 0.0%	0.0 ± 0.0%

	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	104.6 ± 66.2	$0.0 \pm 0.0\%$	1.3 ± 0.8	0 ± 0.0
Stubby	142.4 ± 90.1	$0.0 \pm 0.0\%$	1.3 ± 0.9	0 ± 0.0



	Spine copy number	% of total protein	Molarity (μM)	PSD copy number
Mushroom	104.6 ± 66.2	$0.0 \pm 0.0\%$	1.3 ± 0.8	0 ± 0.0
Stubby	142.4 ± 90.1	$0.0 \pm 0.0\%$	1.3 ± 0.9	0 ± 0.0



References

Antibody: BD Biosciences 611220

Structure: from Takamori et al. 2006

Literature:

Amessou et al., 2007, J. Cell. Sci.

Zwilling et al., 2007, EMBO J.

Antonin et al., 2002, J. Biol. Chem.

Brandhorst et al., 2006, Proc. Natl. Acad. Sci. U S A

Fischer von Mollard and Stevens, 1998, J. Biol. Chem.

Mallard et al., 2002, J. Cell. Biol.

McBride et al., 1999, Cell

Shitara et al., 2013, Mol. Cell. Biochem.

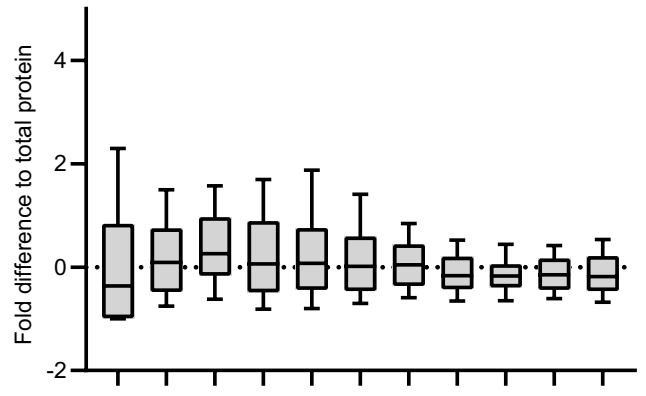
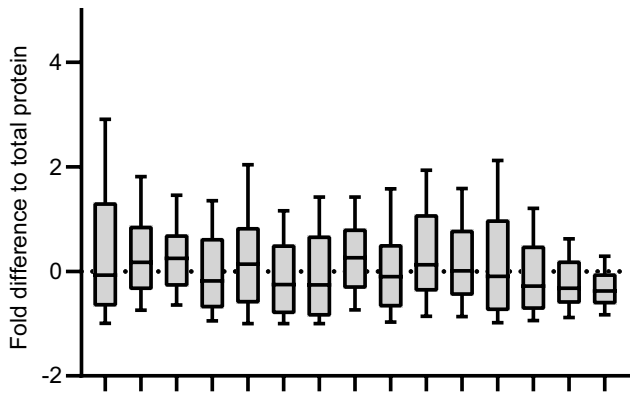
proteinname

Boxplot depicting mushroom zone enrichment. Shown are 10th - 90th percentile whisker, with quartiles and median boxes.

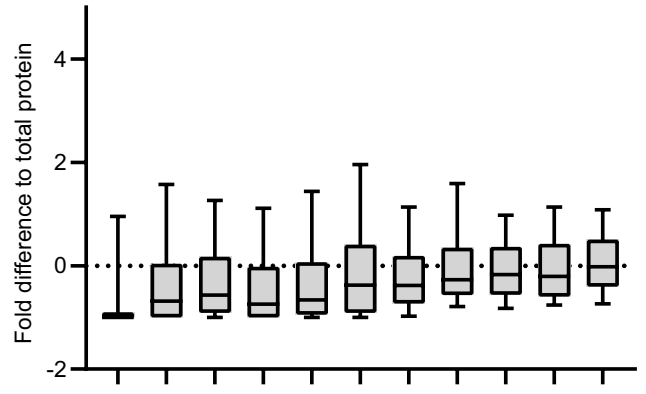
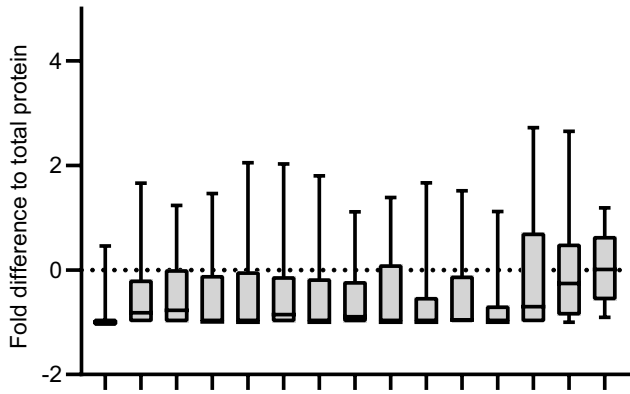
Boxplot depicting stubby zone enrichment. Shown are 10th - 90th percentile whisker, with quartiles and median boxes.

For sample sizes of each protein, please refer to Supplementary Table 5.

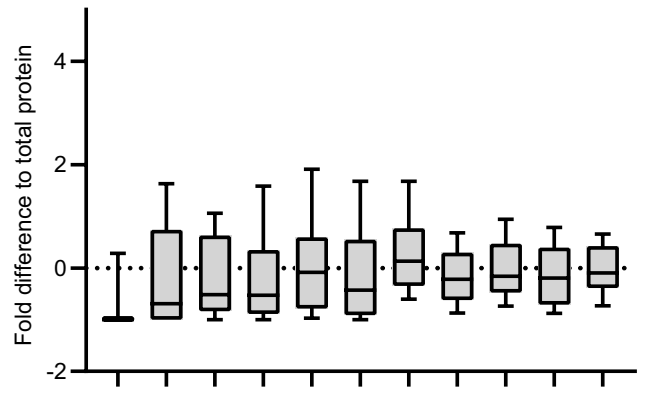
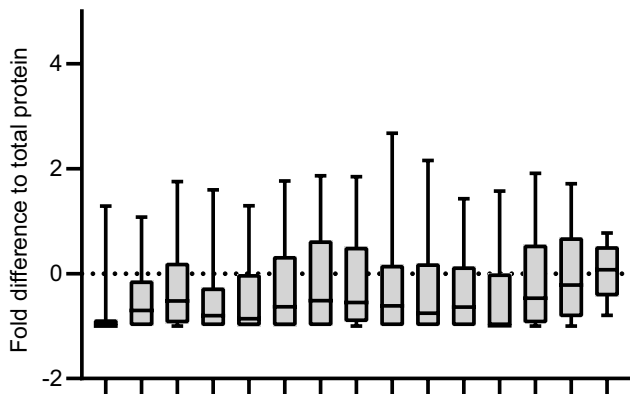
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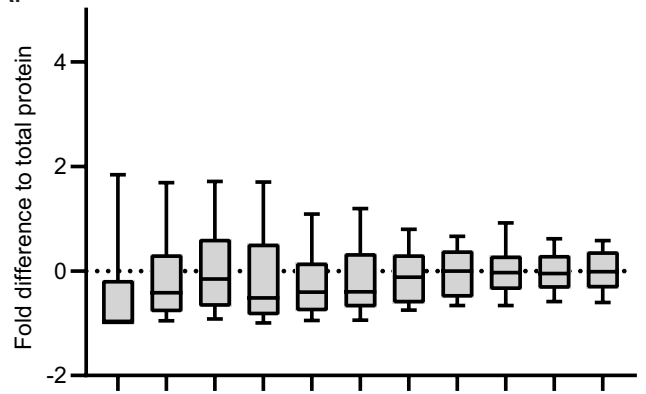
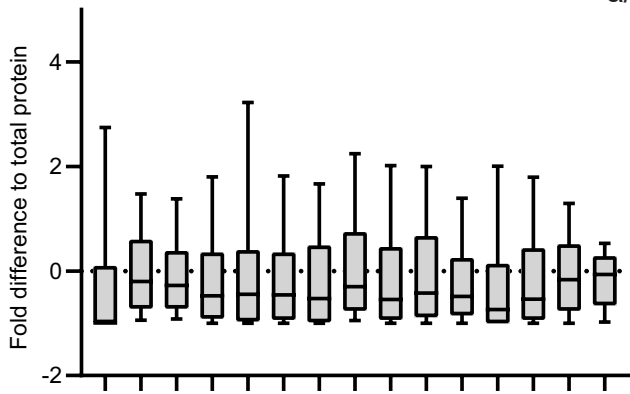
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Akt



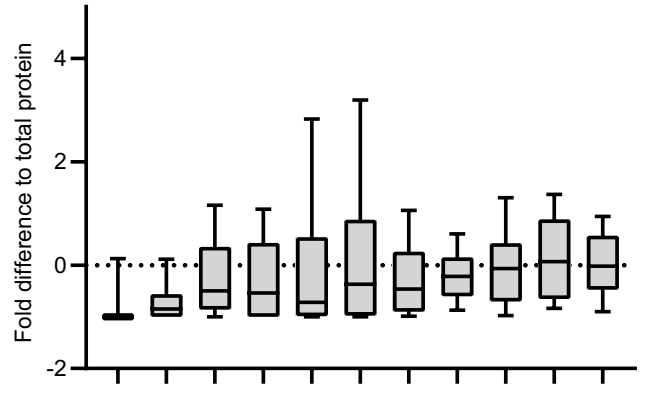
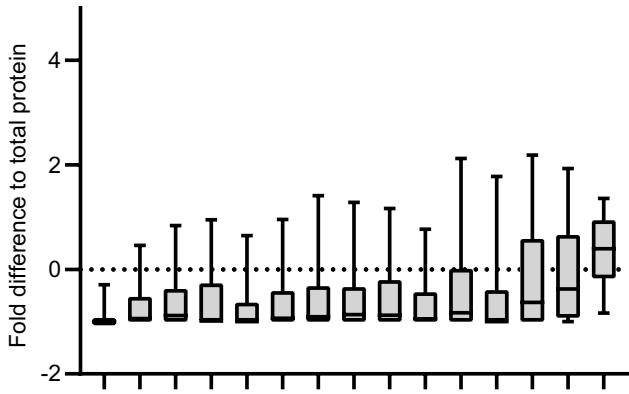
α/β -SNAP



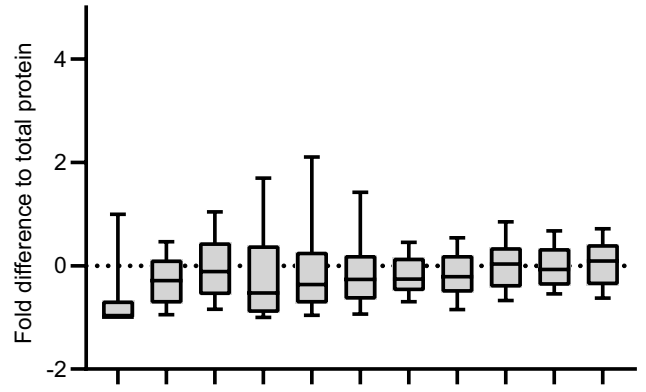
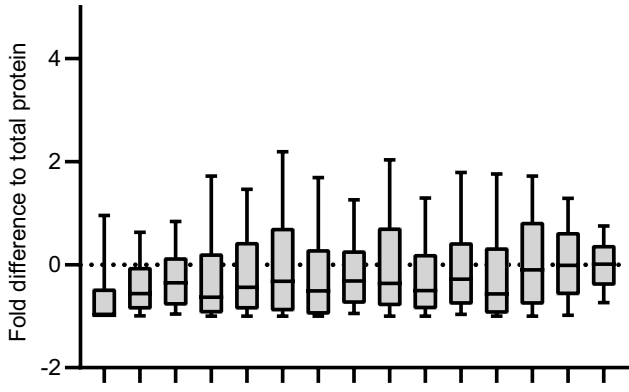
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top lateral membrane
Head lower lateral cytosol
Head lateral cytosol
Membrane lower head
Lower head central cytosol
Neck lateral cytosol
Neck central cytosol
Neck bottom membrane
Neck root cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Proximal perisynaptic
Distal perisynaptic
First ring
Second ring
Third ring
Fourth ring
Fifth ring

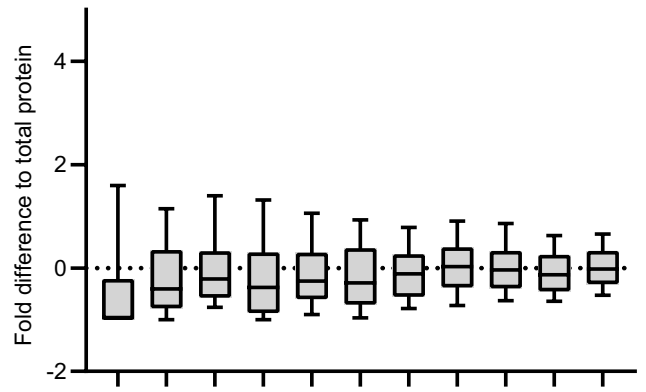
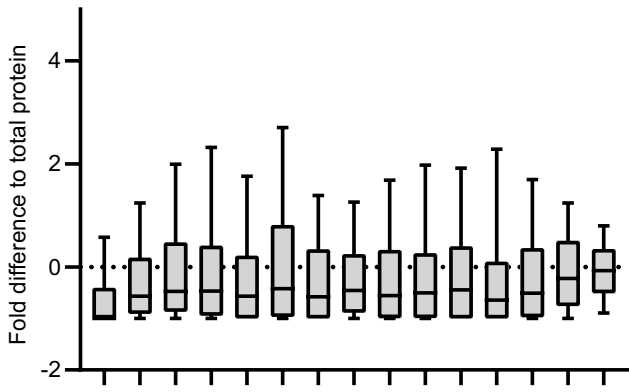
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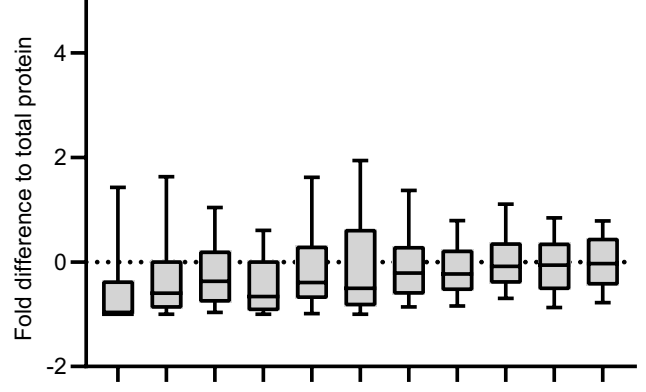
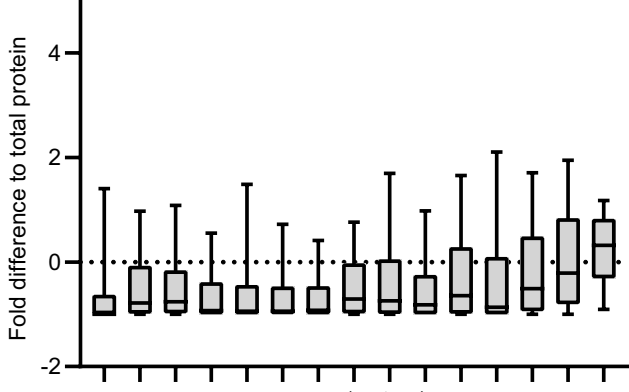
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APP



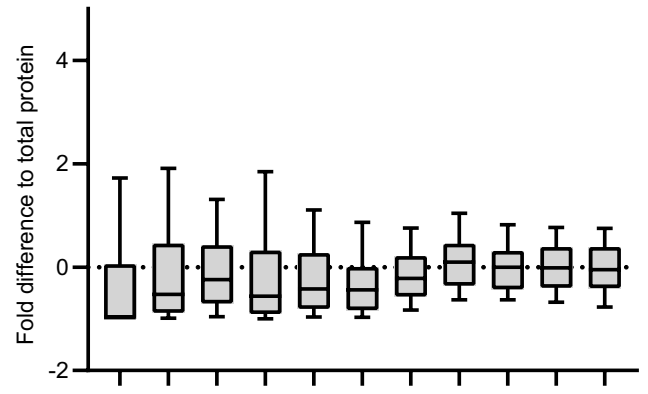
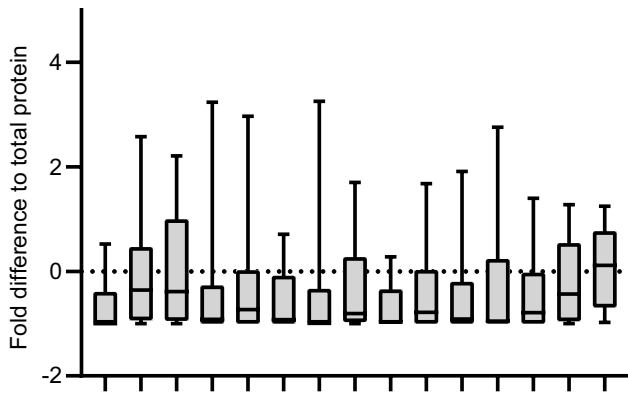
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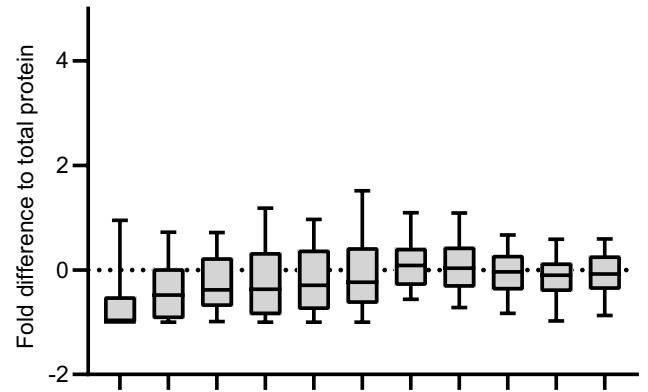
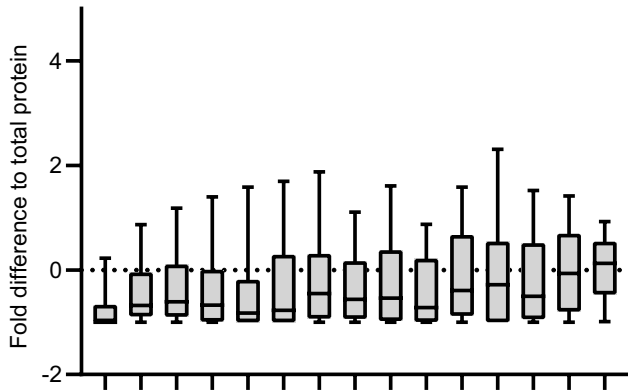
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral cytosol
Membrane lower head
Neck lateral central head
Neck lateral cytosol
Neck central cytosol
Neck bottom membrane
Neck root cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Proximal perisynaptic
Distal perisynaptic
First ring
Second ring
Third ring
Fourth ring
Fifth ring

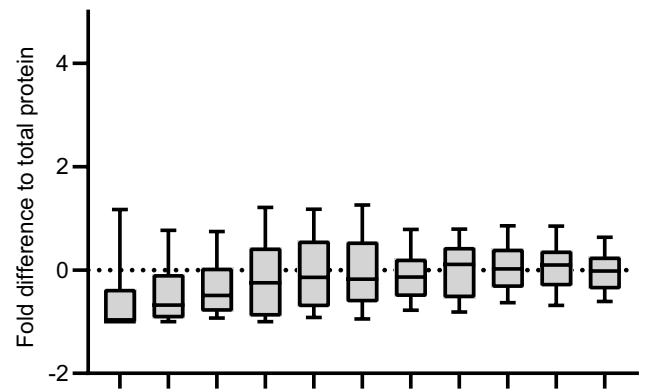
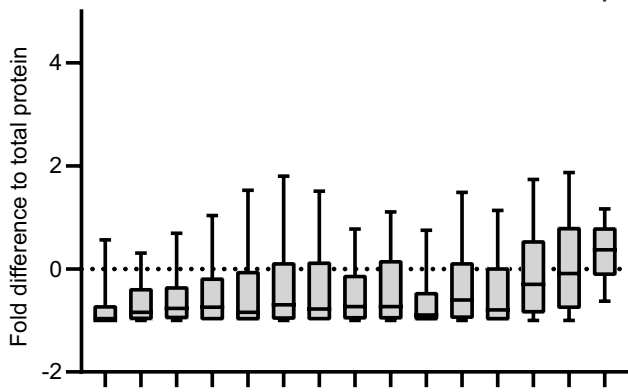
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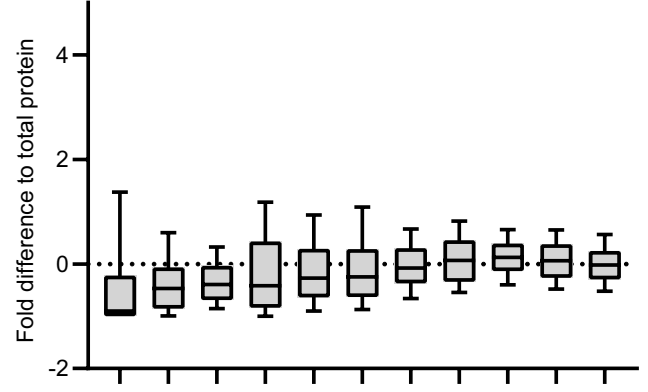
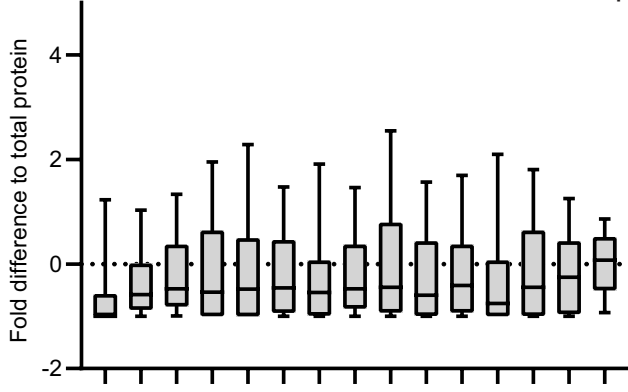
β -2-spectrin



β -3-tubulin



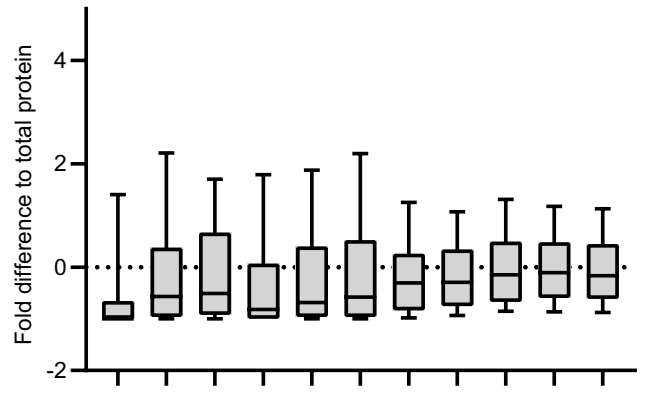
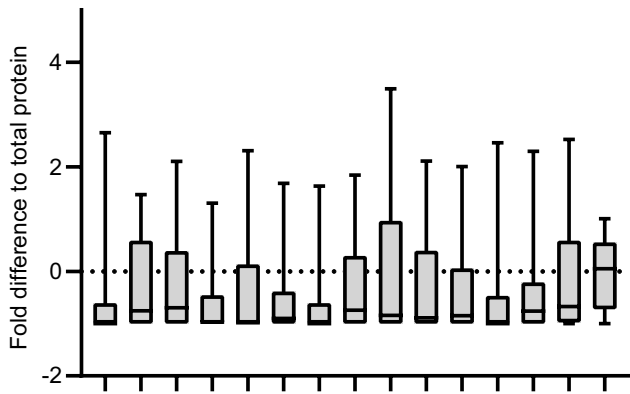
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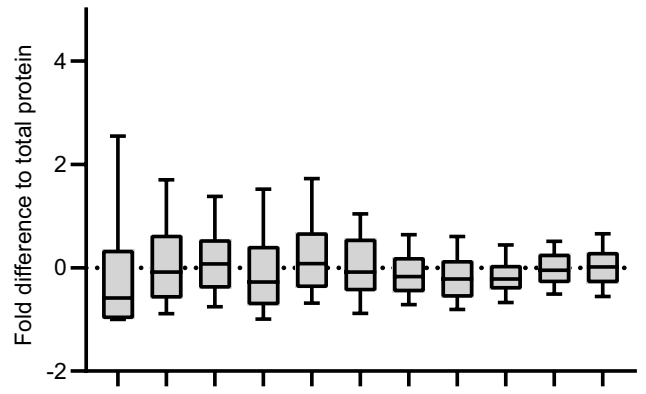
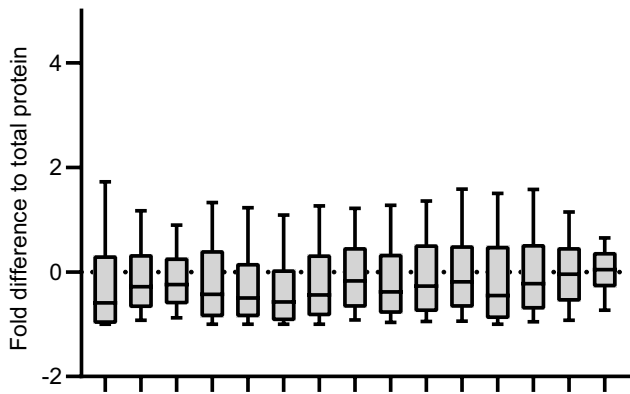
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral cytosol
Membrane lower head
Neck lateral cytosol
Neck central cytosol
Neck bottom membrane
Neck root cytosol
Shaft base cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Proximal perisynaptic
Distal perisynaptic
First ring
Second ring
Third ring
Fourth ring
Fifth ring

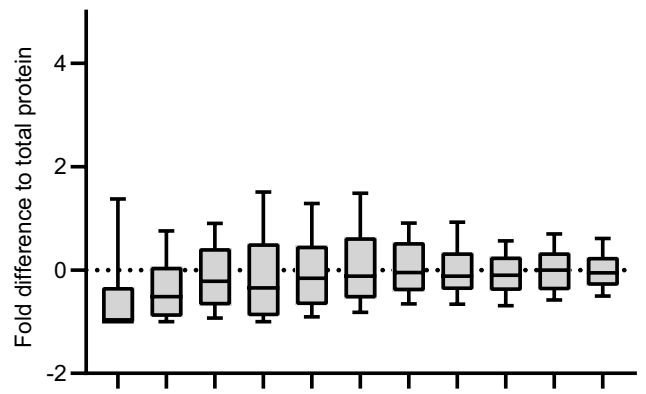
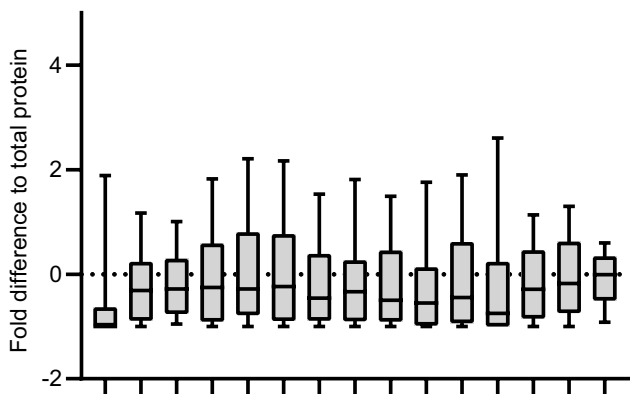
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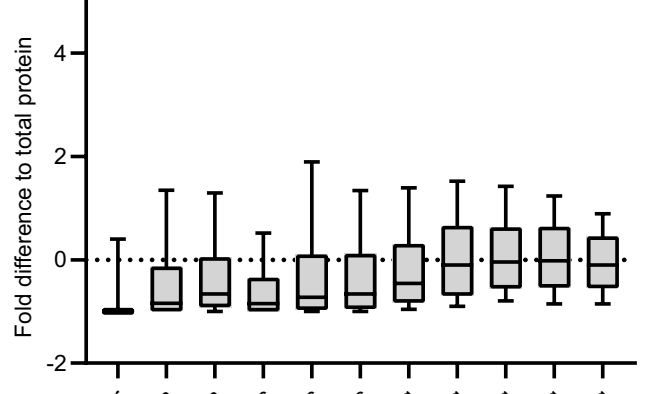
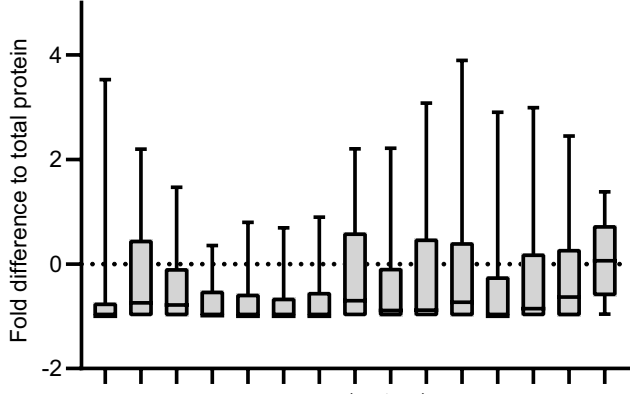
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Calmodulin



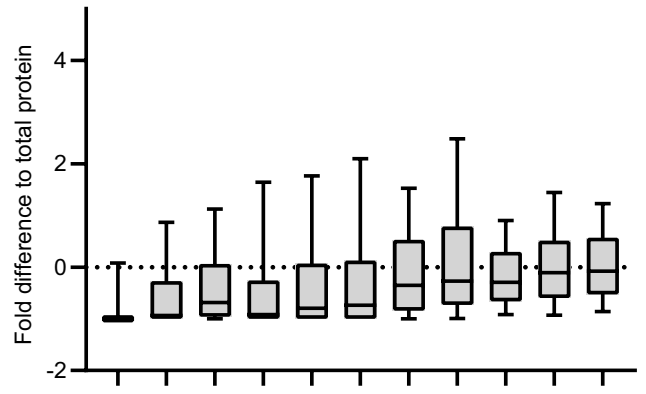
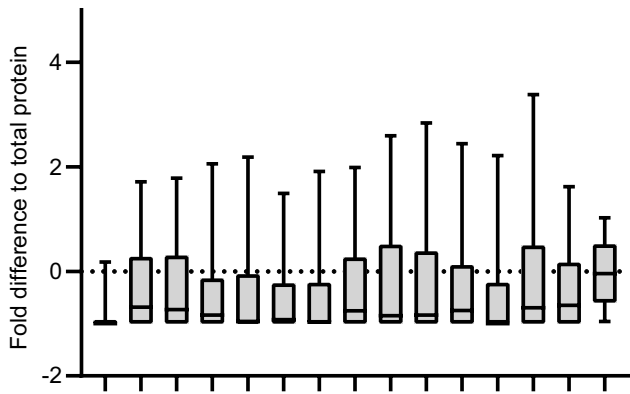
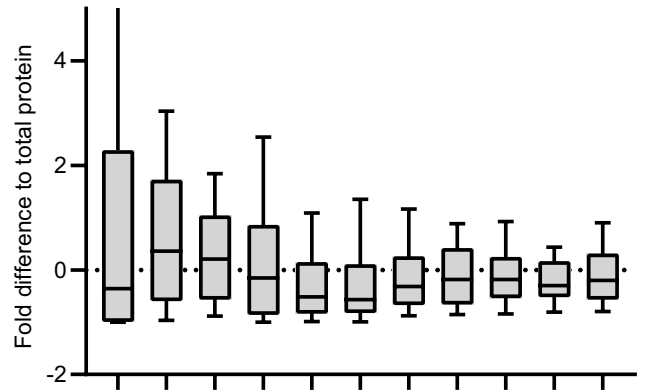
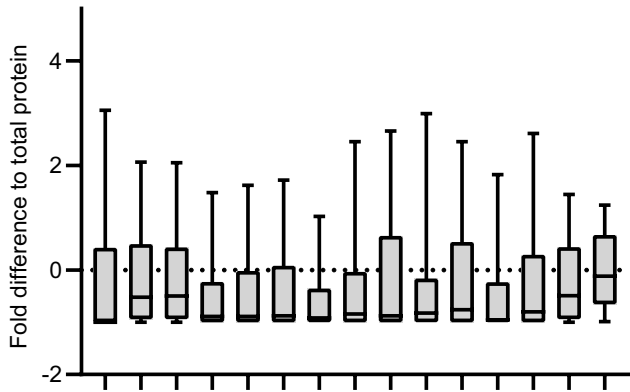
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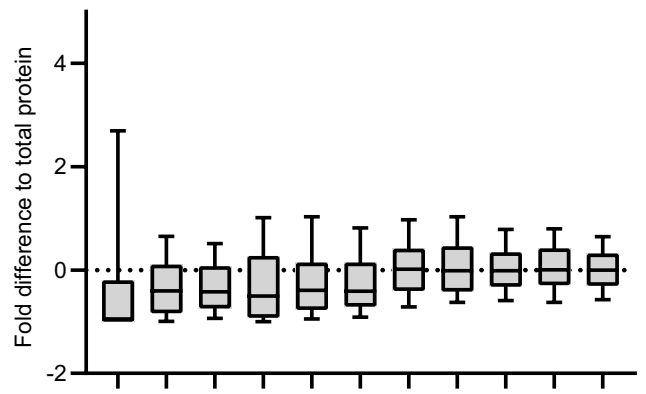
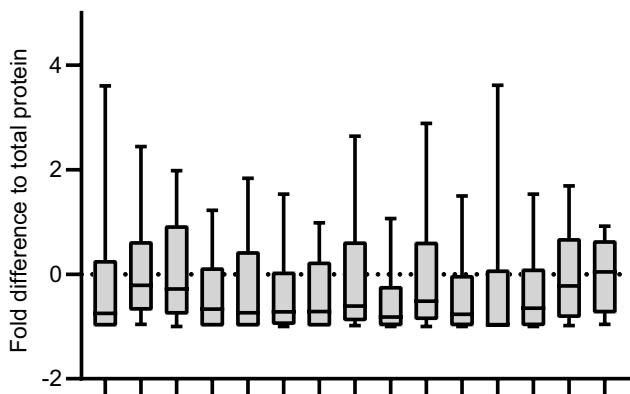
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top lateral membrane
Head lower lateral cytosol
Head lower lateral cytosol
Membrane lower cytosol
Lower head central cytosol
Neck lateral cytosol
Neck central cytosol
Neck bottom membrane
Neck root cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Proximal perisynaptic
Distal perisynaptic
First ring
Second ring
Third ring
Fourth ring
Fifth ring

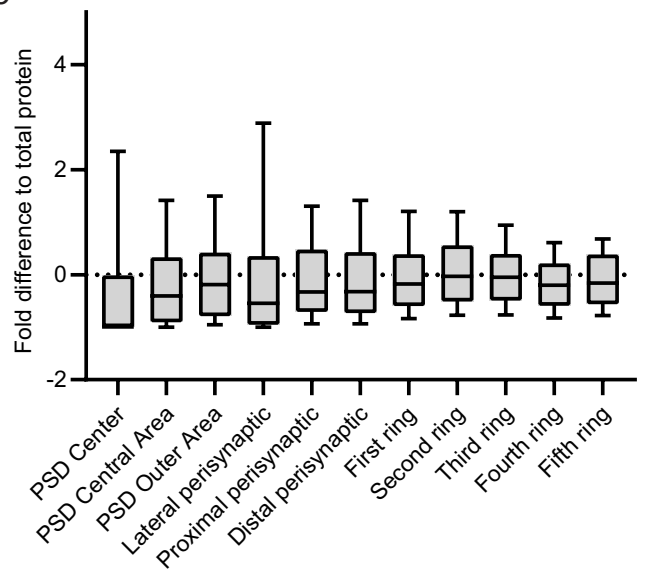
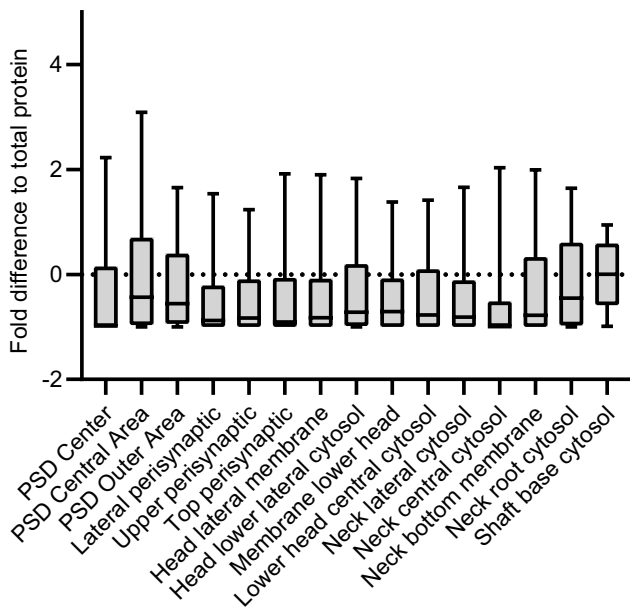
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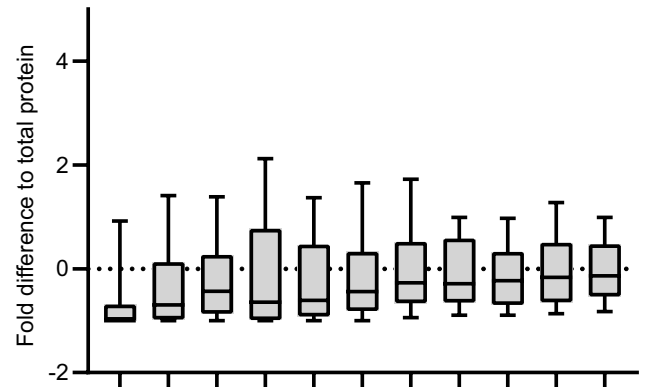
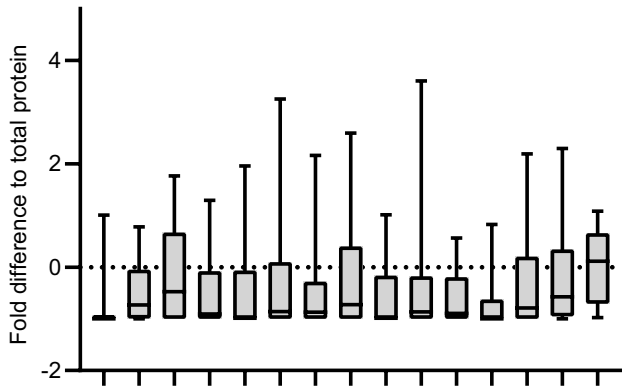
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CAPS1

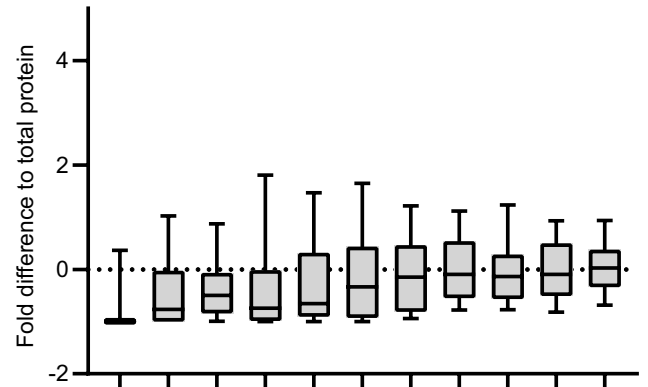
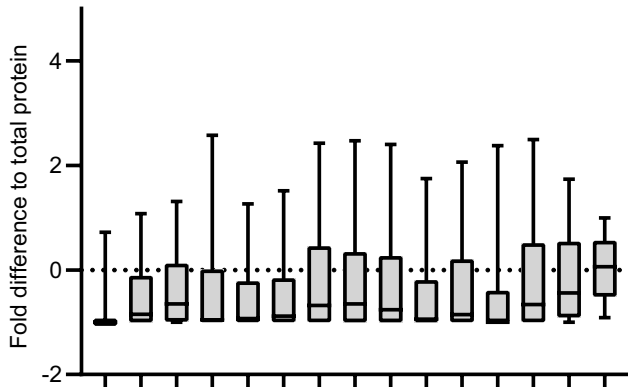


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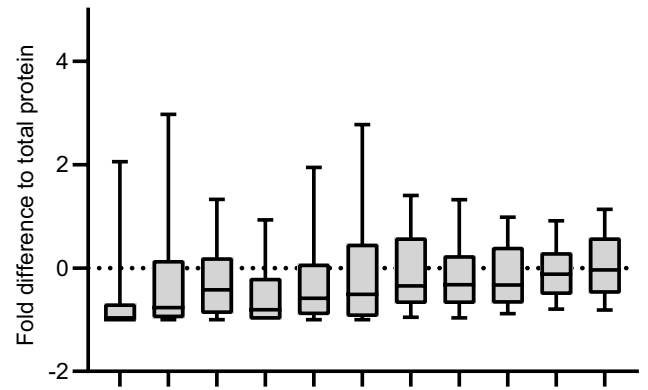
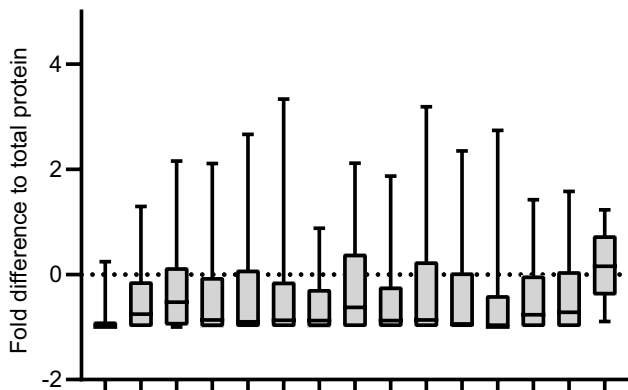


Ca_v2.1

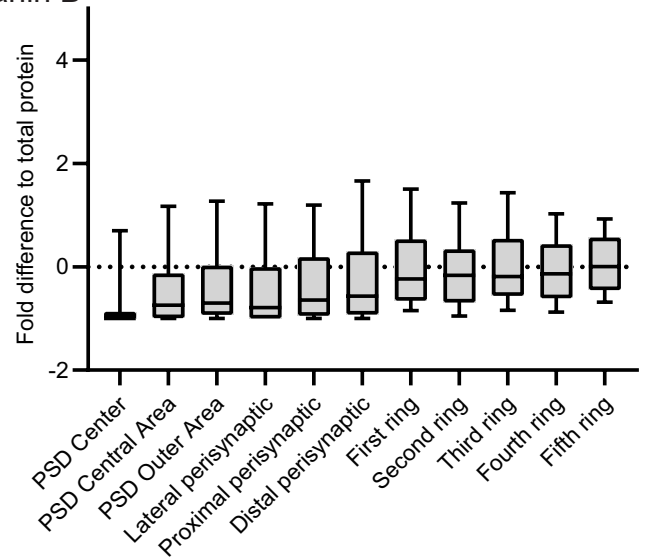
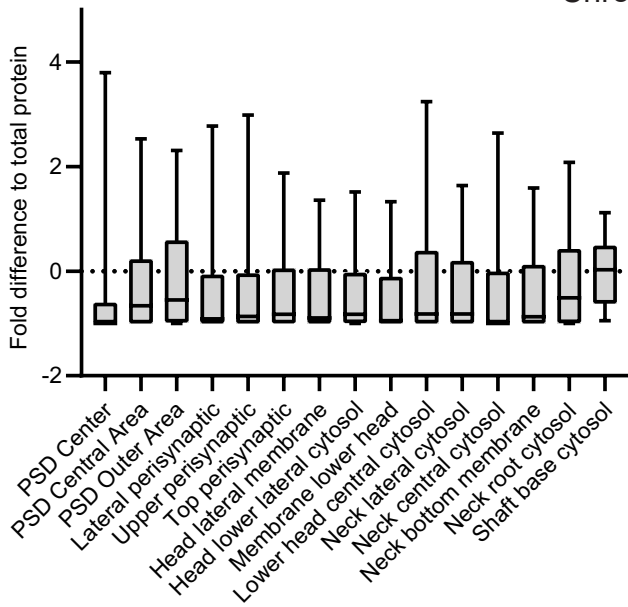
CDC42



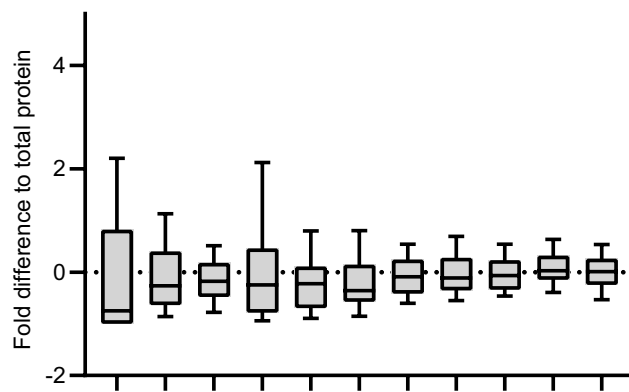
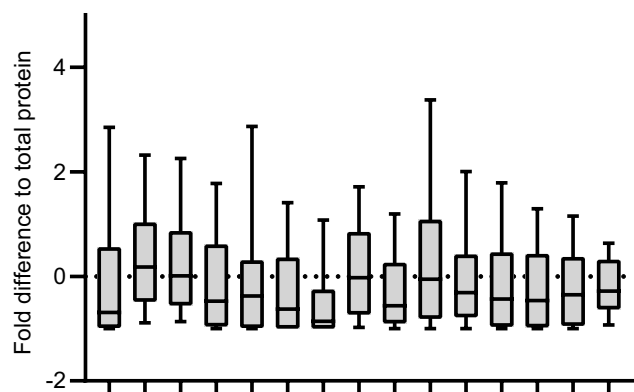
Chromogranin A



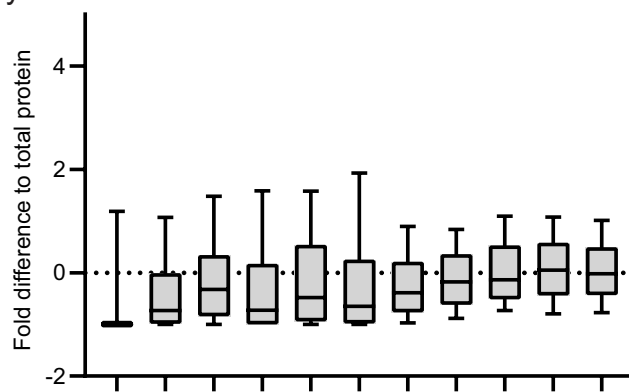
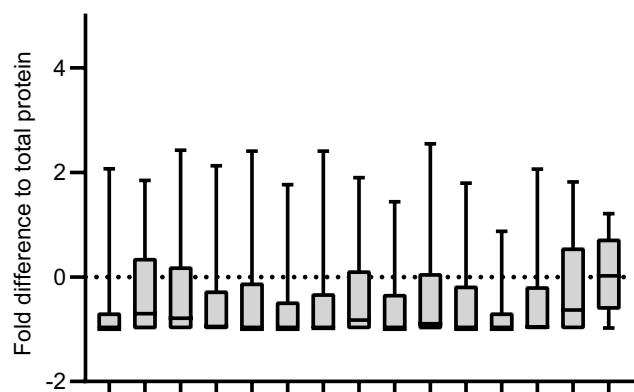
Chromogranin B



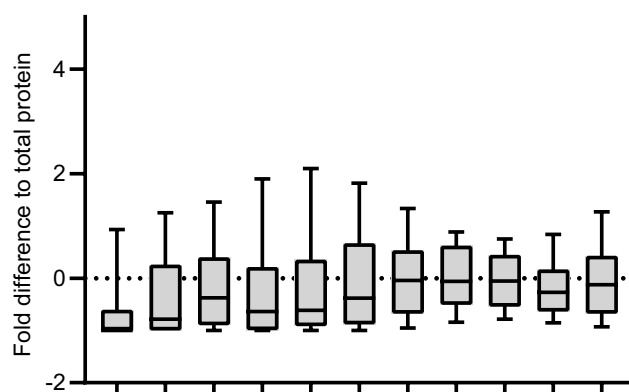
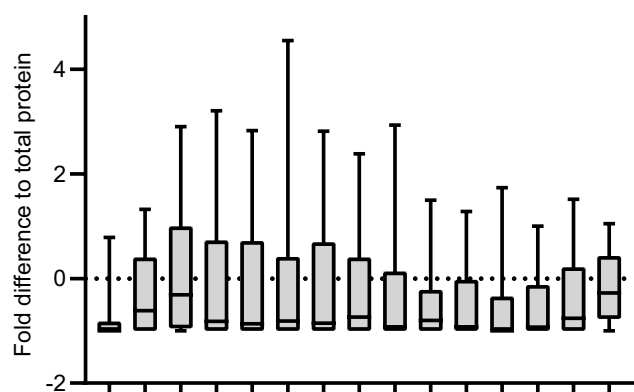
Chromogranin C



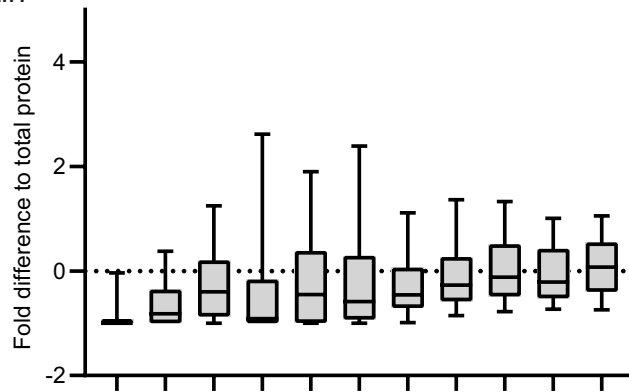
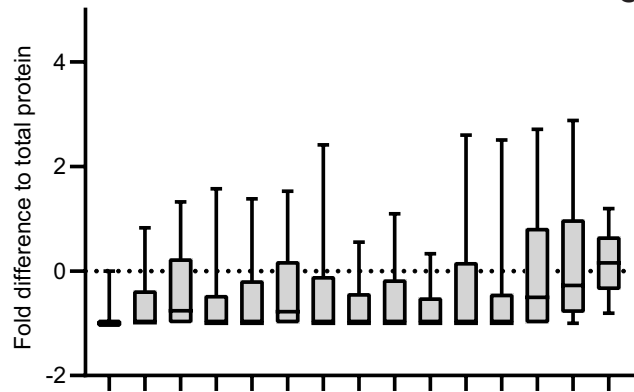
Clathrin heavy chain



Clathrin light chain



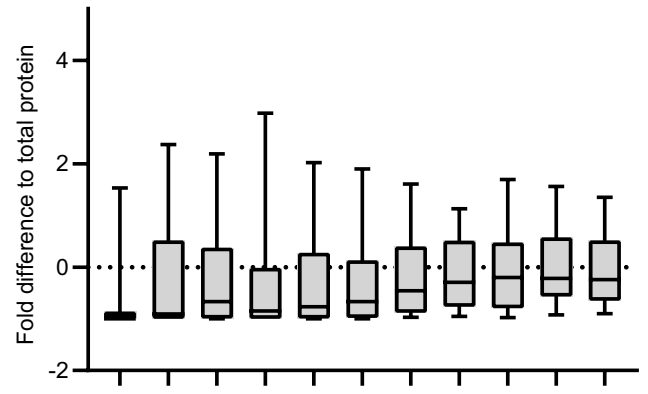
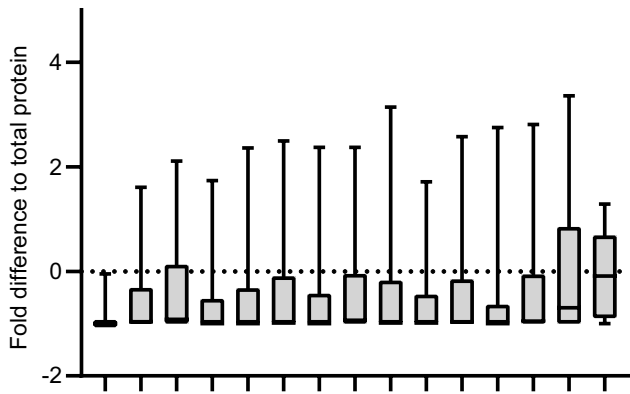
Cortactin



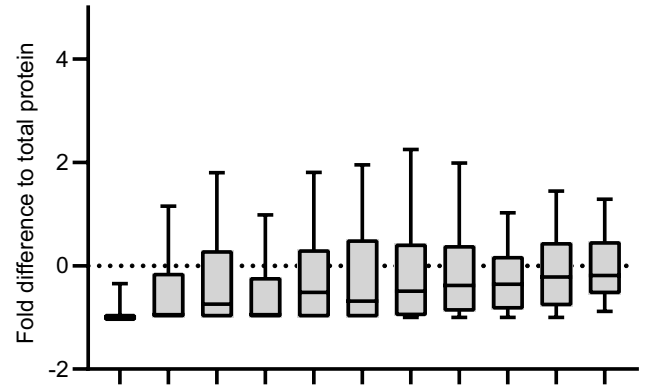
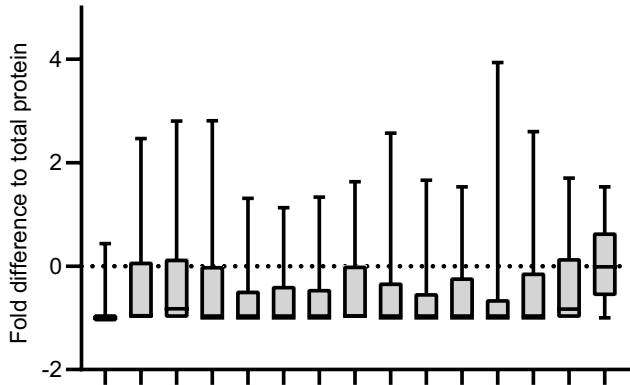
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral membrane
Membrane lower head
Neck lateral cytosol
Neck central cytosol
Neck bottom cytosol
Neck root cytosol
Neck base cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Proximal perisynaptic
Distal perisynaptic
First ring
Second ring
Third ring
Fourth ring
Fifth ring

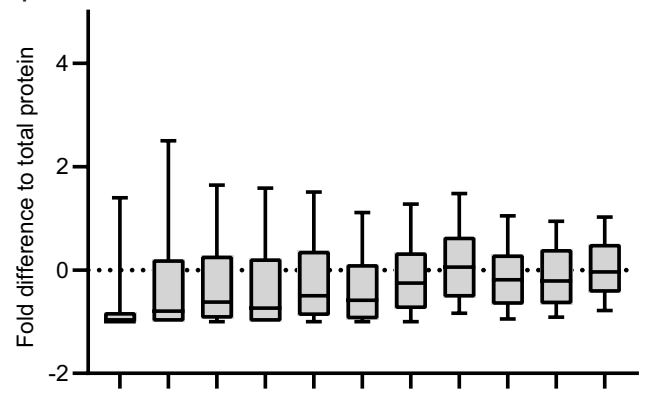
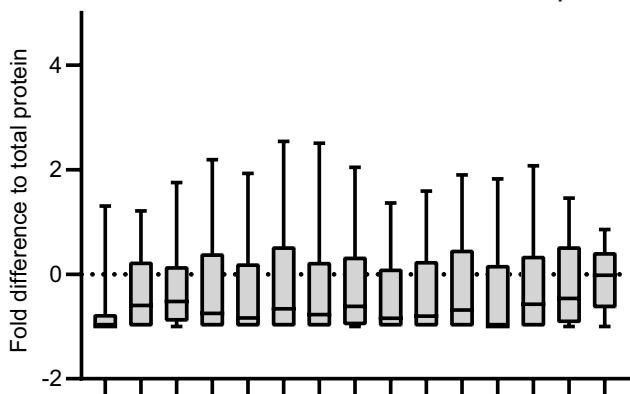
DLGAP1



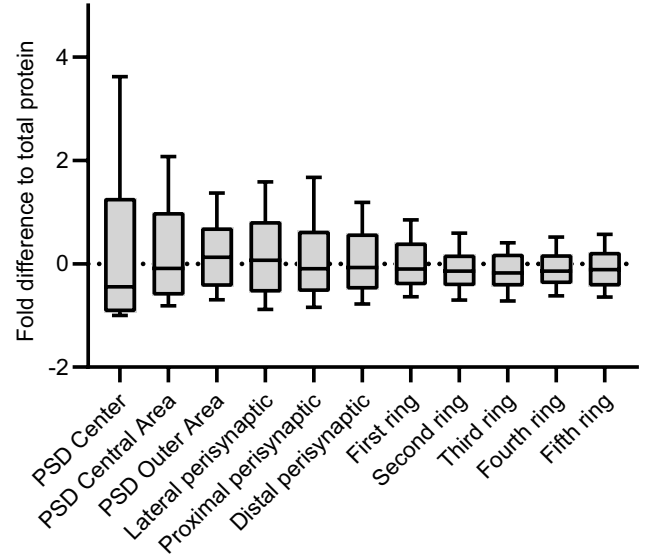
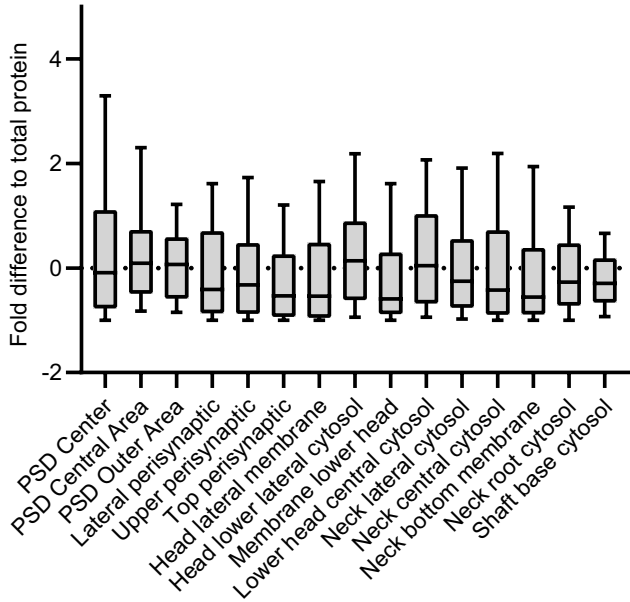
Dopamine receptor D1



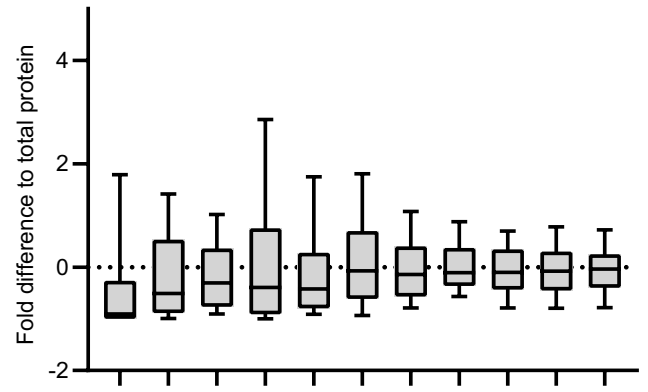
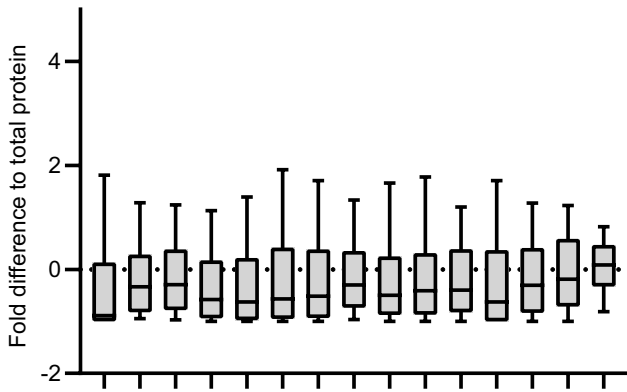
Dopamine receptor D2



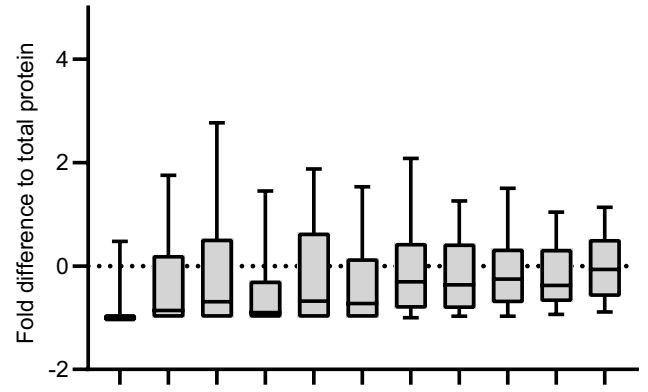
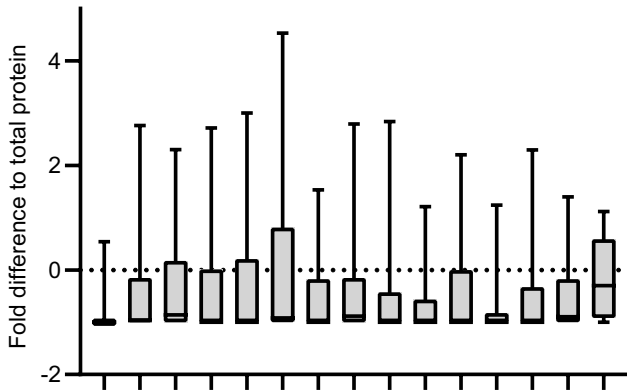
Drebrin



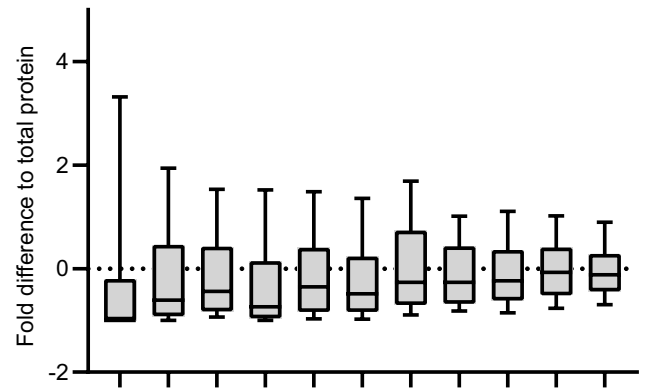
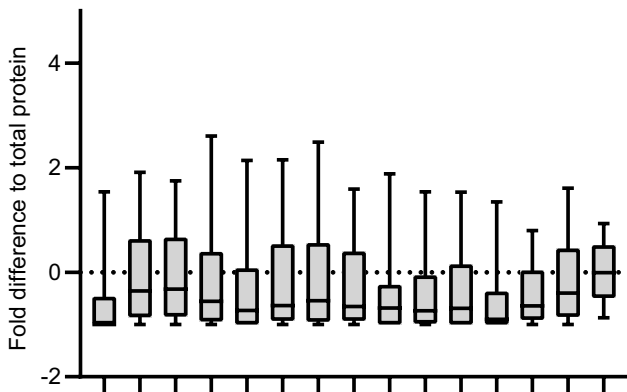
Dynamin1/2/3



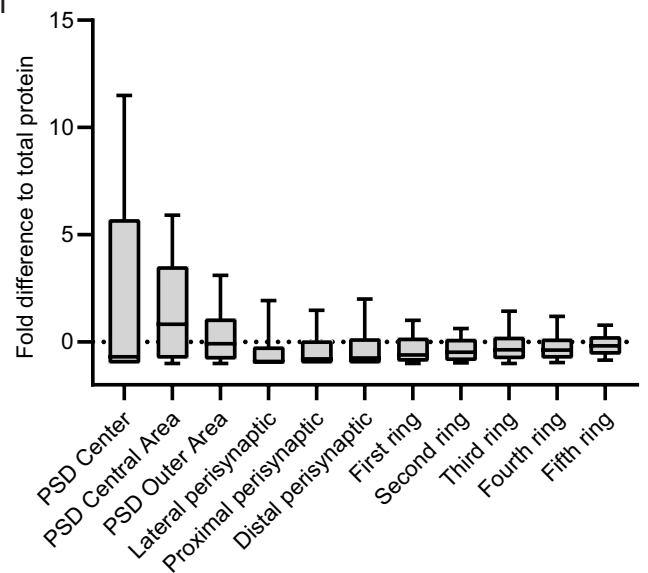
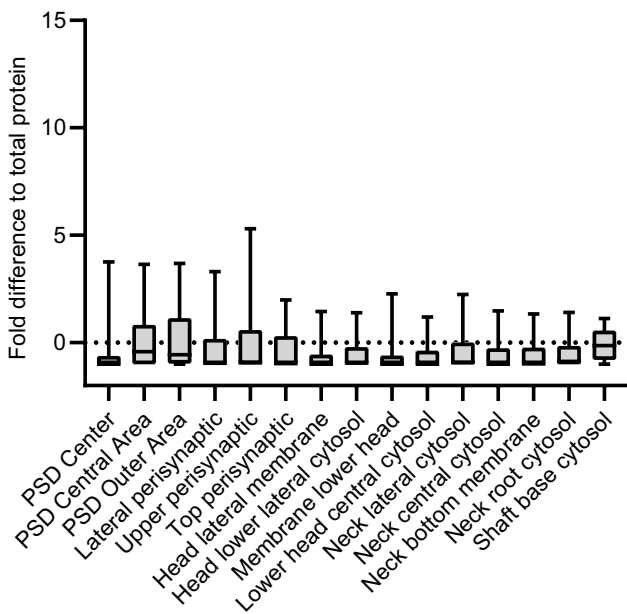
ERp72



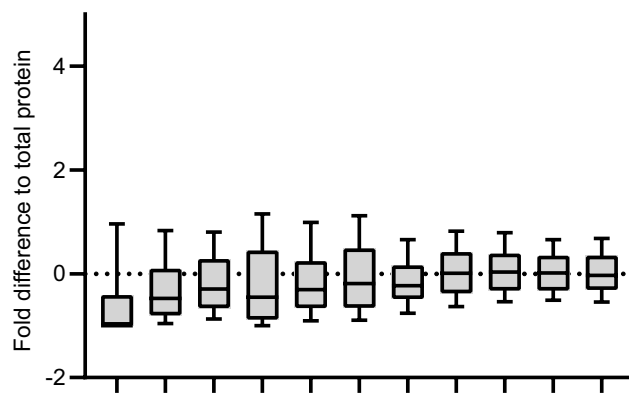
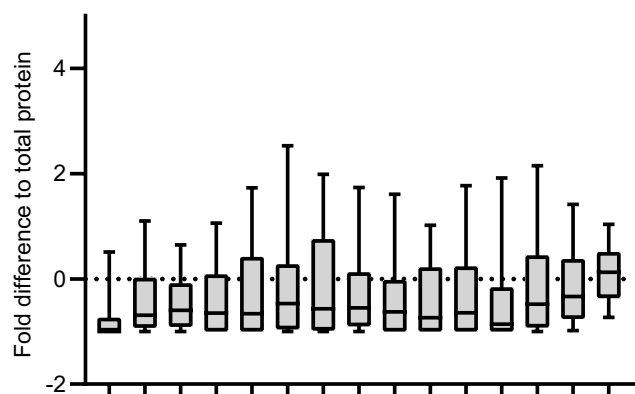
GluK1



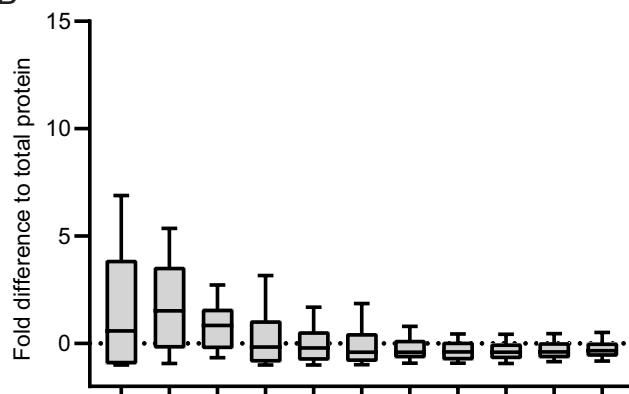
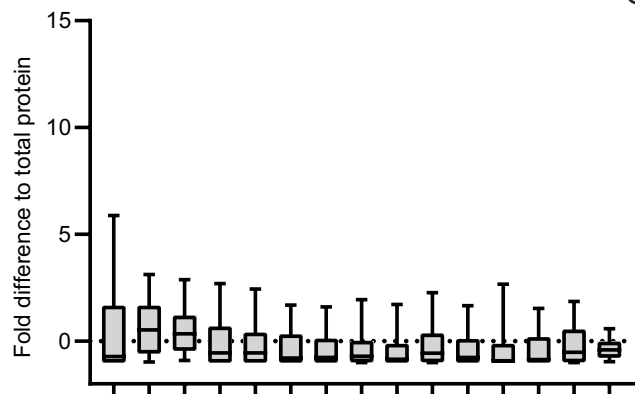
GluN1



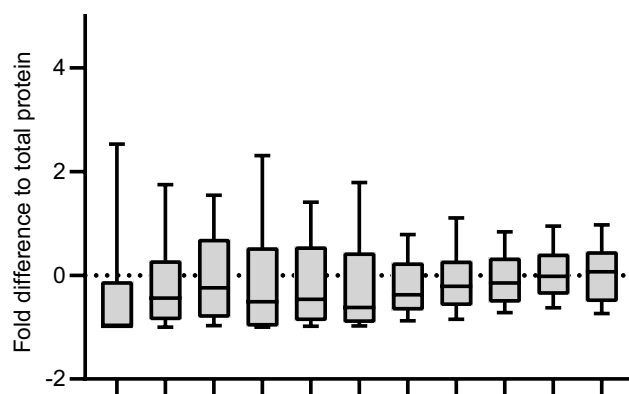
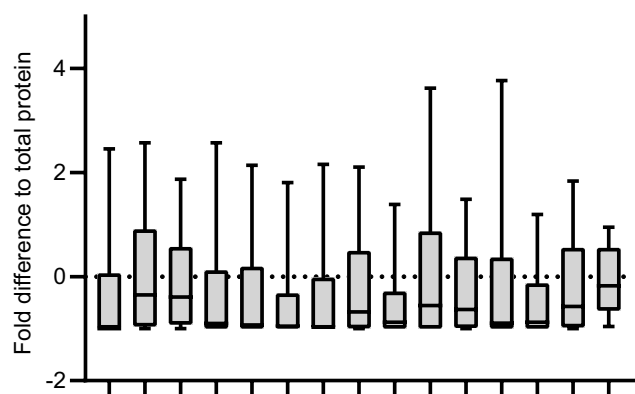
GluN2A



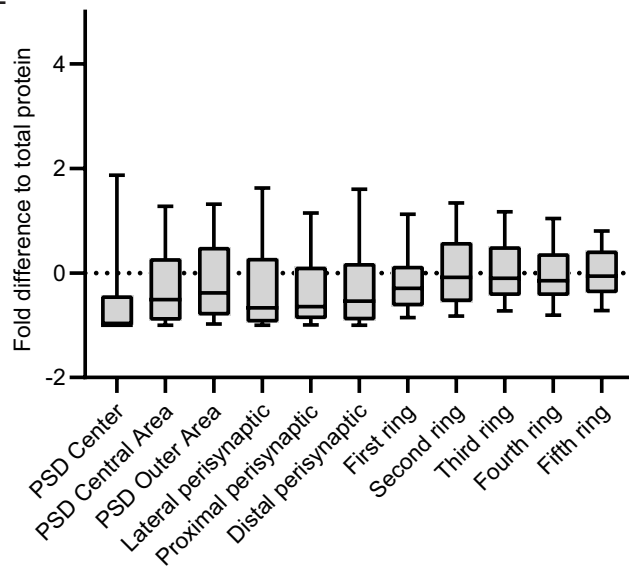
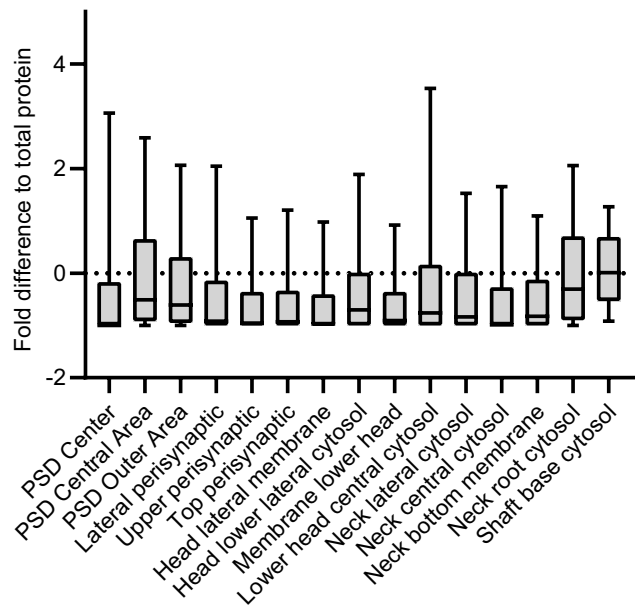
GluN2B



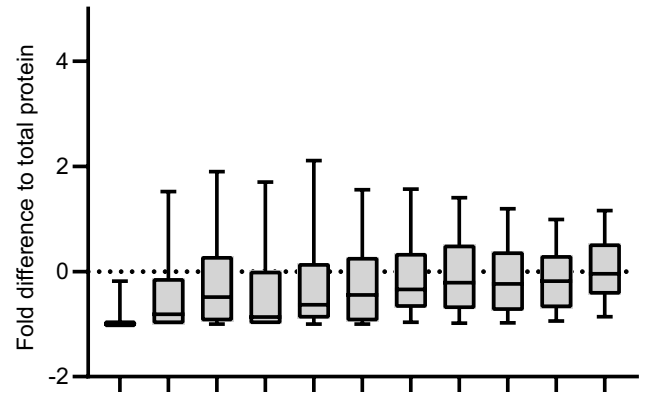
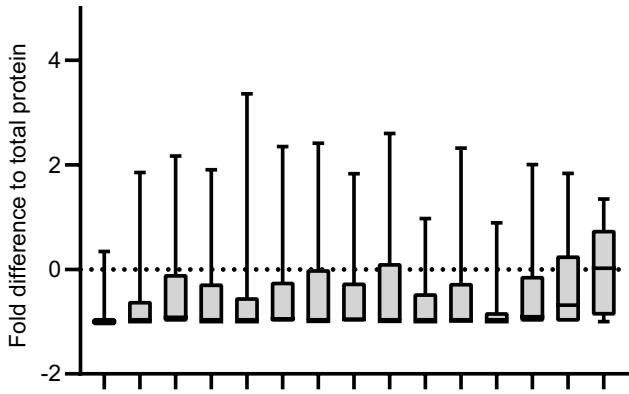
GluR1



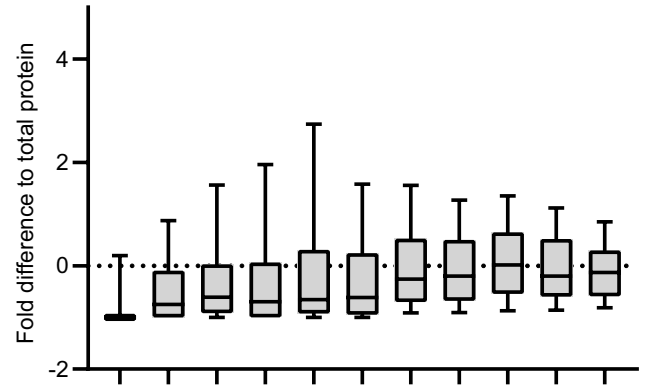
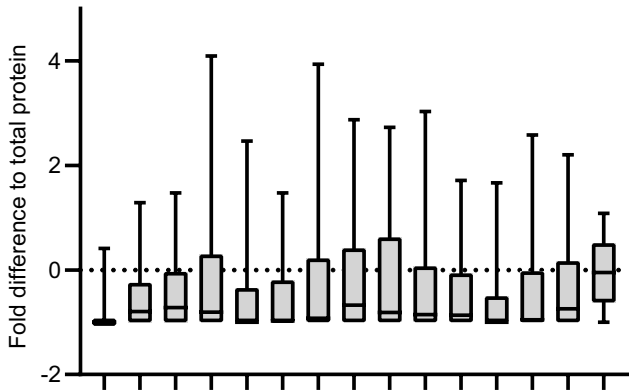
GluR2



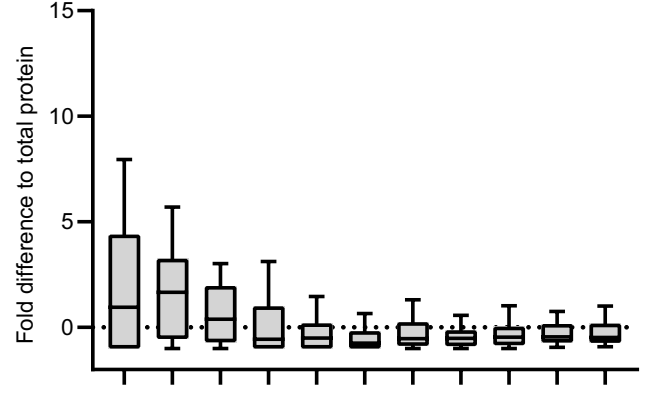
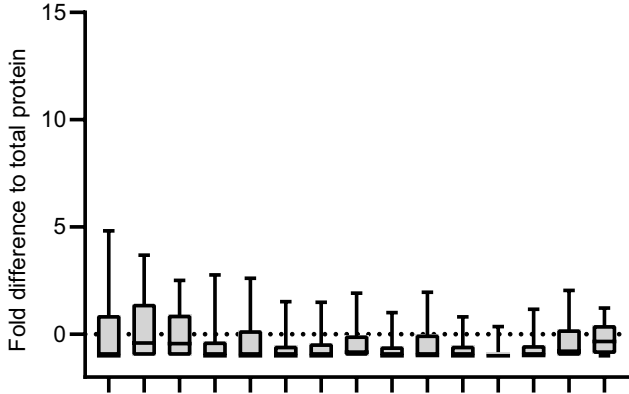
GluR3



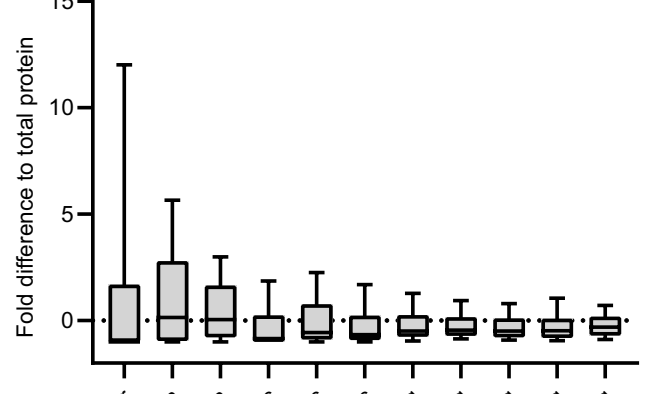
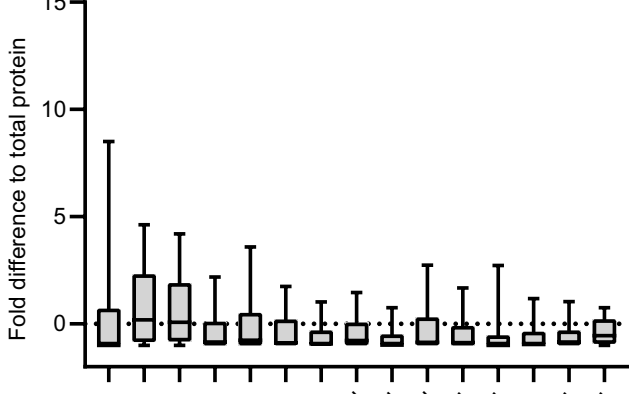
GRIP1/2



Homer1

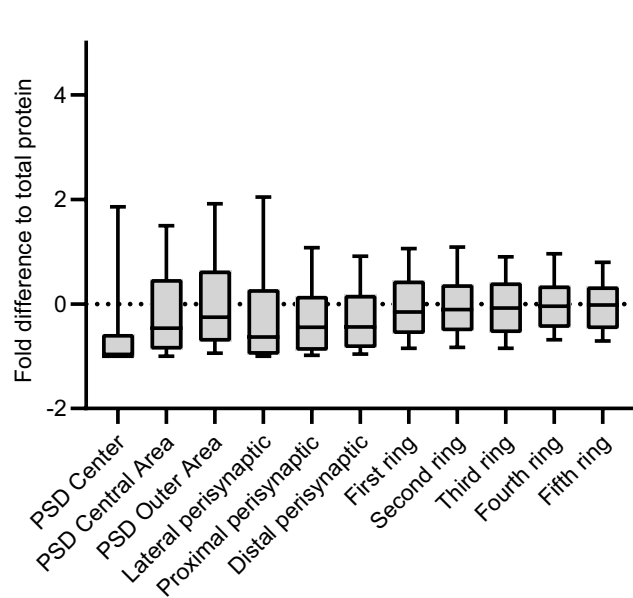
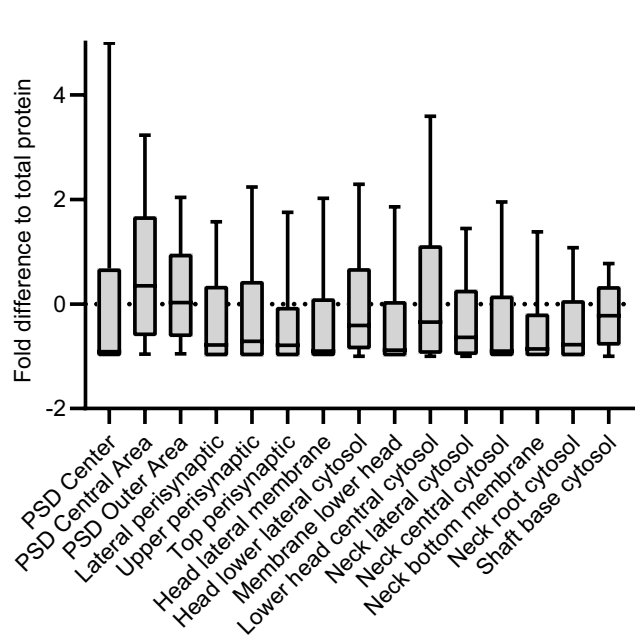
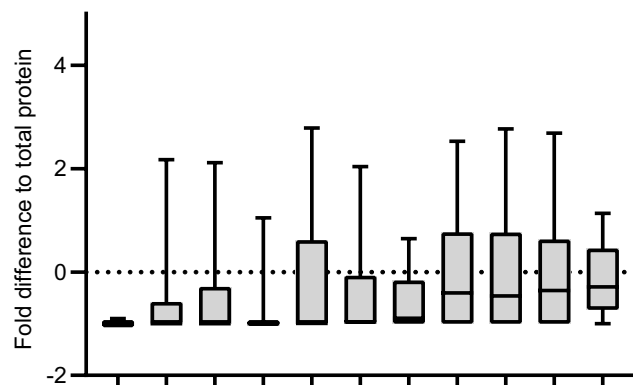
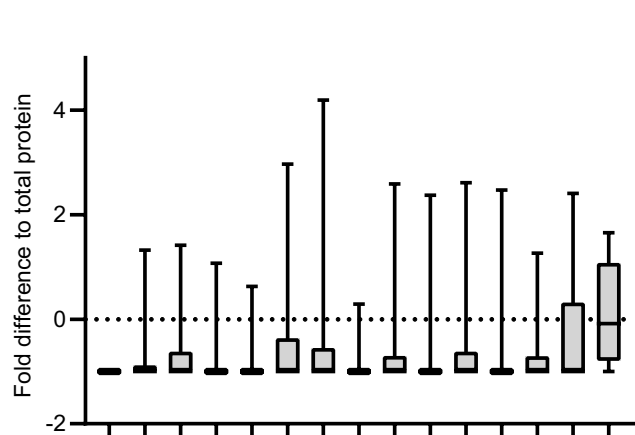
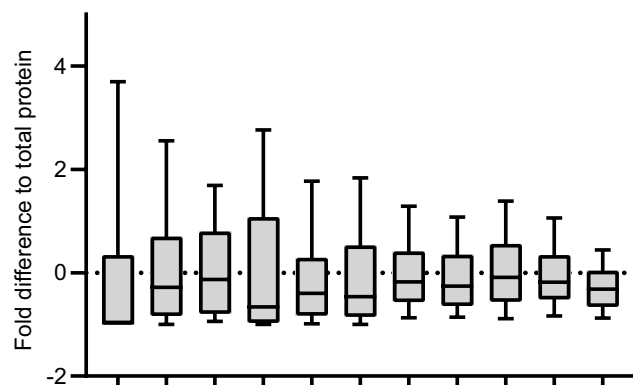
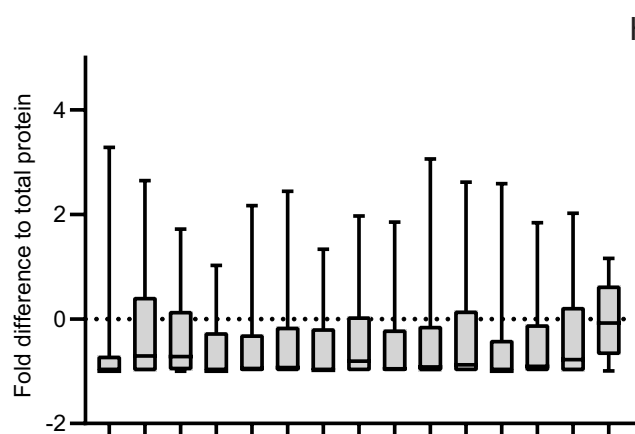
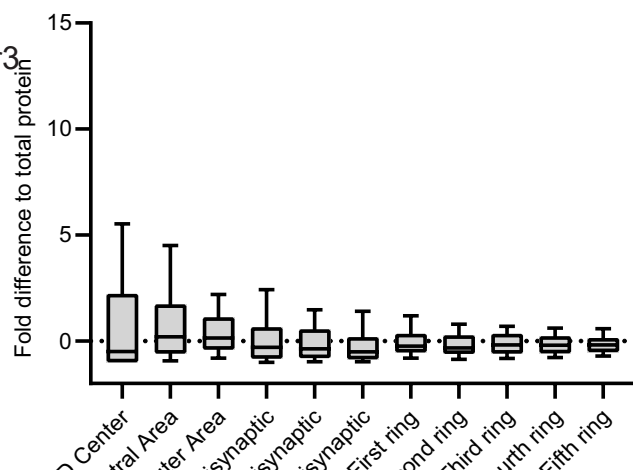
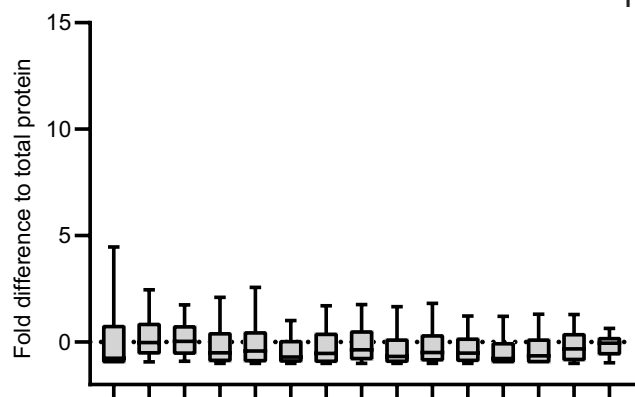


Homer2

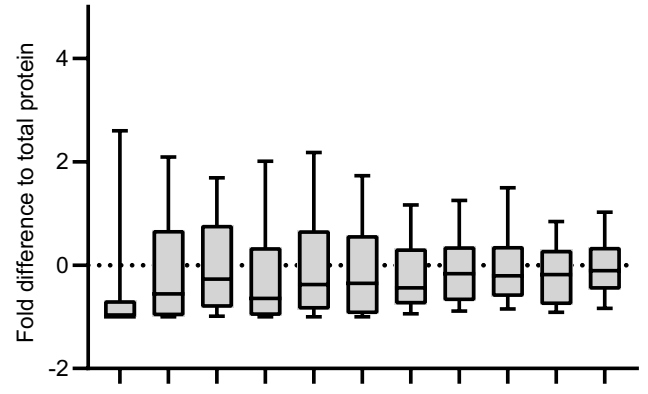
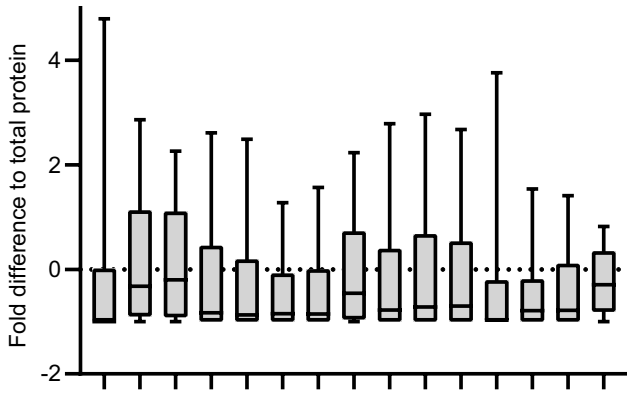


PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral membrane
Membrane lower head
Neck lateral cytosol
Neck central cytosol
Neck bottom membrane
Neck root cytosol
Shaft base cytosol

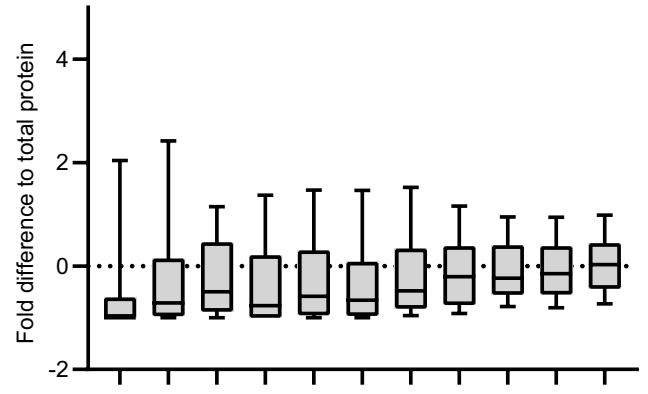
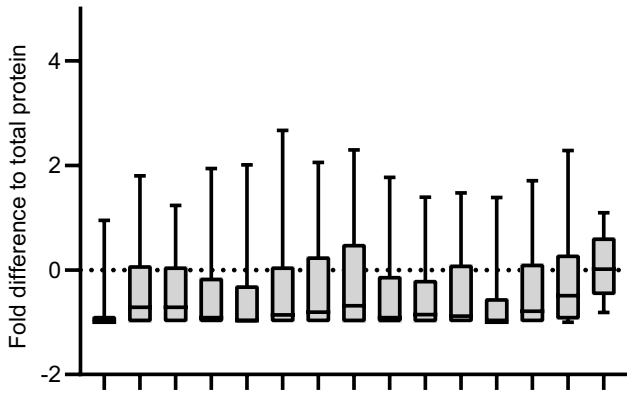
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Proximal perisynaptic
Distal perisynaptic
First ring
Second ring
Third ring
Fourth ring
Fifth ring



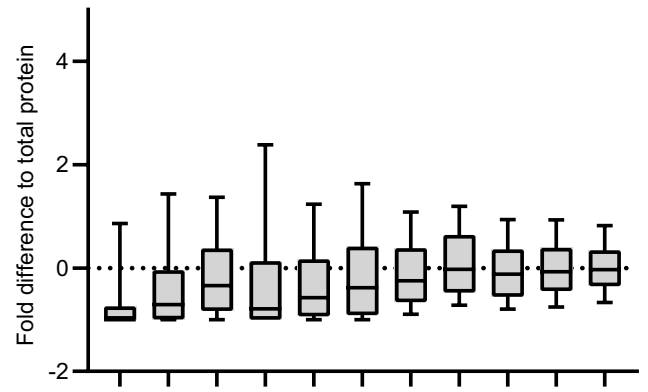
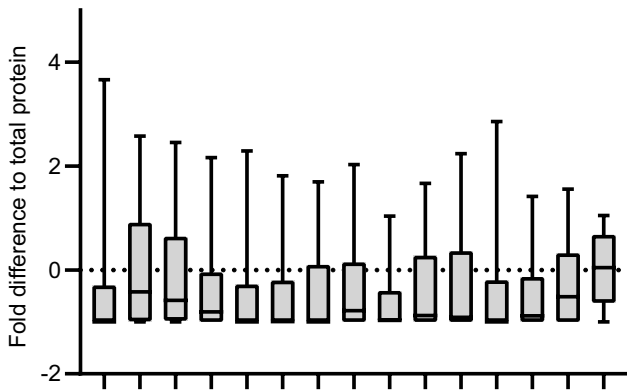
K_v1.1



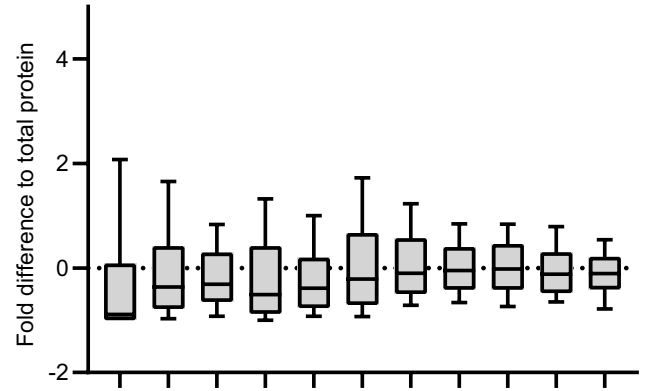
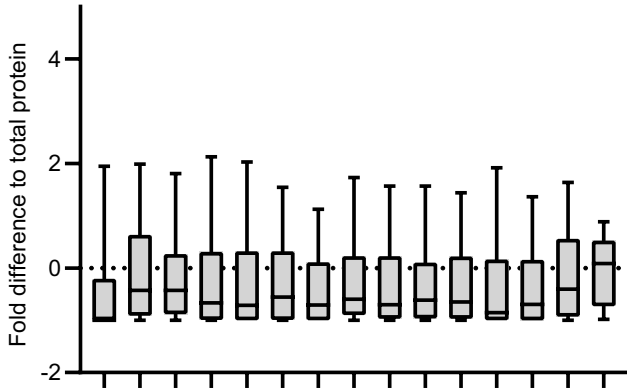
K_v2.1



LNGFR



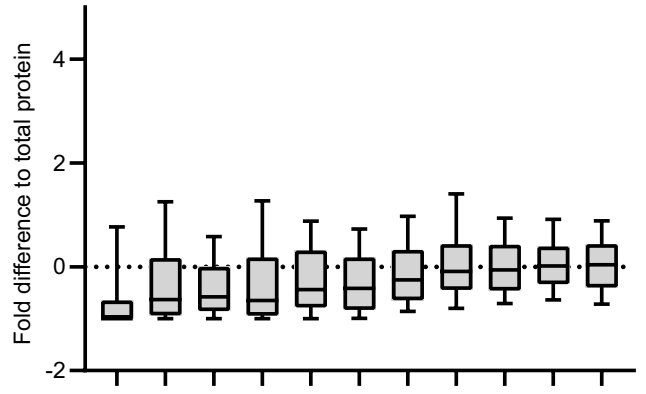
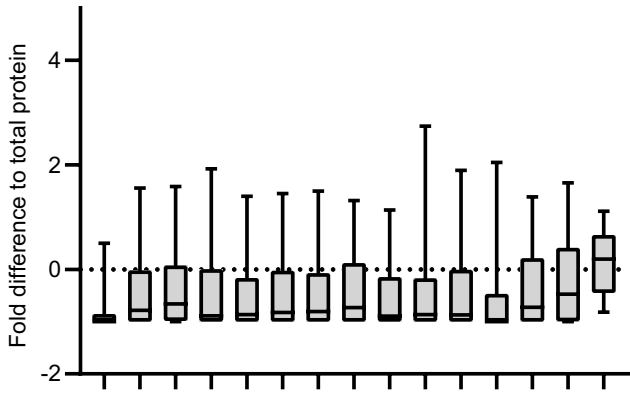
mAChR1



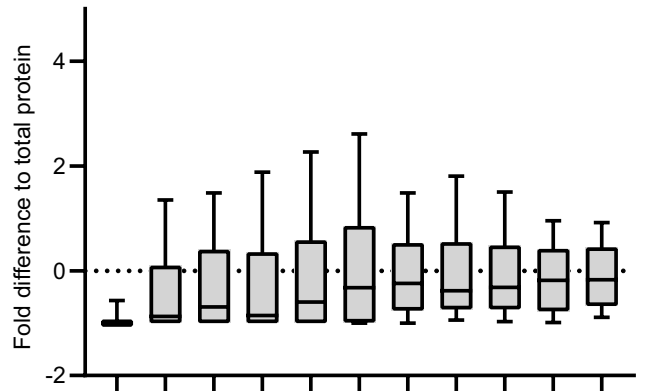
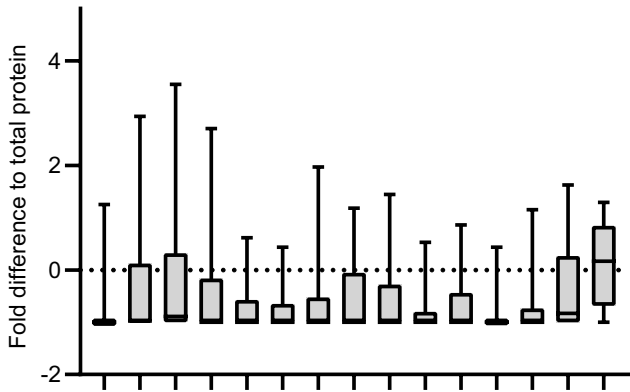
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral cytosol
Membrane lower cytosol
Neck lateral cytosol
Neck central cytosol
Neck bottom membrane
Neck root cytosol
Shaft root cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral cytosol
Membrane lower cytosol
Neck lateral cytosol
Neck central cytosol
Neck bottom membrane
Neck root cytosol
Shaft root cytosol
Shaft base cytosol

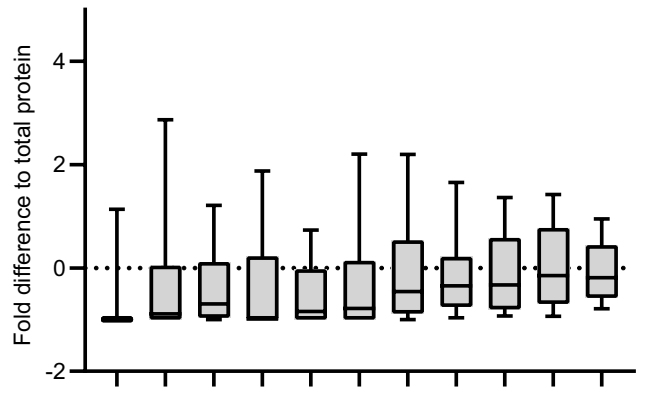
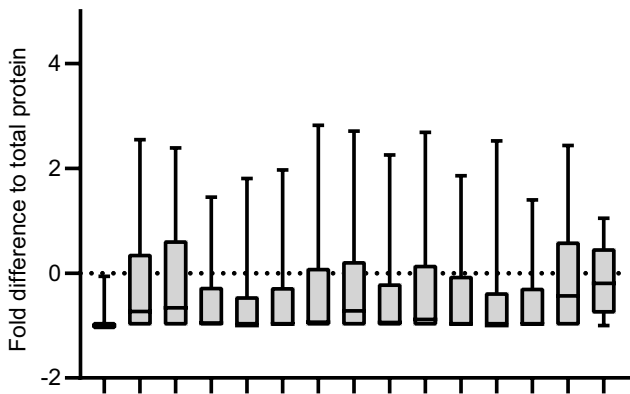
MAP2



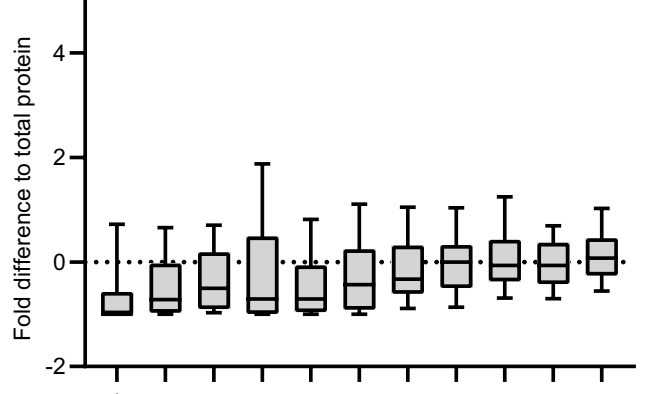
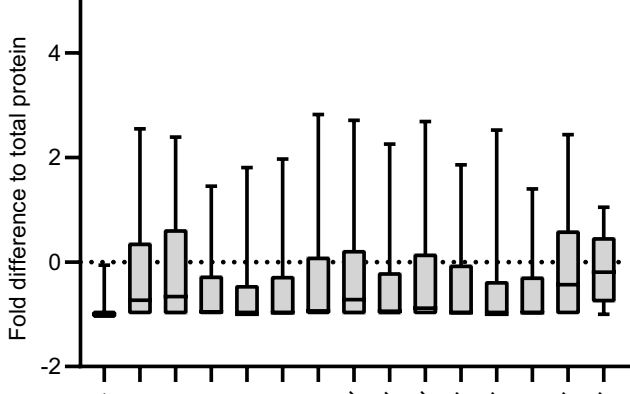
mGluR1



mGluR2



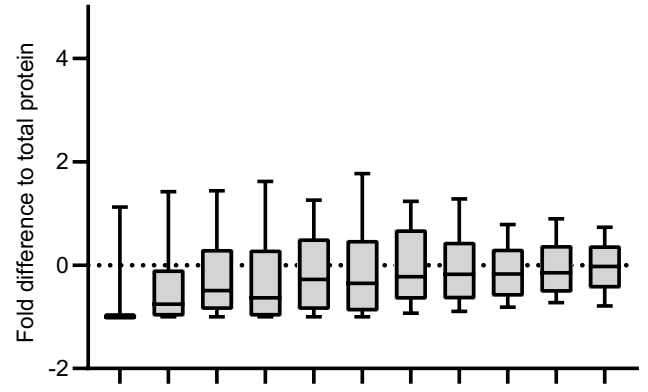
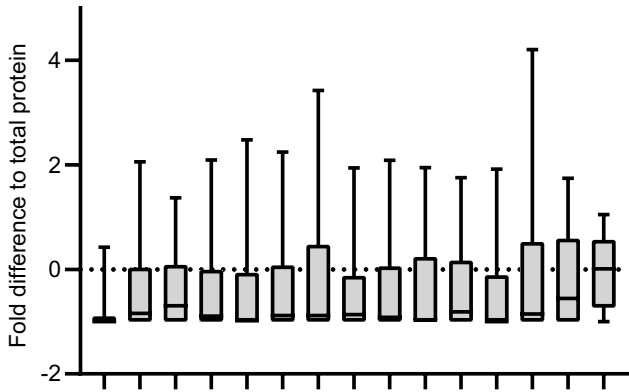
mGluR5



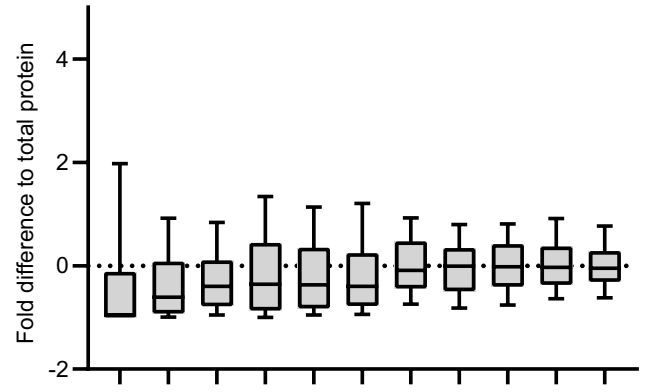
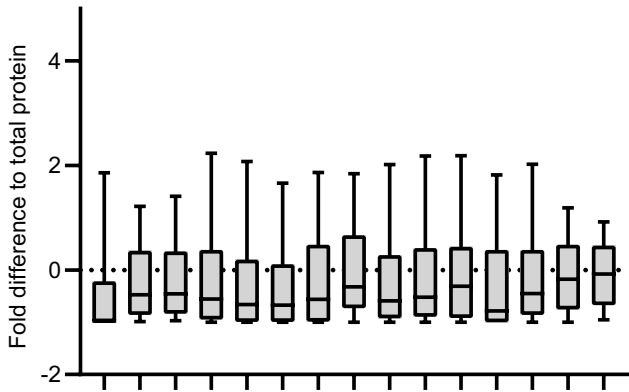
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral cytosol
Membrane lower head
Neck lateral cytosol
Neck central cytosol
Neck bottom cytosol
Neck root cytosol
Shaft base cytosol

PSD Center	PSD Central Area	PSD Outer Area	Lateral perisynaptic	Proximal perisynaptic	Distal perisynaptic	First ring	Second ring	Third ring	Fourth ring	Fifth ring
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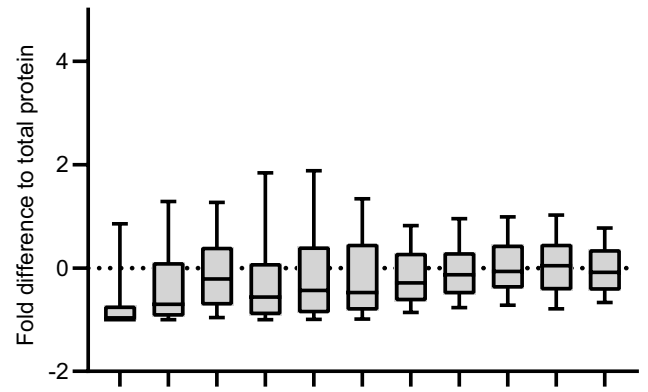
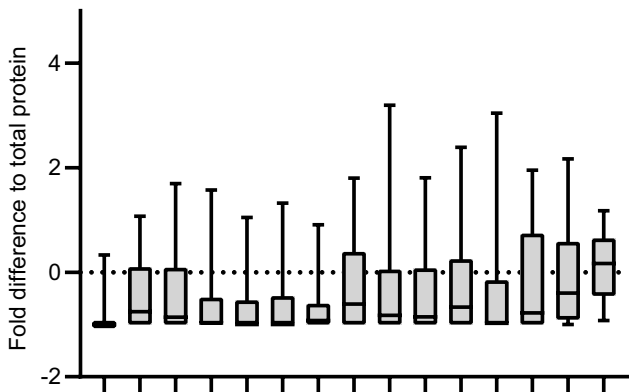
Myosin5a



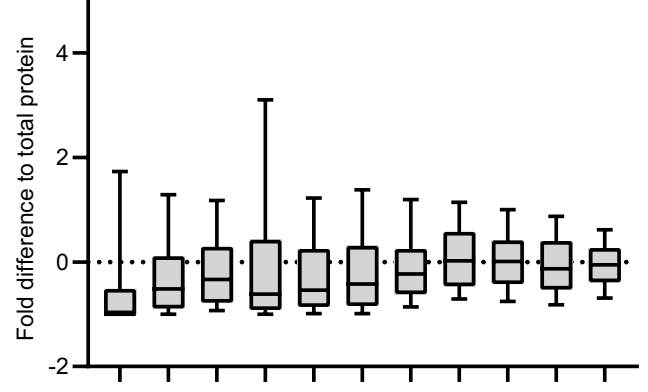
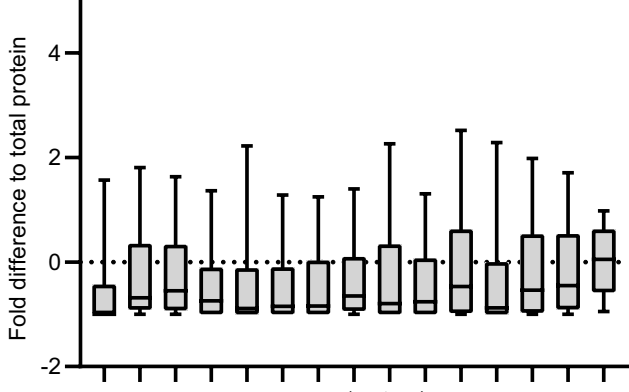
Na β 1



Na⁺/K⁺ ATPase



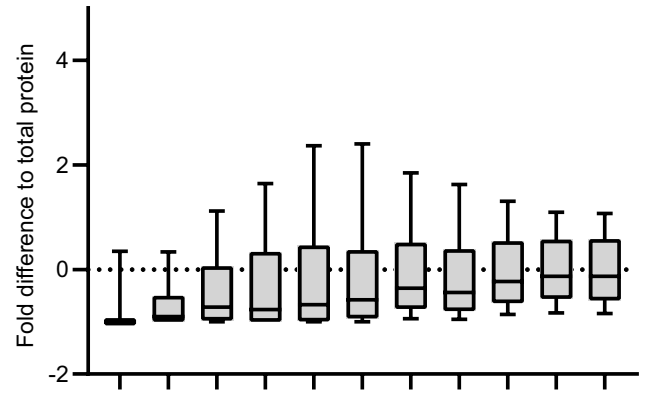
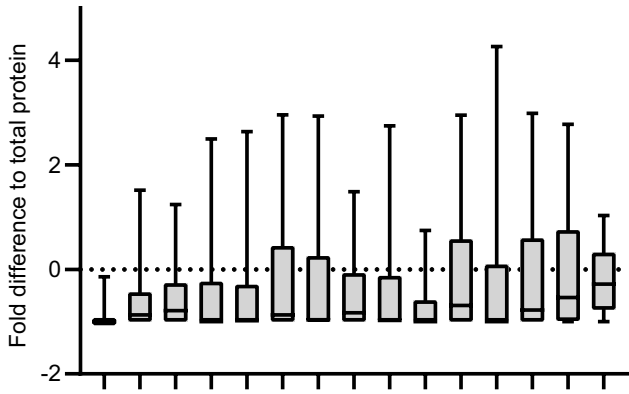
Na_v1.1



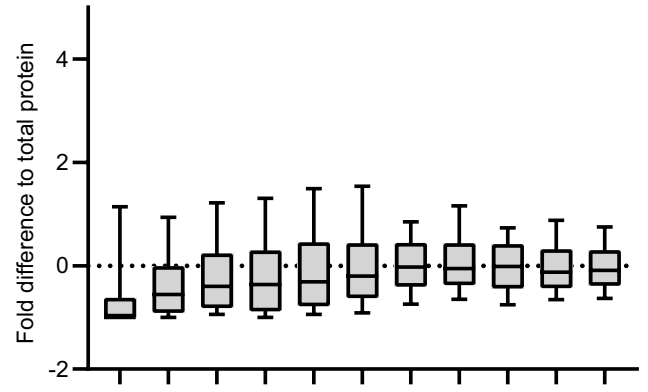
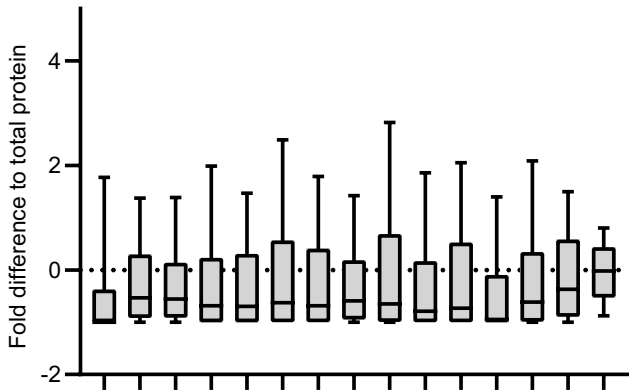
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral cytosol
Membrane lower cytosol
Neck head central cytosol
Neck lateral cytosol
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Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Proximal perisynaptic
Distal perisynaptic
First ring
Second ring
Third ring
Fourth ring
Fifth ring

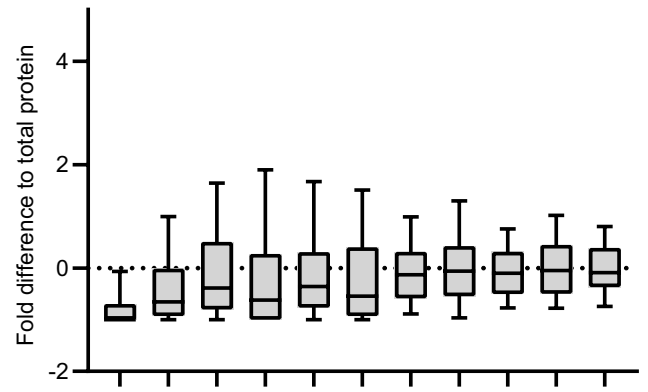
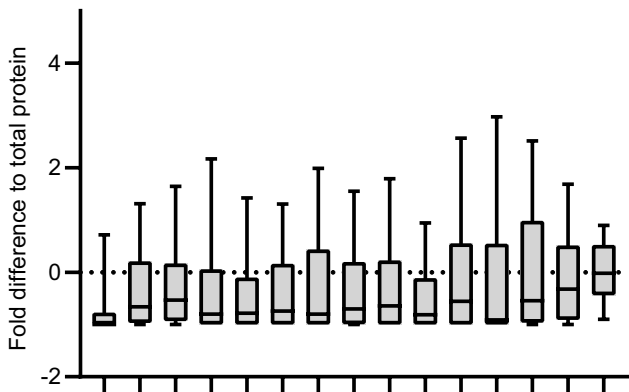
Na_v1.3



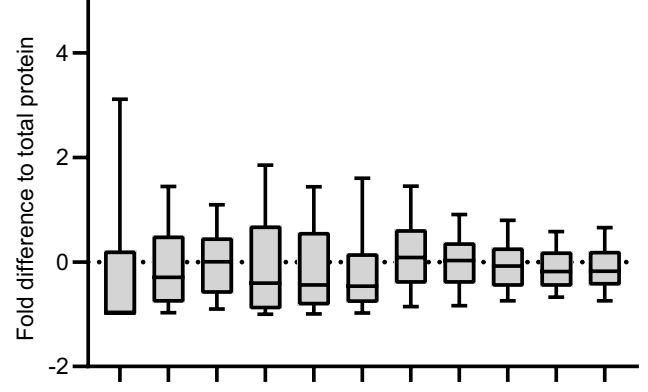
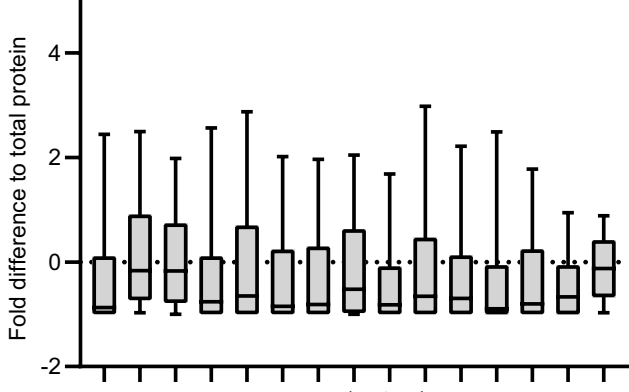
Neurofilament H



Neurofilament L



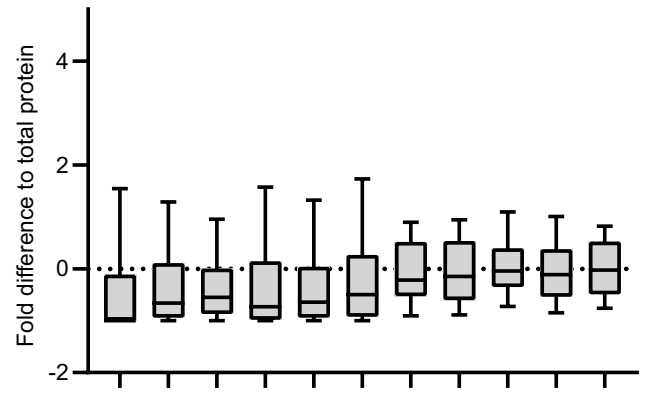
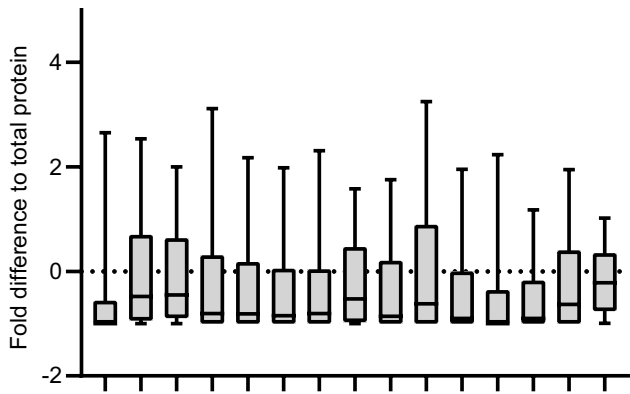
nNOS



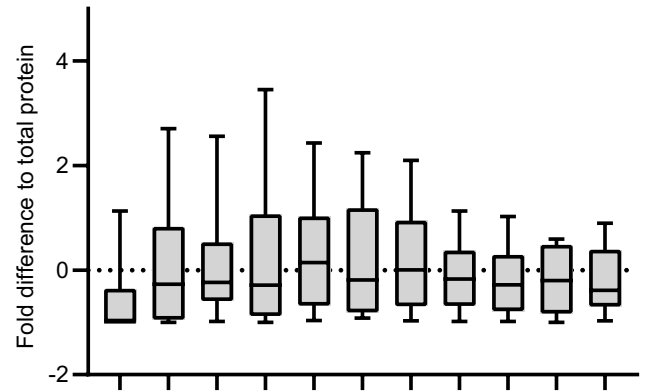
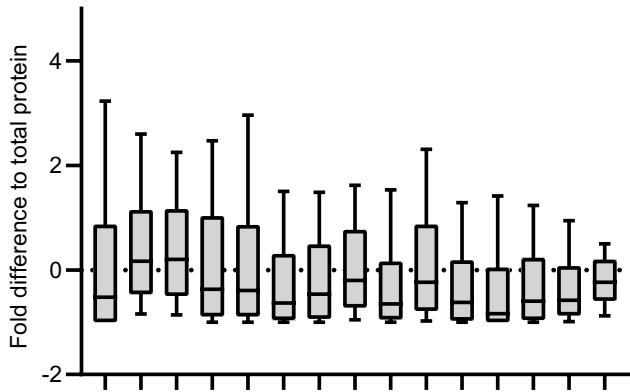
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral cytosol
Head lower central cytosol
Lower head central cytosol
Neck lateral cytosol
Neck bottom cytosol
Neck central cytosol
Neck lateral membrane
Neck root cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Proximal perisynaptic
Distal perisynaptic
First ring
Second ring
Third ring
Fourth ring
Fifth ring

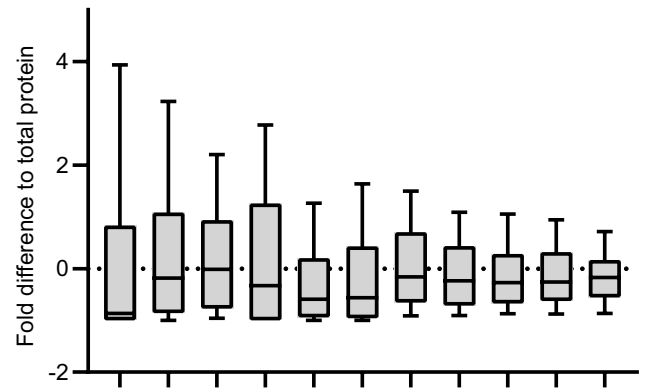
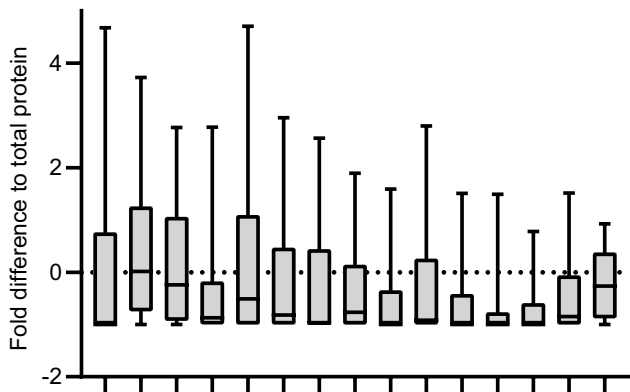
NSF



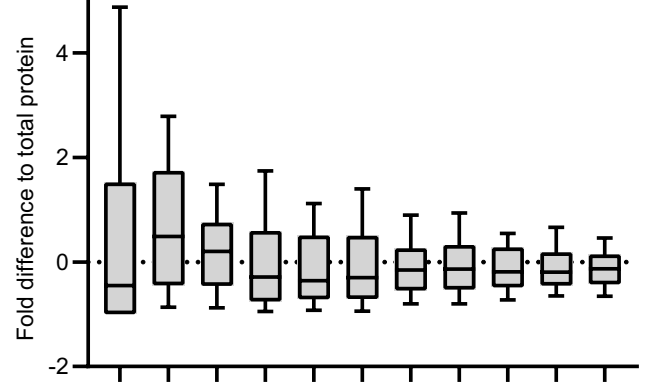
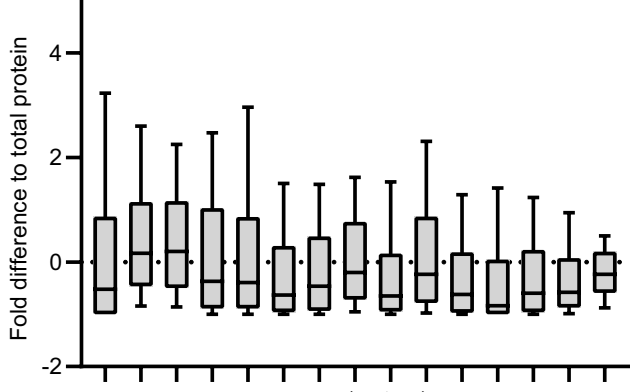
Parvalbumin



PSD93



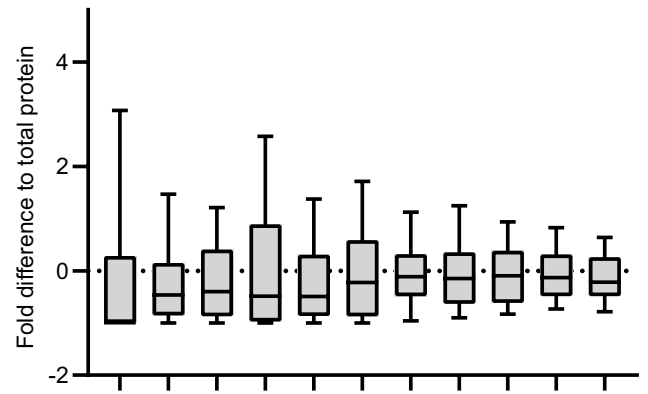
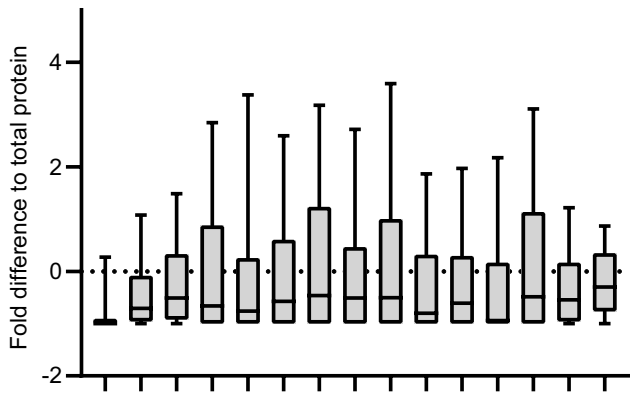
PSD95



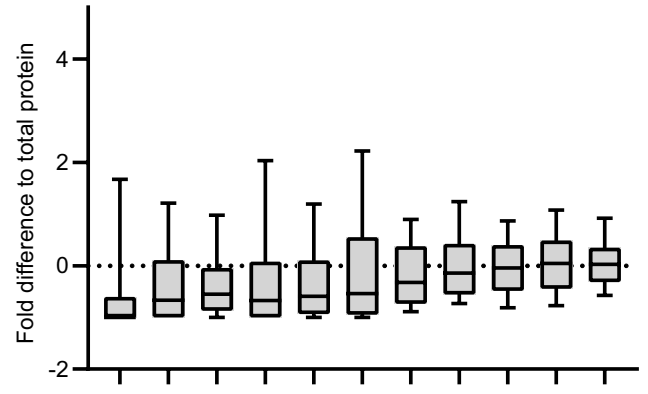
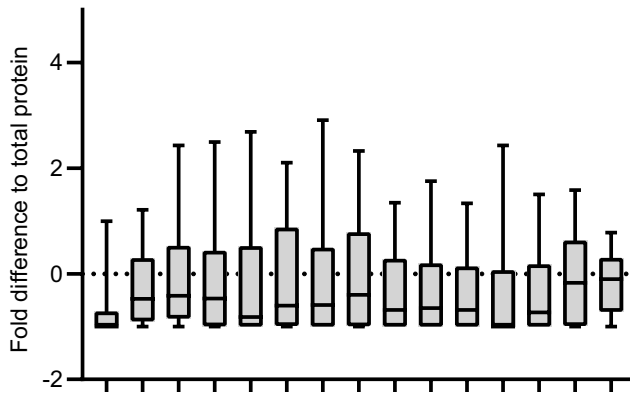
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral cytosol
Head lower central cytosol
Membrane lower head
Neck lateral cytosol
Neck central cytosol
Neck bottom cytosol
Neck root cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Proximal perisynaptic
Distal perisynaptic
First ring
Second ring
Third ring
Fourth ring
Fifth ring

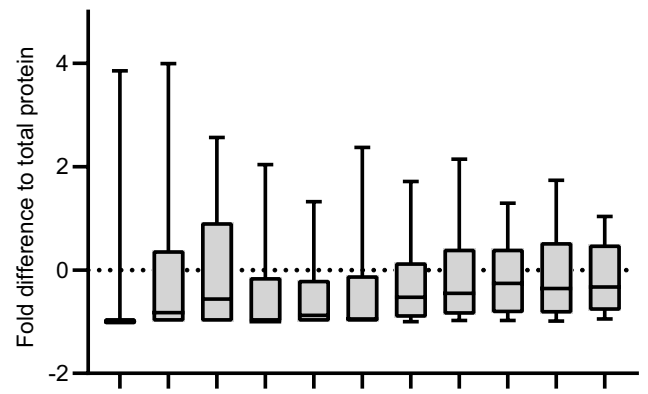
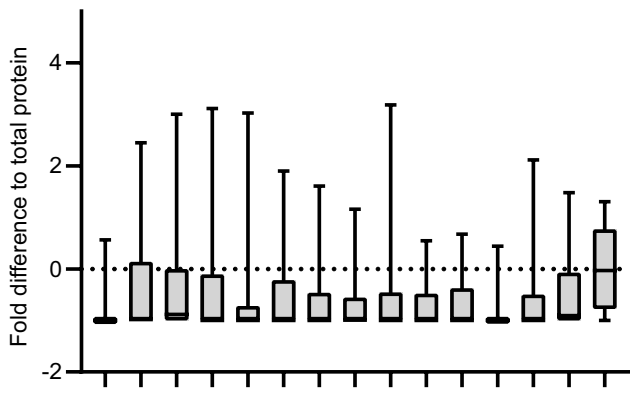
Rab3



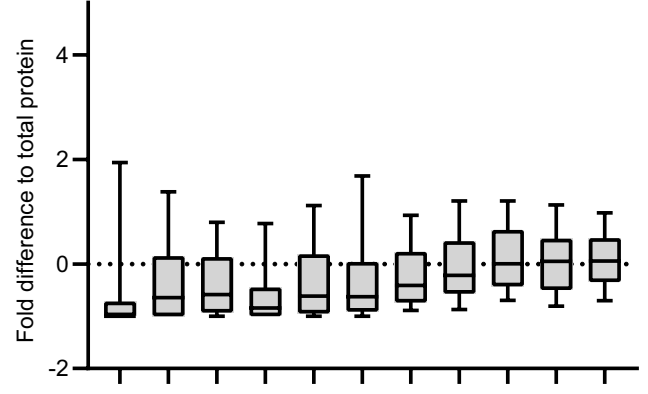
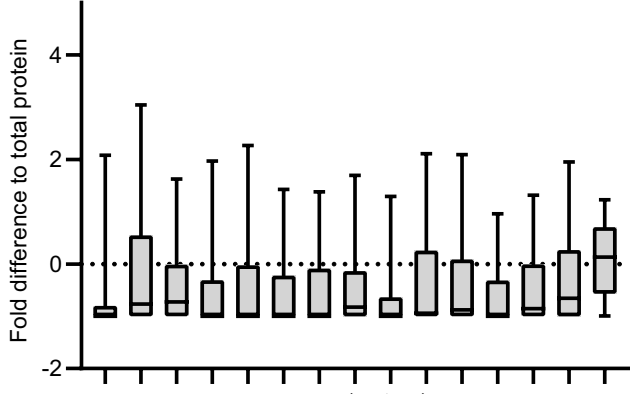
Rab4



Rab5



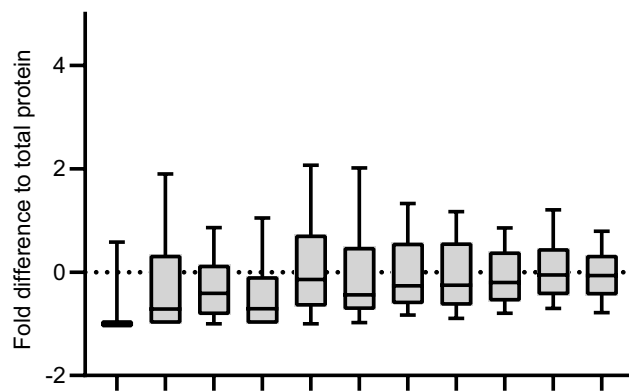
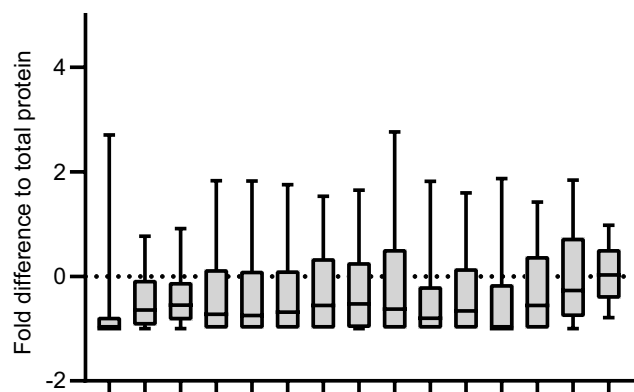
Rab7



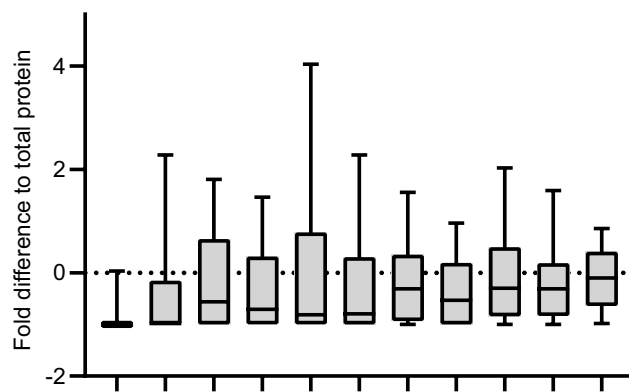
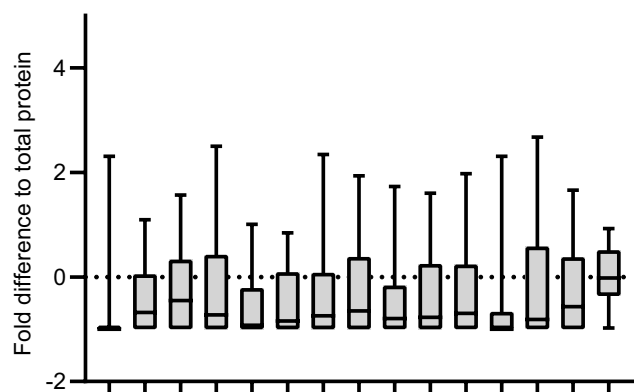
PSD Center
 PSD Central Area
 PSD Outer Area
 Lateral perisynaptic
 Upper perisynaptic
 Top lateral membrane
 Head lower lateral cytosol
 Head lower lateral cytosol
 Membrane lower head
 Neck lateral cytosol
 Neck central cytosol
 Neck bottom membrane
 Neck root cytosol
 Shaft base cytosol

PSD Center
 PSD Central Area
 PSD Outer Area
 Lateral perisynaptic
 Proximal perisynaptic
 Distal perisynaptic
 First ring
 Second ring
 Third ring
 Fourth ring
 Fifth ring

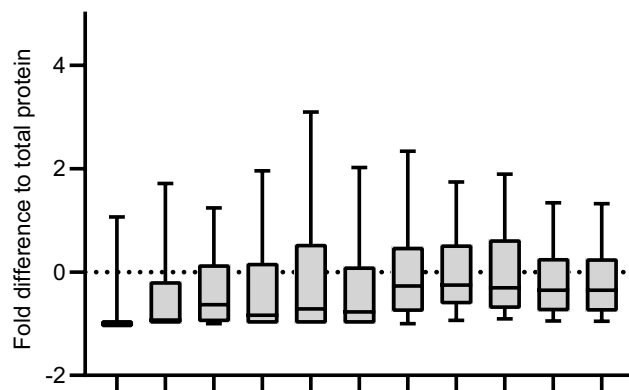
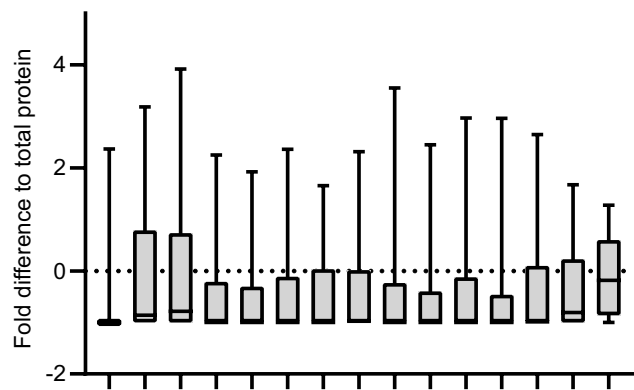
Rab9



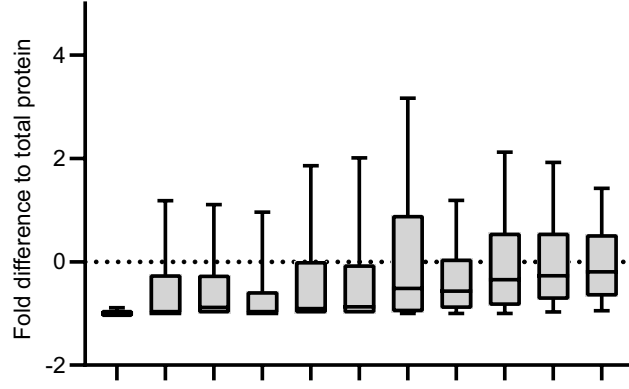
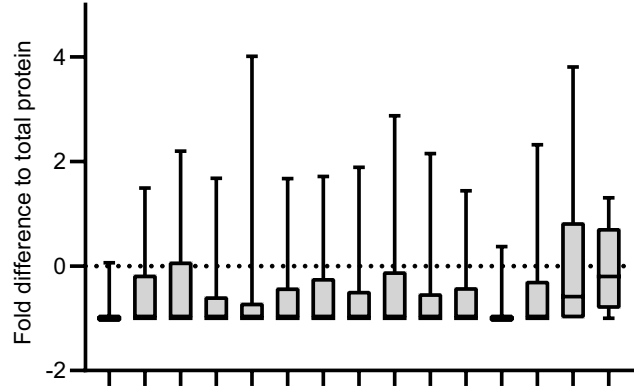
Rab11



Rapsyn



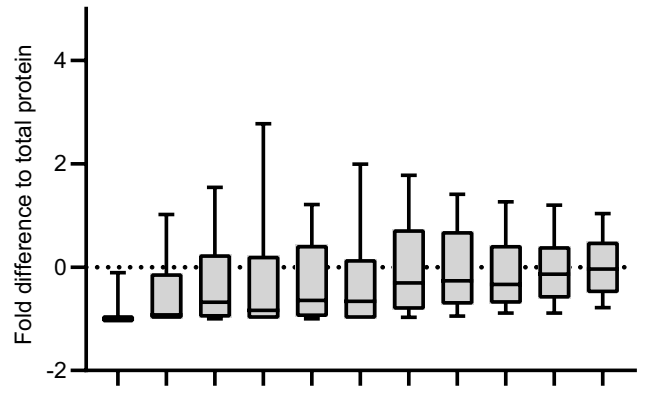
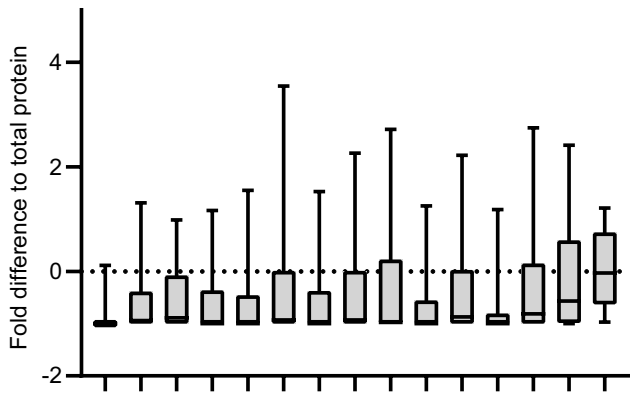
Ribosomal protein L7a



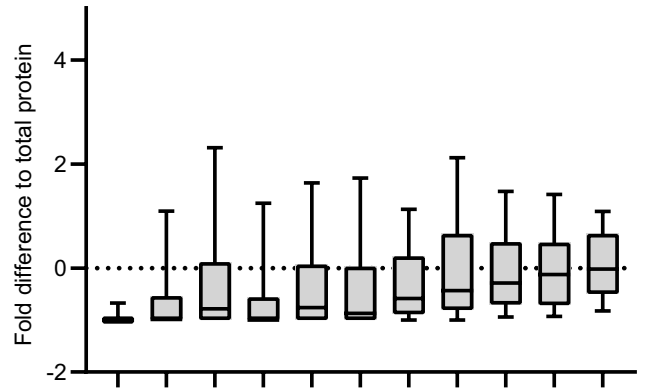
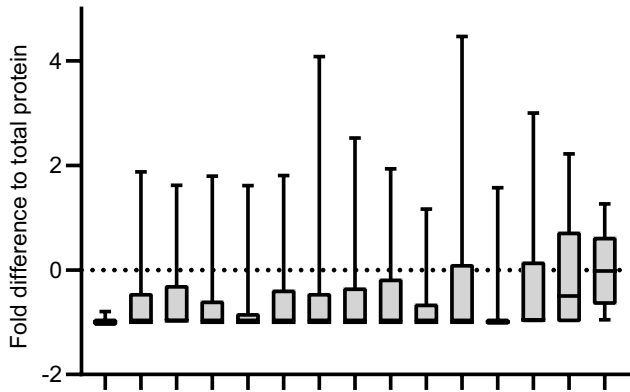
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top lateral membrane
Head lower lateral cytosol
Head lower lateral cytosol
Membrane lower cytosol
Neck lateral cytosol
Neck central cytosol
Neck bottom membrane
Neck root cytosol
Shaft base cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Proximal perisynaptic
Distal perisynaptic
First ring
Second ring
Third ring
Fourth ring
Fifth ring

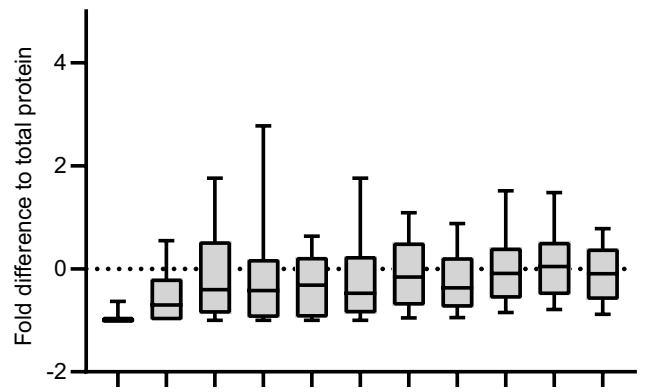
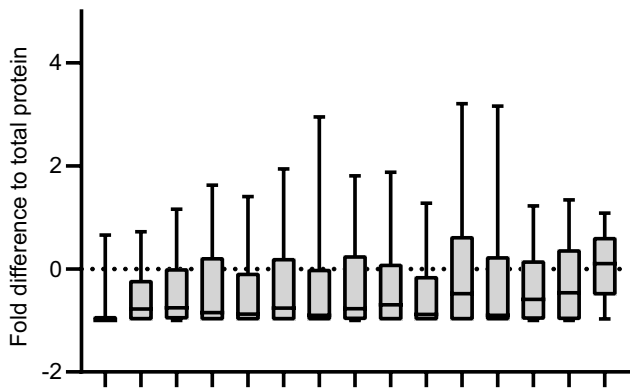
Ribosomal protein S3



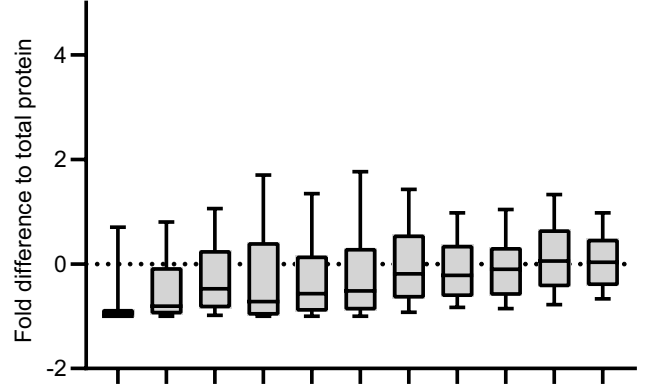
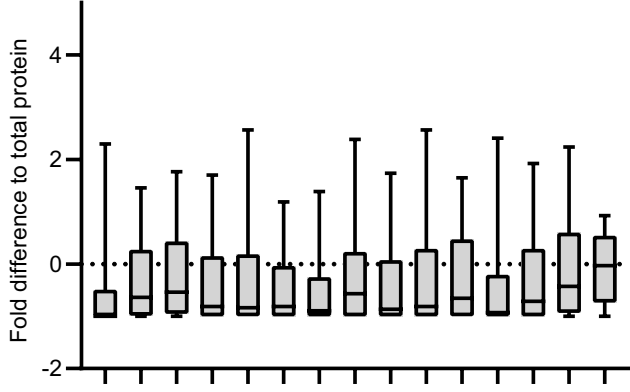
Ribosomal protein S6



Sec22b



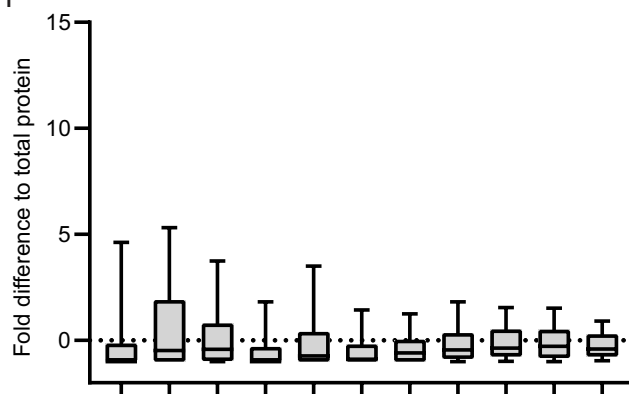
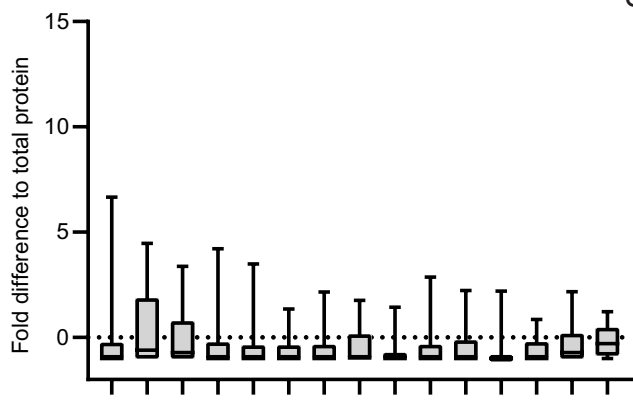
Septin7



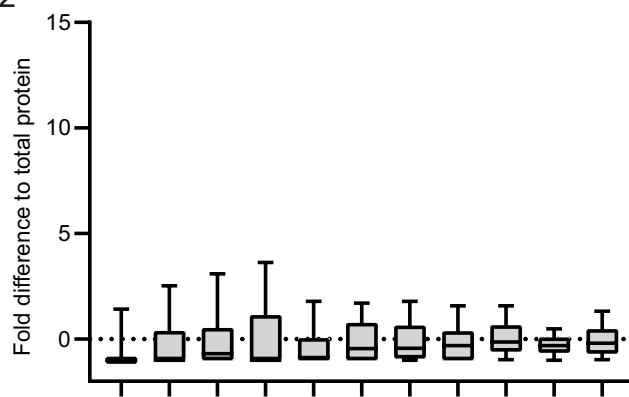
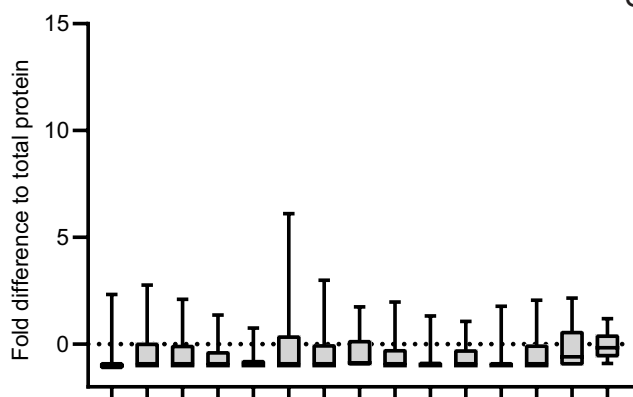
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral membrane
Membrane lower cytosol
Neck lateral cytosol
Neck central cytosol
Neck bottom membrane
Neck root cytosol
Shaft base cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral membrane
Membrane lower cytosol
Neck lateral cytosol
Neck central cytosol
Neck bottom membrane
Neck root cytosol
Shaft base cytosol
Shaft base cytosol

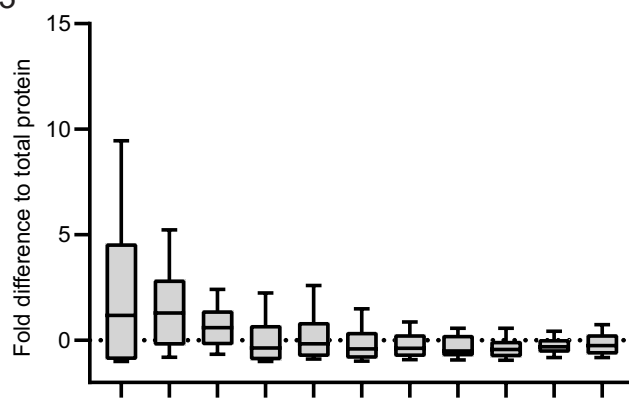
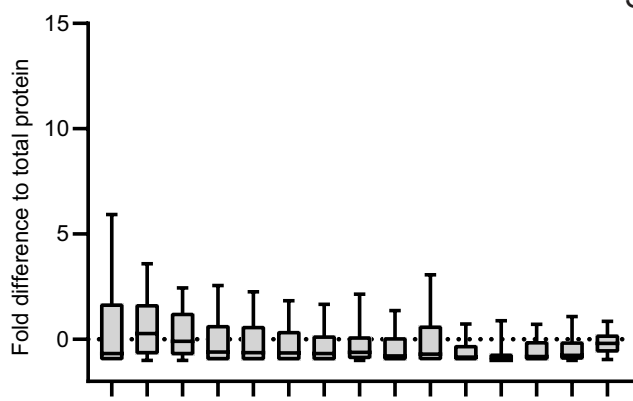
Shank1



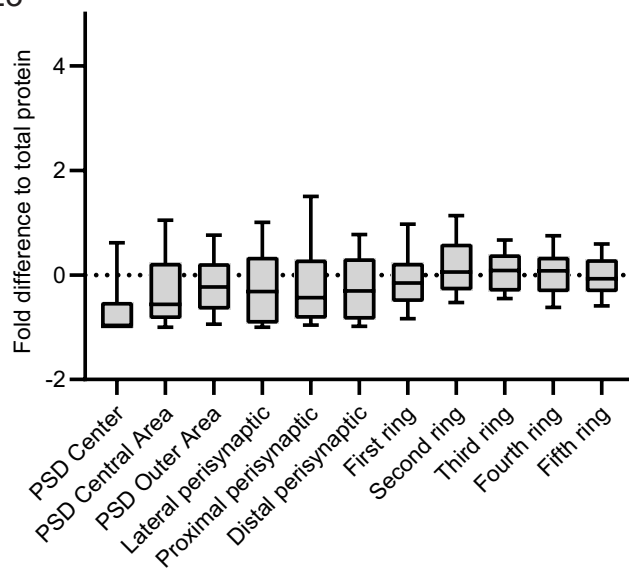
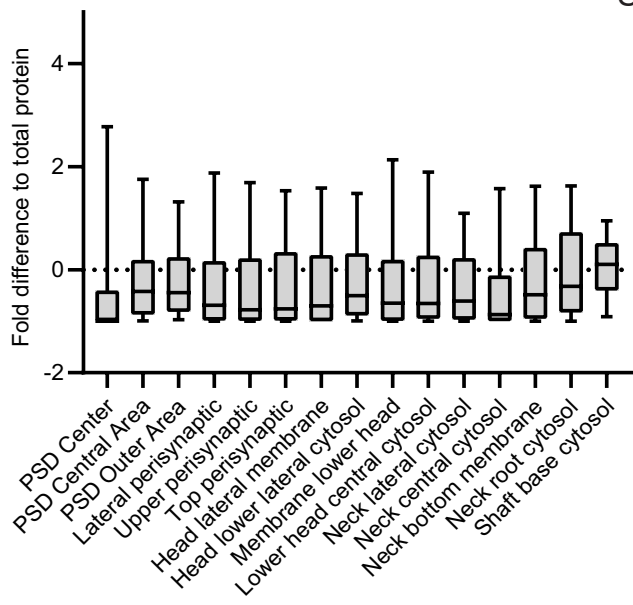
Shank2



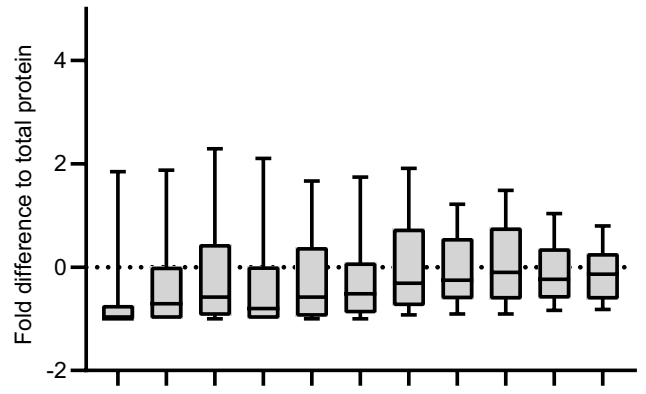
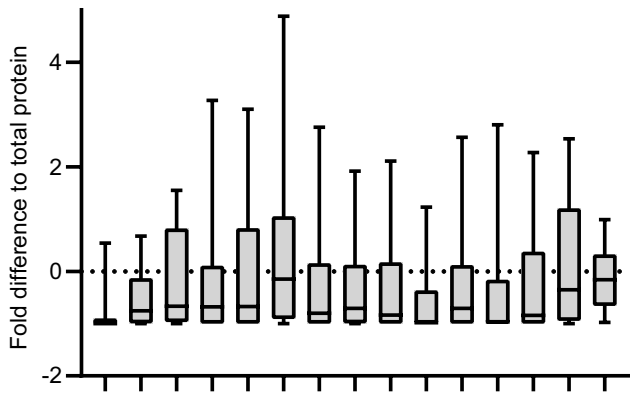
Shank3



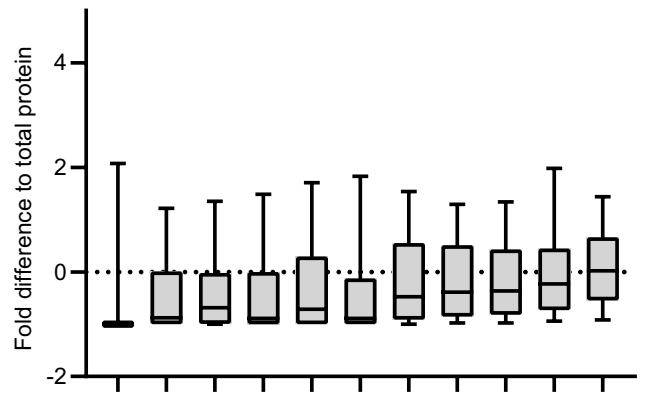
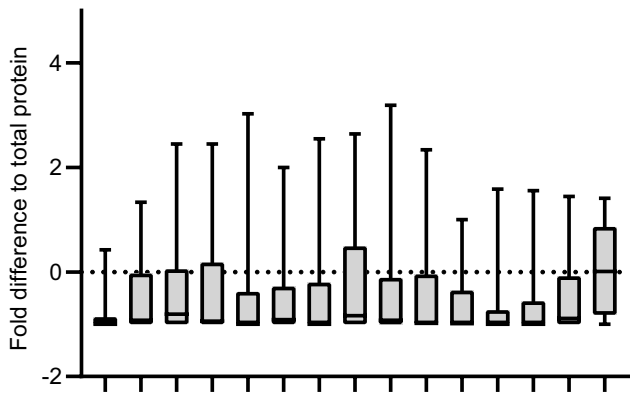
SNAP23



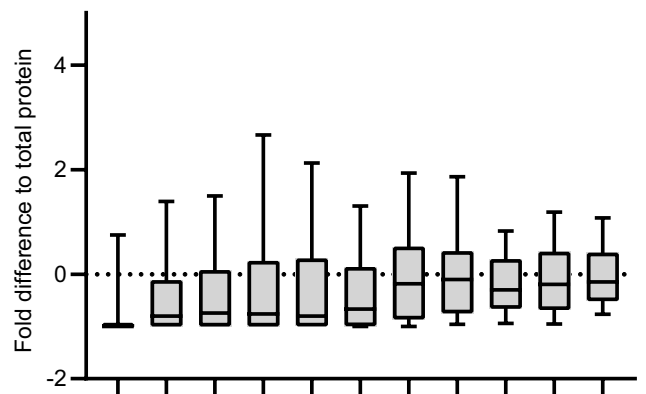
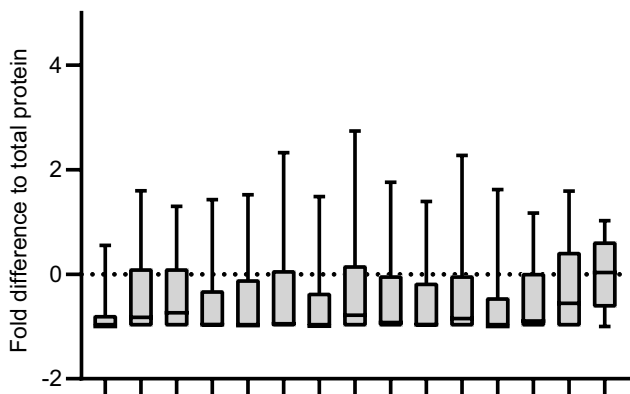
SNAP25



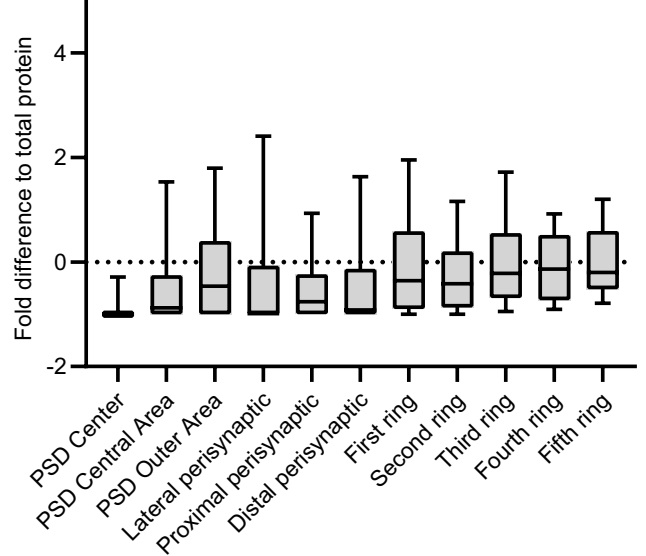
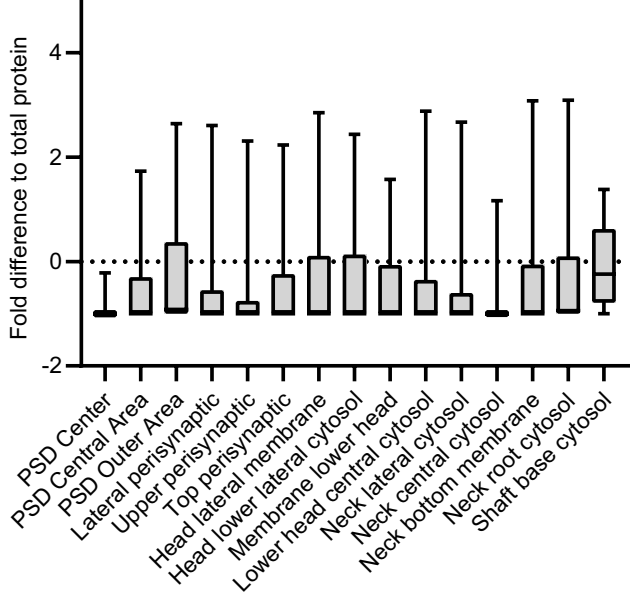
SNAP29



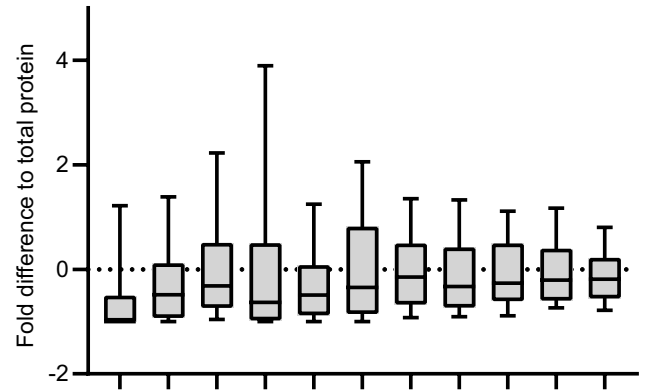
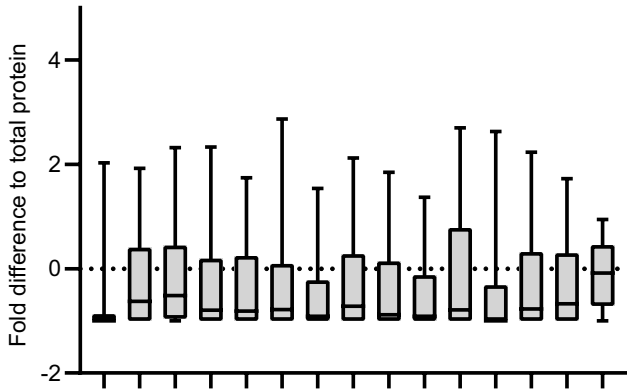
SNAP47



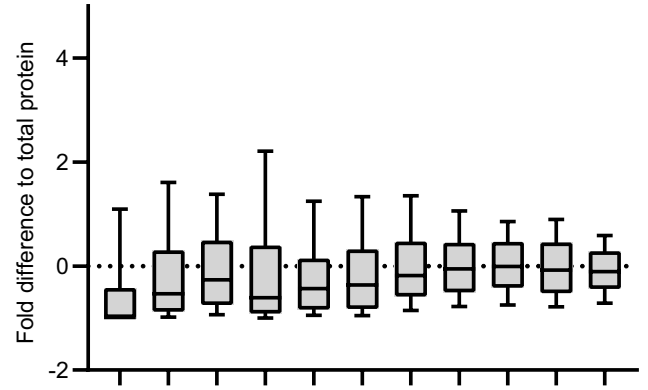
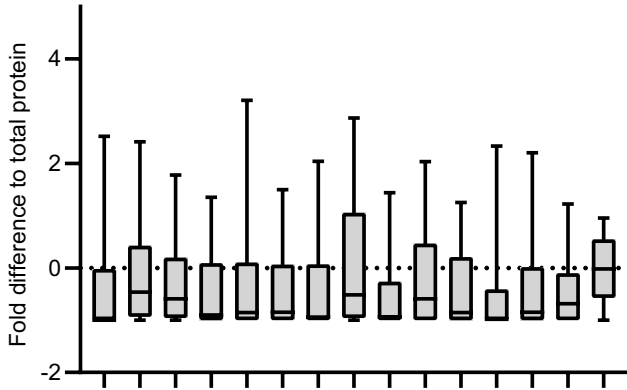
Synaptotagmin4



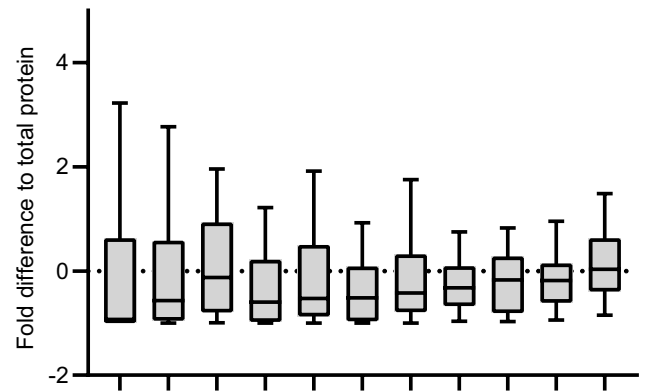
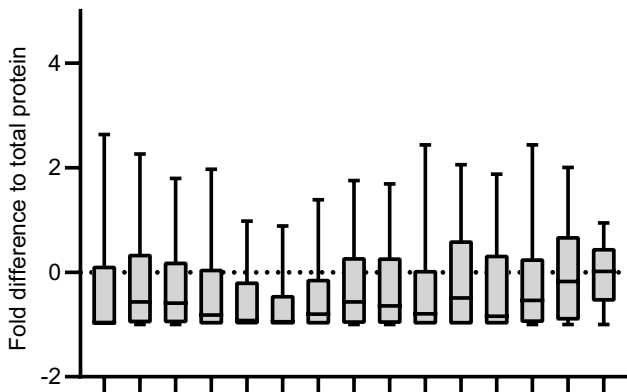
Synaptotagmin5



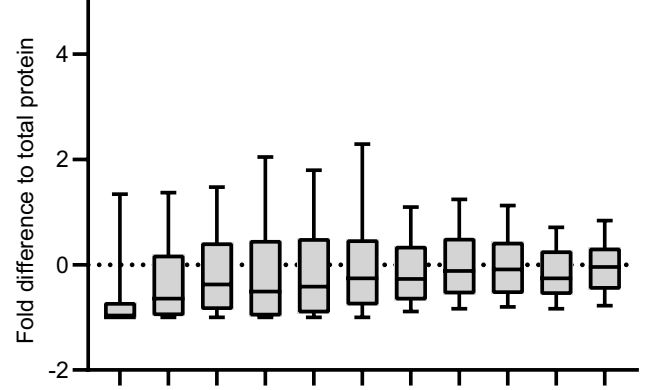
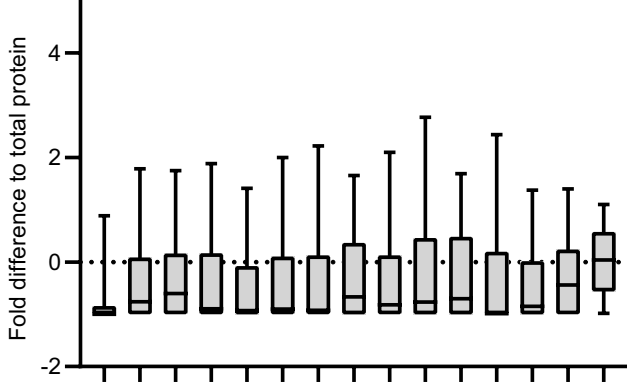
Synaptotagmin7



SynGAP1



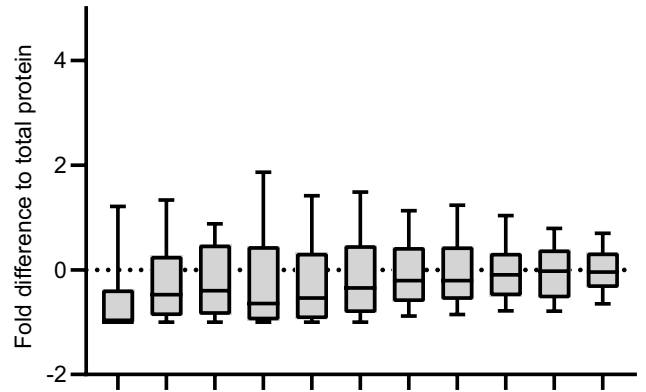
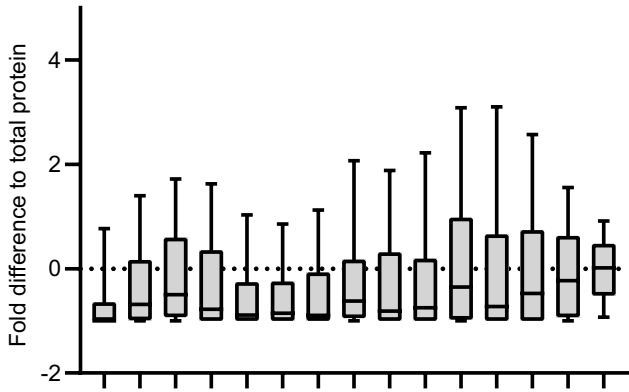
Syntaxin1a



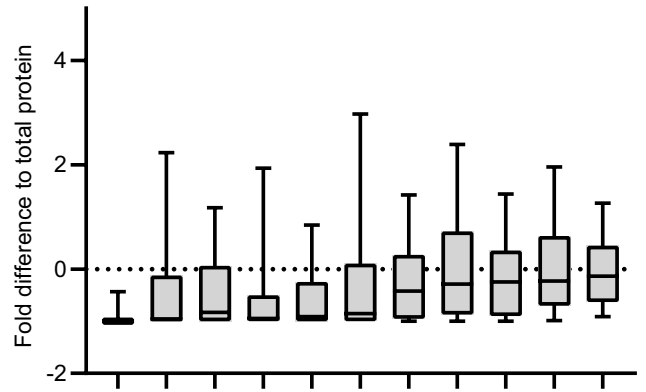
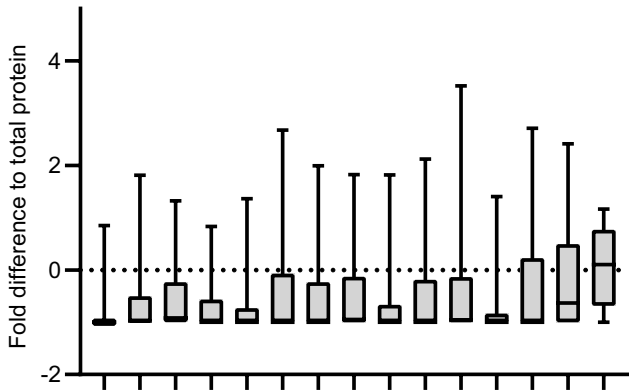
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral membrane
Membrane lower cytosol
Neck lateral cytosol
Neck central cytosol
Neck bottom cytosol
Neck lateral membrane
Neck root cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral membrane
Membrane lower cytosol
Neck lateral cytosol
Neck central cytosol
Neck bottom cytosol
Neck lateral membrane
Neck root cytosol
Shaft base cytosol

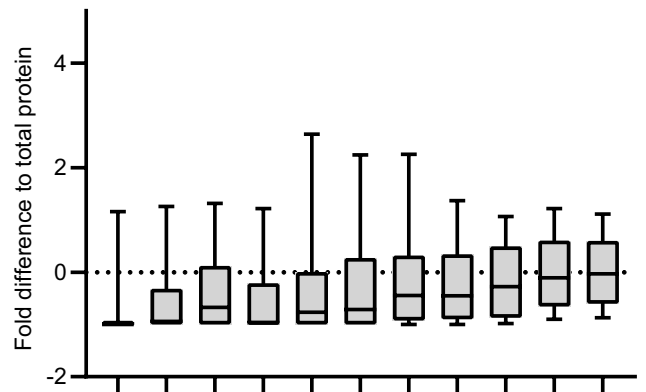
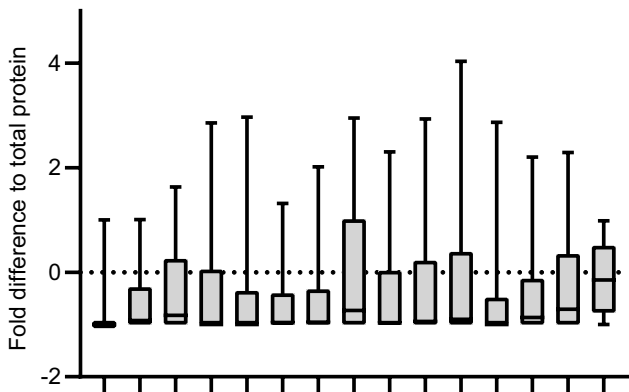
Syntaxin2



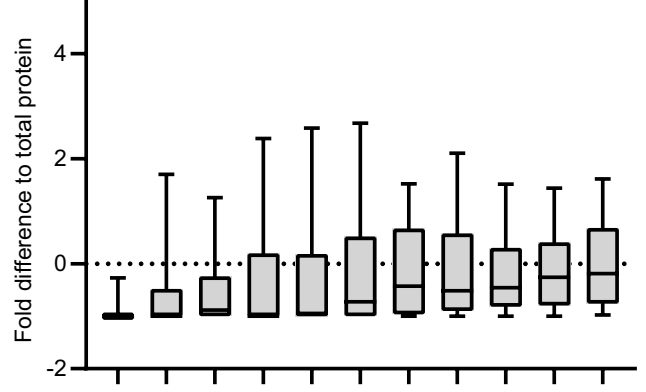
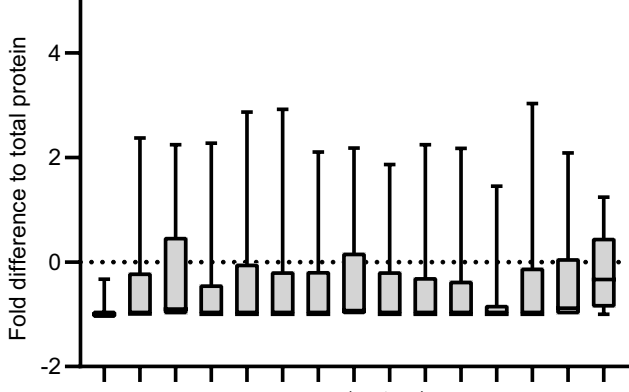
Syntaxin3



Syntaxin4



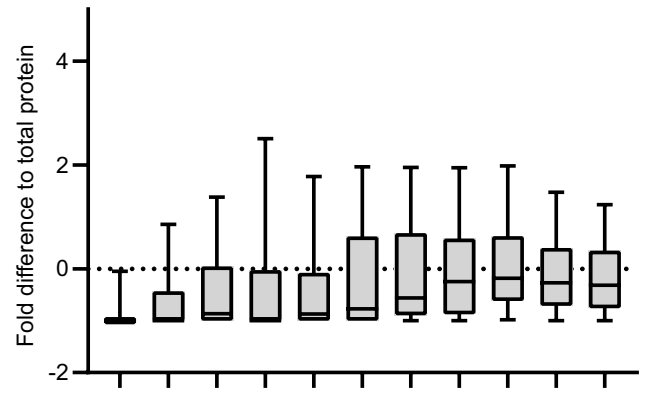
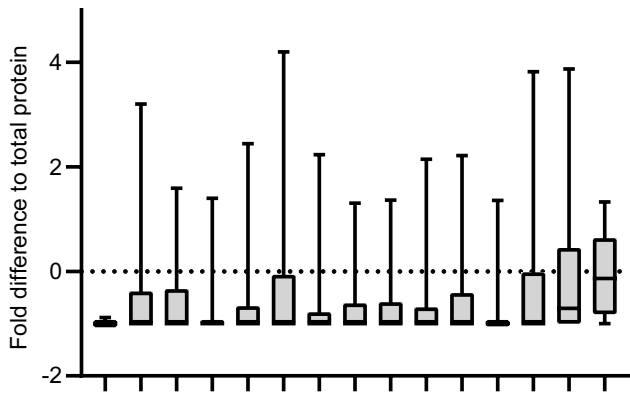
Syntaxin5



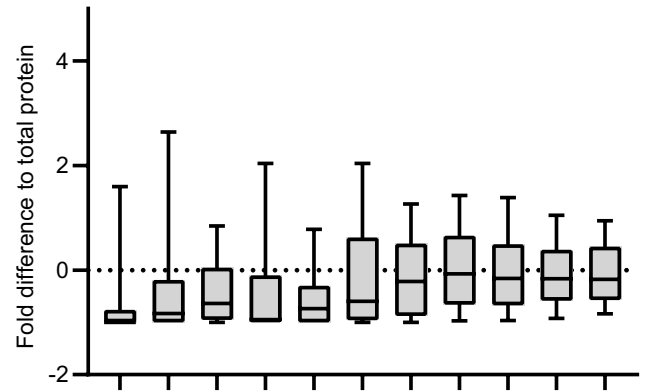
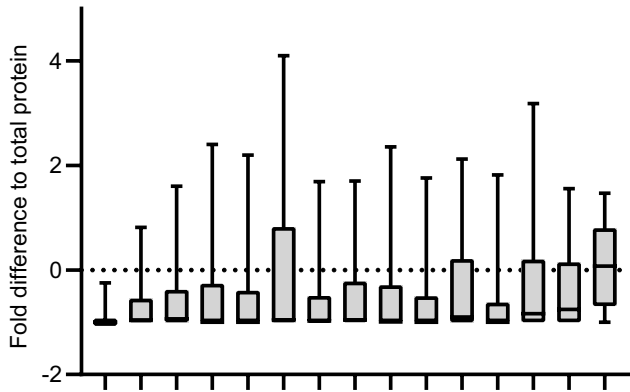
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top lateral membrane
Head lower lateral cytosol
Head lateral cytosol
Membrane lower head
Lower head central cytosol
Neck lateral cytosol
Neck central cytosol
Neck bottom membrane
Neck root cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Proximal perisynaptic
Distal perisynaptic
First ring
Second ring
Third ring
Fourth ring
Fifth ring

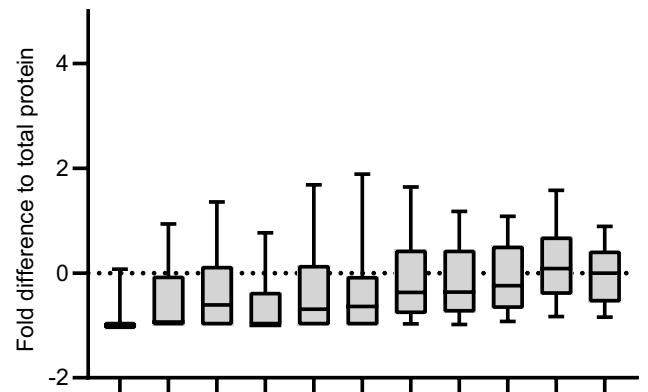
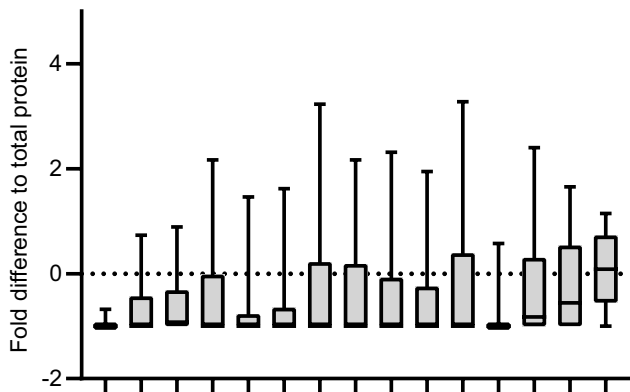
Syntaxin6



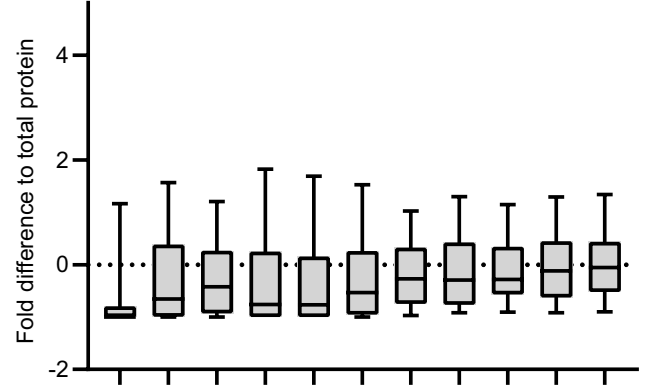
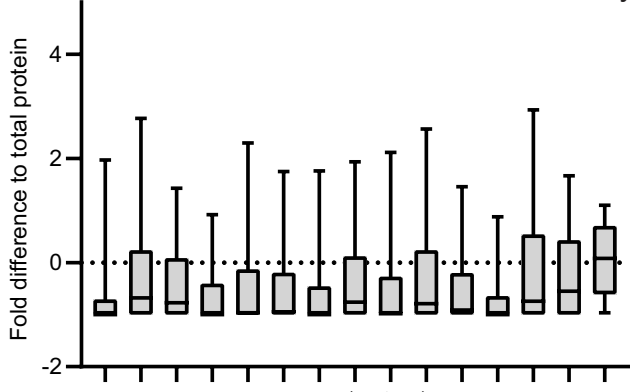
Syntaxin8



Syntaxin13



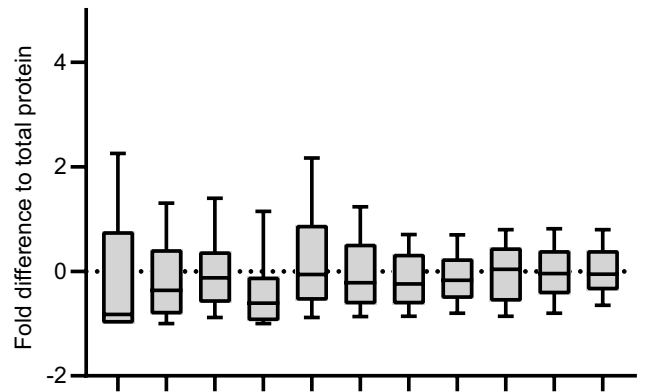
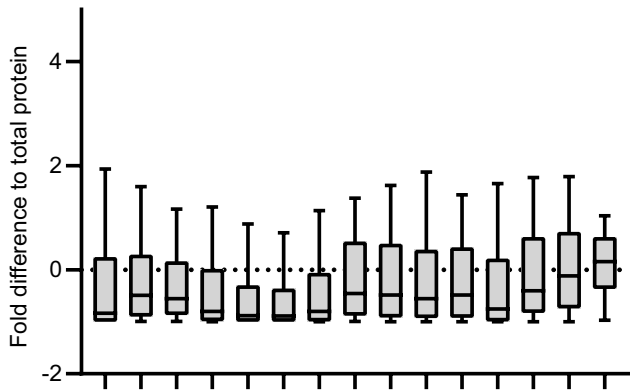
Syntaxin16



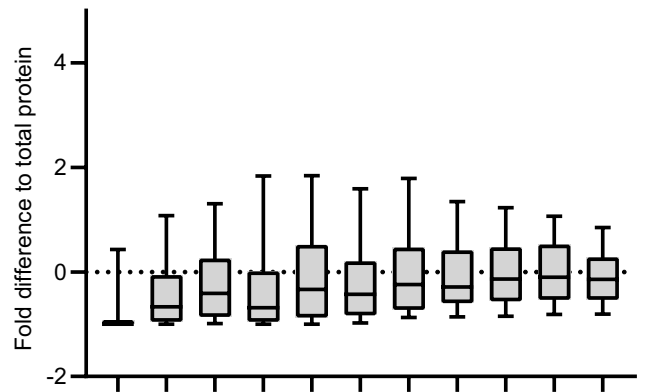
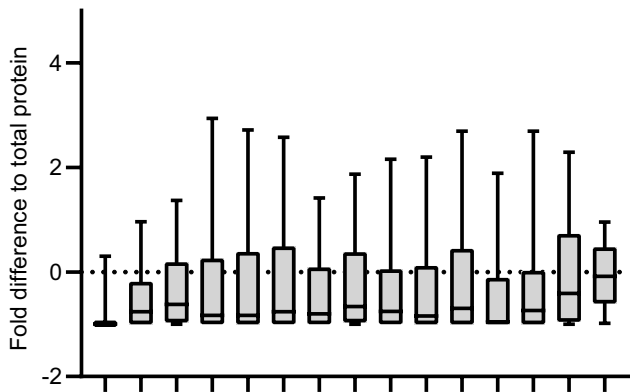
PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Upper perisynaptic
Top perisynaptic
Head lateral membrane
Head lower lateral membrane
Membrane lower head
Neck head central cytosol
Neck lateral cytosol
Neck central cytosol
Neck bottom membrane
Neck root cytosol
Shaft base cytosol

PSD Center
PSD Central Area
PSD Outer Area
Lateral perisynaptic
Proximal perisynaptic
Distal perisynaptic
First ring
Second ring
Third ring
Fourth ring
Fifth ring

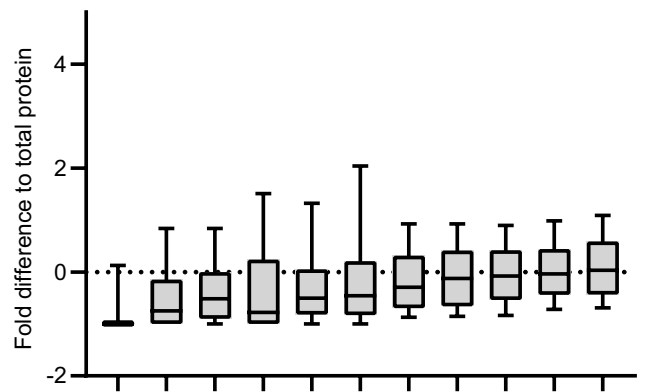
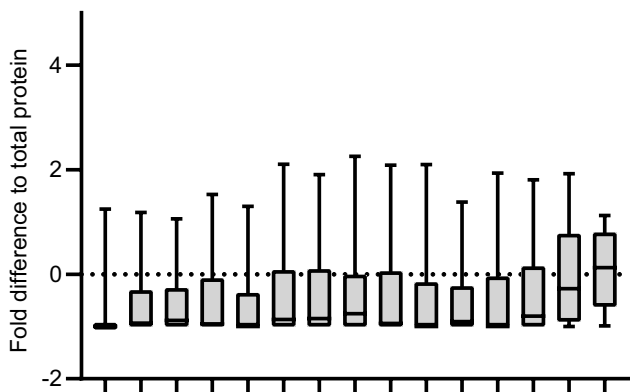
Transferrin receptor



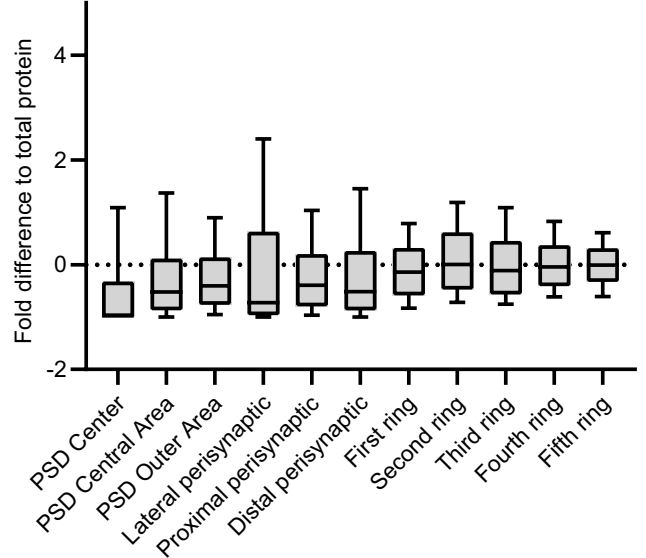
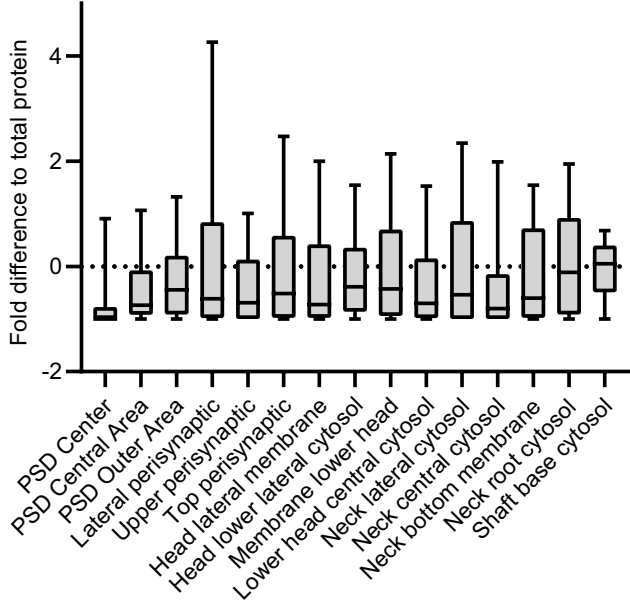
TGN38



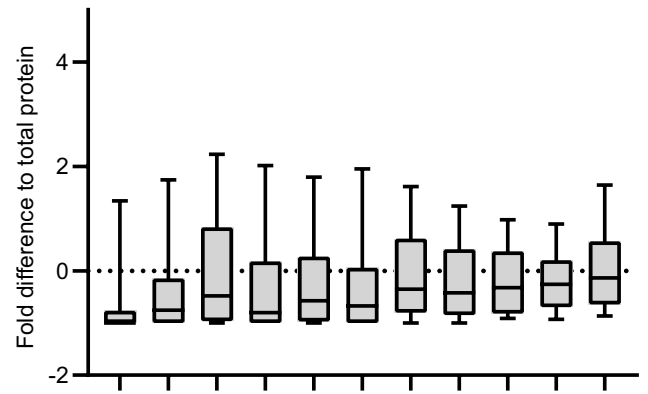
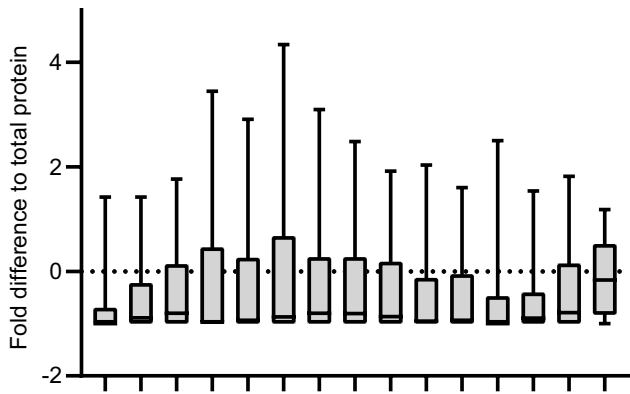
TOM20



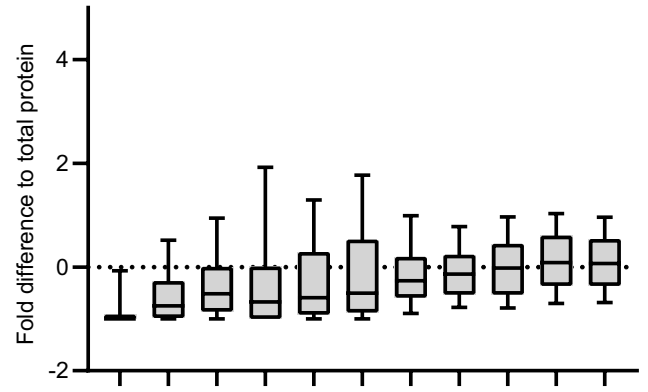
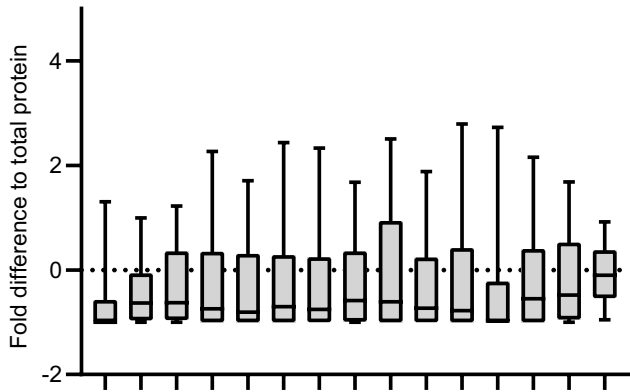
TrkB



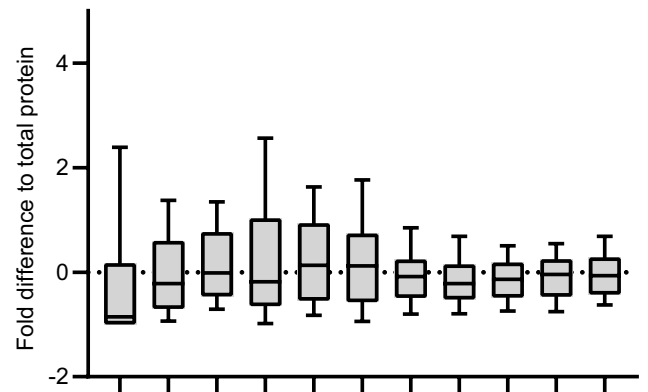
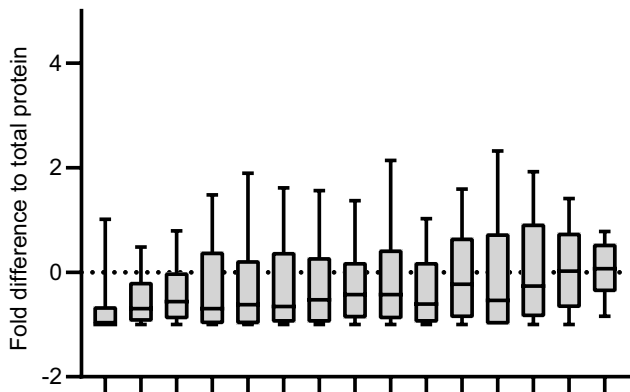
VAMP1



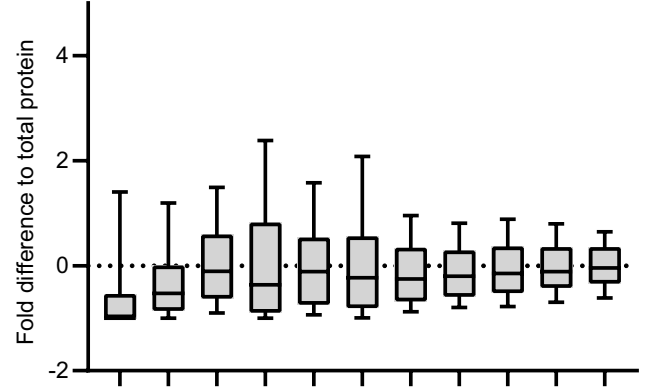
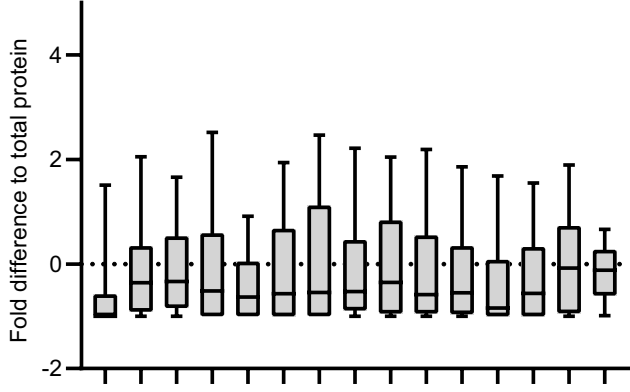
VAMP2



VAMP7



Vti1a



PSD Center
 PSD Central Area
 PSD Outer Area
 Lateral perisynaptic
 Upper perisynaptic
 Top lateral membrane
 Head lower lateral cytosol
 Head lateral membrane
 Membrane lower head
 Lower head central cytosol
 Neck lateral cytosol
 Neck central cytosol
 Neck bottom membrane
 Neck root cytosol
 Shaft base cytosol
 First ring
 Second ring
 Third ring
 Fourth ring
 Fifth ring

Reporting Summary

Nature Research wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Research policies, see our [Editorial Policies](#) and the [Editorial Policy Checklist](#).

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed
<input type="checkbox"/>	<input checked="" type="checkbox"/> The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement
<input type="checkbox"/>	<input checked="" type="checkbox"/> A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
<input type="checkbox"/>	<input checked="" type="checkbox"/> The statistical test(s) used AND whether they are one- or two-sided <i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i>
<input type="checkbox"/>	<input checked="" type="checkbox"/> A description of all covariates tested
<input type="checkbox"/>	<input checked="" type="checkbox"/> A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
<input type="checkbox"/>	<input checked="" type="checkbox"/> A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
<input type="checkbox"/>	<input checked="" type="checkbox"/> For null hypothesis testing, the test statistic (e.g. F , t , r) with confidence intervals, effect sizes, degrees of freedom and P value noted <i>Give P values as exact values whenever suitable.</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/> For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
<input type="checkbox"/>	<input checked="" type="checkbox"/> For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
<input type="checkbox"/>	<input checked="" type="checkbox"/> Estimates of effect sizes (e.g. Cohen's d , Pearson's r), indicating how they were calculated

Our web collection on [statistics for biologists](#) contains articles on many of the points above.

Software and code

Policy information about [availability of computer code](#)

Data collection	Data was acquired using Leica Application Suite Advanced Fluorescence 2.7.3.9723 and NIS Elements 5.02.03
Data analysis	Custom code written in Matlab2017b and 2019b, Python 3.7.6, icy 1.9.5.1, Graphpad Prism 8 and Excel 2016 was used in this study. Mass spectrometry analysis was performed using MaxQuant 1.5.3.8 or 1.6.0.16.

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A list of figures that have associated raw data
- A description of any restrictions on data availability

The mass spectrometry proteomics data have been deposited to the ProteomeXchange Consortium via the PRIDE partner repository with the dataset identifier PXD015308. Image data are available from the corresponding author on reasonable request.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☒ Life sciences ☐ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see [nature.com/documents/nr-reporting-summary-flat.pdf](https://www.nature.com/documents/nr-reporting-summary-flat.pdf)

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

Sample size	The largest possible numbers of experiments were performed, taking into account the high number of target proteins (>100), and is well within the range of typical super-resolution imaging experiments. No formal sample size calculation was performed, as this would require an estimate of the effect size between two conditions, whereas we are only investigated a single condition here.
Data exclusions	No data were excluded
Replication	In general 3 independent experiments were performed, with several hundred synapses investigated per protein. All replications were successful. For a detailed list see Supplementary Table 4, for an example analysis please see Extended Data Figure 6.
Randomization	Not relevant for this manuscript, as only 1 experimental group was investigated.
Blinding	Blinding was not relevant to the study, because no conditions were compared, only 1 experimental group was investigated.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
<input type="checkbox"/>	<input checked="" type="checkbox"/> Antibodies
<input checked="" type="checkbox"/>	<input type="checkbox"/> Eukaryotic cell lines
<input checked="" type="checkbox"/>	<input type="checkbox"/> Palaeontology and archaeology
<input type="checkbox"/>	<input checked="" type="checkbox"/> Animals and other organisms
<input checked="" type="checkbox"/>	<input type="checkbox"/> Human research participants
<input checked="" type="checkbox"/>	<input type="checkbox"/> Clinical data
<input checked="" type="checkbox"/>	<input type="checkbox"/> Dual use research of concern

Methods

n/a	Involved in the study
<input checked="" type="checkbox"/>	<input type="checkbox"/> ChIP-seq
<input checked="" type="checkbox"/>	<input type="checkbox"/> Flow cytometry
<input checked="" type="checkbox"/>	<input type="checkbox"/> MRI-based neuroimaging

Antibodies

Antibodies used	Please refer to the relevant part of the Methods, describing at length all antibodies
Validation	<p>ADAM22 mouse 500 Novus Biologicals NBP2-22425 Validated in 21</p> <p>Akt (pan) rabbit 400 Cell Signaling 4691 Validated in 37</p> <p>α/β-SNAP mouse 100 Jahn Laboratory 77.2 Validated in 23</p> <p>α-internexin rabbit 500 LSBio LS-B10413 Clear observation of internexin filaments, as expected from the literature. Low signal outside of filaments. Shown in Supplementary Data File 1.</p> <p>AP180 rabbit 100 Synaptic Systems 155 003 K.O. validated</p> <p>Ankyrin-G mouse 500 Neuromab AB_10673030, clone N106/36 Validated in 115</p> <p>APP mouse 100 Millipore MAB-348 Validated in 23</p> <p>Arc rabbit 1000 Synaptic Systems 156 003 K.O. validated</p> <p>β-2-spectrin mouse 100 BDBiosciences 612562 Validated in 14</p> <p>β-tubulin llama 100 Self-made See 38 Validated in 38</p>

β -3-Tubulin rabbit 500 Cell Signaling 5568 Validated in 39
 BDNF rabbit 100 Biorbyt orb38809 Manufacturer, available at antibodypedia.com
 Calbindin-D28K rabbit 500 Synaptic Systems 214 002 Control Antigen
 Calcineurin A rabbit 1000 Synaptic Systems 387 002 Control Antigen
 Calmodulin rabbit 100 Abcam ab45689 Validated in 23
 Calreticulin rabbit 200 Cell Signaling 12238 Validated in 14
 Calretinin rabbit 250 Novus Biologicals NBP1-88220 K.D. validated
 CaMKII (alpha subunit, phosphorylated form) mouse 500 Abnova MAB6627 Validated in 40
 CAPS1 rabbit 500 Abcam ab69797 Validated in 23
 Cav1.3 rabbit 50 Alomone Labs ACC-311 Control Antigen
 Cav2.1 rabbit 500 Synaptic Systems 152 203 K.O. validated
 CDC42 rabbit 100 Thermo Scientific PA1-092 K.D. validated 41
 Chromogranin A rabbit 500 Synaptic Systems 259 003 K.O. validated
 Chromogranin B rabbit 500 Synaptic Systems 259 103 K.O. validated
 Chromogranin C rabbit 250 Abcam ab12241 Validated in 42
 Clathrin heavy chain mouse 100 BD Biosciences 610499 Validated in 23
 Clathrin light chain mouse 1000 Synaptic Systems 113 011 Validated in 23
 Cortactin mouse 500 Synaptic Systems 313 111 Validated in 43
 DLGAP1 rabbit 50 Novus Biologicals NBP1-76911 Validated in 21
 Dopamine receptor 1 rabbit 1000 Abcam ab40653 Control antigen
 Dopamine receptor 2 rabbit 500 Merck AB5084P K.O. validated in 44
 Drebrin1 mouse 100 Novus Biologicals NB100-1951 Validated in 45
 Dynamin 1/2/3 mouse 100 BDBiosciences 610245 Validated in 23
 ERp72 rabbit 100 Cell Signaling 5033 Validated in 21
 GAD65 mouse 500 Synaptic Systems 198 111 Control antigen
 GFAP mouse 500 Synaptic Systems 173 011 Control antigen
 GluK1 rabbit 100 Alomone AGC-008 Control antigen
 GluN1 mouse 1000 Synaptic Systems 114 011 Validated in 46
 GluN2A mouse 100 NeuroMab 75-288 Validated in 21
 GluN2B mouse 100 NeuroMab 75-101 Validated in 21
 GluR1 rabbit 500 Synaptic Systems 182 003 K.O. validated
 GluR2 rabbit 100 Alomone Labs AGC-005 Control antigen
 GluR3 mouse 100 Invitrogen 32-0400 Validated in 21
 GRIP1/2 rabbit 100 Synaptic Systems 151 003 Control antigen
 Homer1 mouse 500 Synaptic Systems 160 011 Control antigen
 Homer1 rabbit 500 Synaptic Systems 160 003 Control antigen
 Homer2 rabbit 500 Synaptic Systems 160 203 Validated in 47
 Homer3 rabbit 250 Synaptic Systems 160 303 Control antigen

HSC70 mouse 100 Santa Cruz sc-7298 Control antigen

Iba1 guinea pig 500 Synaptic Systems 234 004 Control antigen

IGF-1 Receptor rabbit 300 Cell Signaling 3027 Validated in 21,48

KCNJ2 rabbit 100 Novus Biologicals NBP1-95482 Validated in 21

Kv1.1 rabbit 100 Thermo Scientific PA5-19593 Validated in 21

Kv2.1 rabbit 500 Synaptic Systems 231 002 Control antigen

LNGFR rabbit 1000 Cell Signaling 8238 Validated in 49

m-AChR-1 rabbit 100 Novus Biologicals NBP1-87466 Validated in 50

MAP2 rabbit 1000 Synaptic Systems 188 002 Control antigen

mGluR1 α rabbit 250 Abcam ab51314 Validated in 51

mGluR2 rabbit 100 Abcam ab150387 Validated in 52

mGluR5 rabbit 100 Abcam ab76316 Validated in 53

myosin5a rabbit 200 Sigma-Aldrich M5062 Validated in 21

Na β 1 rabbit 50 Alomone Labs ASC-041 Control antigen

Na⁺/K⁺ ATPase mouse 1000 Thermo Scientific MA3-915 Validated in 21

Nav1.1 rabbit 100 Merck 06-811 Validated in 54

Nav1.3 rabbit 250 Alomone Labs ASC-004 Control antigen

Neurofilament H rabbit 1000 LSBio LS-C143052 Clear observation of filaments, as expected from the

literature. Shown in Supplementary Data File 1. Similar pattern to Neurofilament L. Similar STED fluorescence pattern to multiple previous STED publications 55,56

Neurofilament L rabbit 500 Synaptic Systems 171 002 Validated in 14

nNOS rabbit 100 Thermo Scientific PA1-033 Validated in 21

NSF rabbit 500 Synaptic Systems 123 002 Validated in 23

Olig2 rabbit 500 Synaptic Systems 292 003 Presence only in subset of cells with oligodendrocyte morphology. Missing in all other cells. Data analyzed in Extended Data Fig. 2.

Parvalbumin rabbit 500 Swant PV25 K.O. validated

PSD93 rabbit 300 Invitrogen 34-4700 Validated in 57

PSD95 rabbit 100 Cell Signaling 3450 Validated in 14

Rab11 rabbit 100 Cell Signaling 3539 Validated in 21

Rab3 mouse 100 BD Biosciences 610379 Validated in 23

Rab4 mouse 100 BD Biosciences 610888 Validated in 58

Rab5 mouse 100 Jahn Laboratory cl. 621.3 Validated in 21

Rab7 rabbit 100 Cell Signaling 9367 Validated in 21

Rab9 rabbit 100 Cell Signaling 5118 Validated in 59–61

Rapsyn rabbit 100 Atlas Antibodies HPA039475 Validated in 21

Ribosomal protein L7a rabbit 100 Cell Signaling 2403 Validated in 62

Ribosomal protein S3 rabbit 50 Cell Signaling 9538 Validated in 63

Ribosomal protein S6 rabbit 100 Cell Signaling 2217 Validated in 64

Sec22b rabbit 100 Synaptic Systems 186 003 K.D. validated

Septin7 rabbit 50 Atlas Antibodies HPA029524 Validated in 21

Shank1 rabbit 500 Synaptic Systems 162 013 K.O. validated

Shank2 rabbit 500 Synaptic Systems 162 202 K.O. validated

Shank3 rabbit 500 Synaptic Systems 162 302 K.O. validated

SMI310 mouse 200 Abcam 24570 Validated in 65

SNAP29 rabbit 500 Synaptic Systems 111 302 K.O. validated

SNAP47 rabbit 200 Synaptic Systems 111 403 Validated in 21

SNAP23 rabbit 100 Synaptic Systems 111 202 K.O. validated

SNAP25 mouse 100 Synaptic Systems 111 011 K.O. validated

Synaptophysin guinea pig 1000 Synaptic Systems 101 004 Control antigen

Synaptotagmin4 rabbit 1000 Synaptic Systems 105 143 K.O. validated

Synaptotagmin5/9 rabbit 100 Synaptic Systems 105 053 K.O. validated

Synaptotagmin7 rabbit 250 Synaptic Systems 105 173 K.O. validated

SynGAP1 rabbit 1000 Thermo Scientific PA1-046 Validated in 21

Syntaxin1 mouse 200 Synaptic Systems 110 011 Control antigen

Syntaxin13 mouse 100 Jahn Laboratory cl. 151.1 Validated in 23

Syntaxin16 rabbit 100 Synaptic Systems 110 162 Control antigen

Syntaxin2 rabbit 100 Synaptic Systems 110 022 Control antigen

Syntaxin3 rabbit 100 Synaptic Systems 110 033 Control antigen

Syntaxin4 rabbit 100 Synaptic Systems 110 042 Control antigen

Syntaxin5 rabbit 100 Synaptic Systems 110 053 K.D. validated

Syntaxin6 rabbit 100 Cell Signaling 2869 Validated in 21

Syntaxin8 rabbit 100 Synaptic Systems 110 083 Control antigen

TGN38 rabbit 100 Sigma-Aldrich T9826 Validated in 66

TOM20 mouse 200 Sigma-Aldrich WH0009804M1 Validated in 21

Transferrin Receptor rabbit 100 Abcam ab84036 Validated in 67

TrkB rabbit 500 Abcam ab33655 Validated in 68

vAChT rabbit 100 Synaptic Systems 139 103 K.O. validated

Vamp1 rabbit 500 Synaptic Systems 104 002 Control antigen

Vamp2 mouse 1000 Synaptic Systems 104 211 K.O. validated

VAMP7 rabbit 100 Abcam ab68776 Validated in 21

Vti1a mouse 100 BDBiosciences 611220 Validated in 23

Animals and other organisms

Policy information about [studies involving animals](#); [ARRIVE guidelines](#) recommended for reporting animal research

Laboratory animals

Rattus norvegicus, Wistar, both sexes, E18-P0

Wild animals

None

Field-collected samples

None

Note that full information on the approval of the study protocol must also be provided in the manuscript.