

Supplementary Figure 1. AD hippocampi contain significantly higher levels of p(Thr286)CaMKII. An ACA of the membrane soluble fraction of hippocampal homogenates showed significantly greater p(Thr286)CaMKII levels in AD ($p = 0.029$). Values are normalized to total CaMKII. Control (white; 0.285 ± 0.054 ; $n = 4$); AD (black; 0.663 ± 0.094 ; $n = 14$).

Supplementary Figure 2. Cytoarchitecture of analyzed hippocampal regions 1) the pyramidal neurons of Cornu Ammonis 3 (CA3); 2) the stratum radiatum, where the apical dendrites of CA3 neurons are located; 3) the dentate gyrus (DG) granule cells; 4) the molecular layer, which contains the apical dendrites of the DG; and 5) the hilus, where the basal dendritic arborizations of the DG neurons are found.

Supplementary Figure 3. CaMKII immunoreactivity is not significantly shifted in MCI and AD DG. (A) CaMKII (green), and DAPI (blue) in representative micrographs of control, MCI, and AD hippocampus show that the immunoreactivity is comparable in the granule cell layer (arrowheads) and hilus (circleheads; 10x, scale bar 100 μ m); (B) CaMKII ratio (granule layer / hilus) is not significantly different ($F = 1.048$, $p = 0.394$) between control (1.058 ± 0.181 ; $n = 3$), MCI (1.381 ± 0.186 ; $n = 3$), and AD (1.237 ± 0.143 ; $n = 5$).

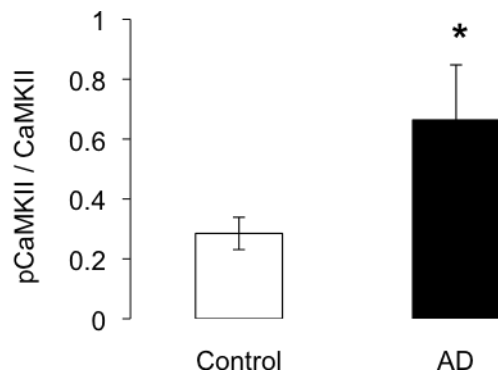
Supplementary Figure 4. Oligomeric, but not fibrillar A β binds dendritic processes of primary hippocampal neurons. DIV 17 neurons were exposed to 500 nM oligomers or 500 nM fibrils for 60 minutes then fixed and immunolabeled using 6E10 (green), which recognizes A β (A-C) and MAP2 (blue) antibodies. Merge is shown in (D-F), scale bar 10 μ m.

Supplementary Figure 5. Fibrillar A β has no effect on the average p(Thr286)CaMKII and PSD95 intensity at the synapse, and does not decrease PSD95 puncta size. Primary hippocampal neurons (DIV20) were treated with 500nM fibrillar A β for 0, 15, 30, or 60 minutes (A-D, scale bar 10 μ m). Double immunolabeling for p(Thr286)CaMKII (red) and PSD95 (green), with merge shown below (scale bar 5 μ m). White arrowheads indicate representative synapses. (E) Fibril-treated neurons show no significant differences in synaptic p(Thr286)CaMKII (black triangles; $F=0.264$; $p=0.850$) or PSD95 intensity (white squares; $F=0.075$; $p=0.972$); (F) PSD95 puncta size was also unchanged during fibril treatment ($F=0.537$; $p=0.663$). The values from *E* and *F* can be found in Supplementary Table 2.

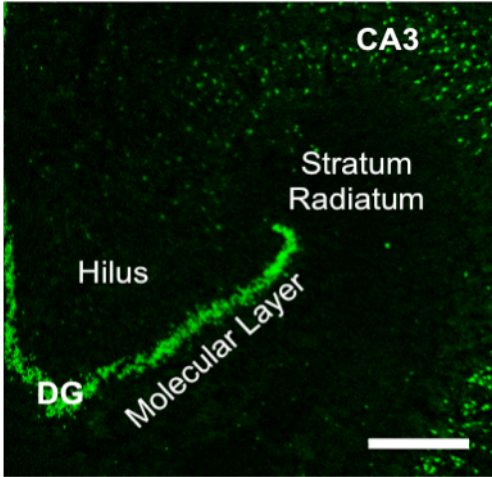
Supplementary Table 1. Demographical information of cases. Asterisk denotes exclusion from MMSE correlation due to the lapse between cognitive testing and tissue collection. To preserve subject confidentiality, individuals over 89 years are listed only as >89.

Supplementary Table 2. Data sets from Fig. 6, 7 and S. Fig. 5 are shown. For each condition average fluorescence intensity of p(Thr286)CaMKII and PSD95, and puncta size were measured. Data are mean \pm SEM.

Supplementary Figure 1

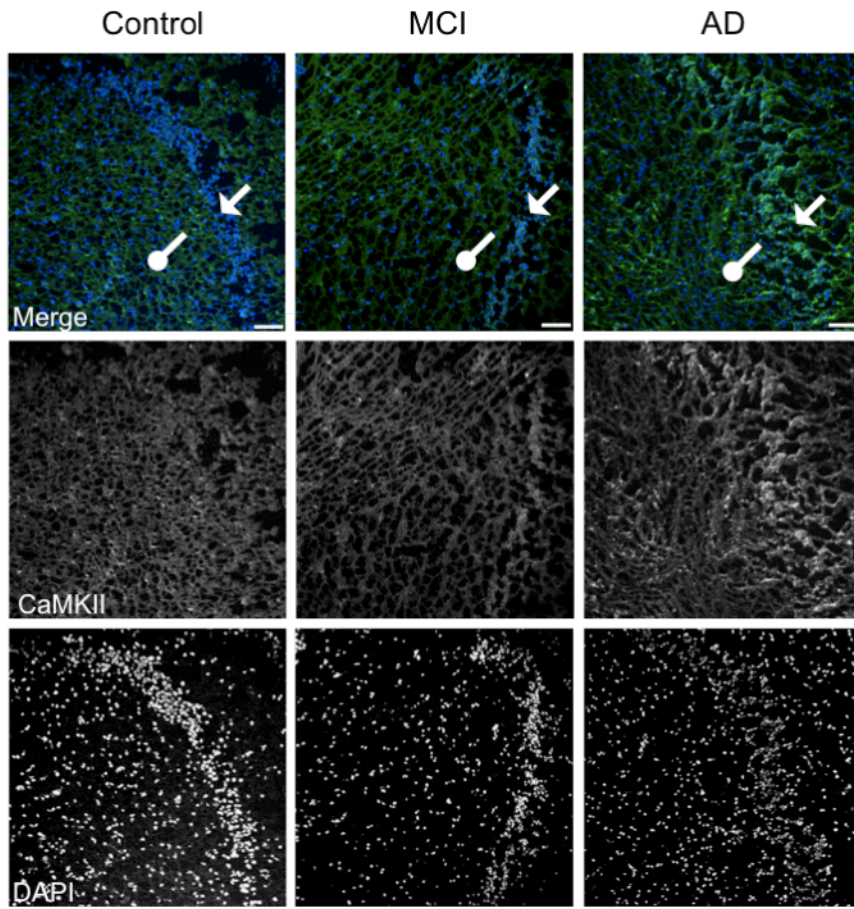


Supplementary Figure 2

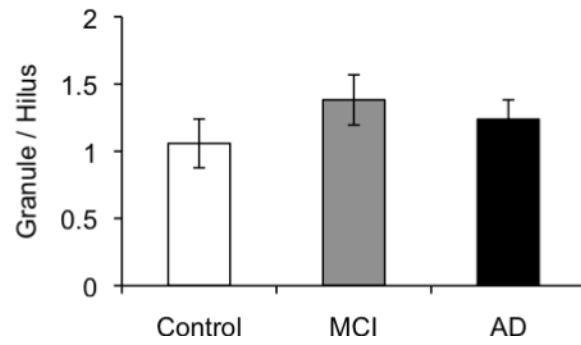


Supplementary Figure 3

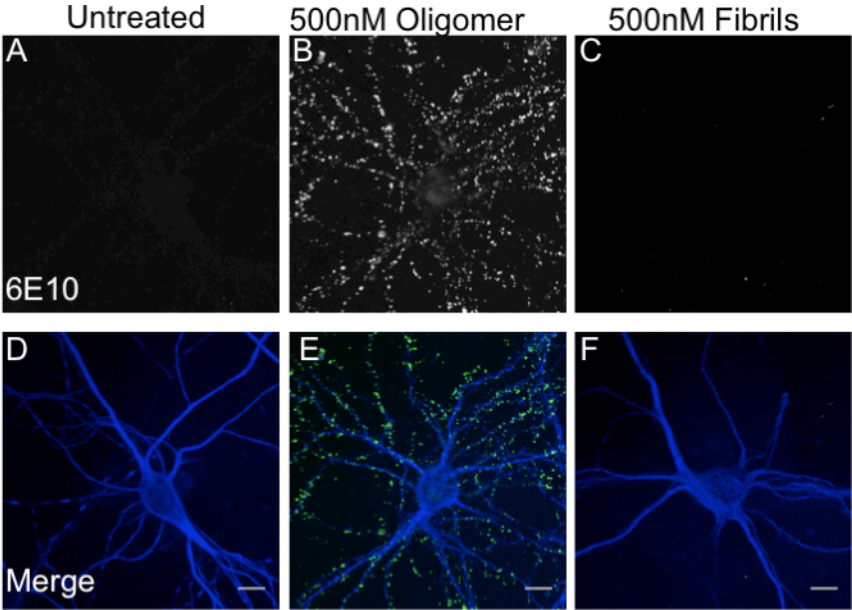
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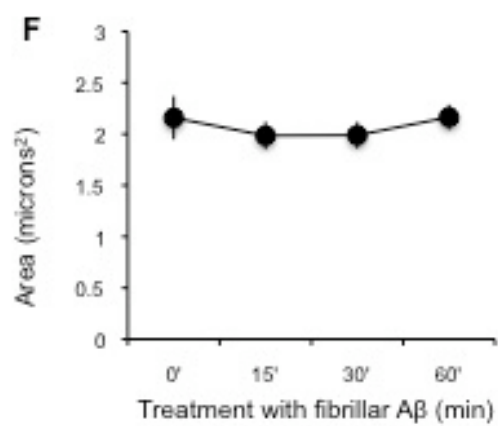
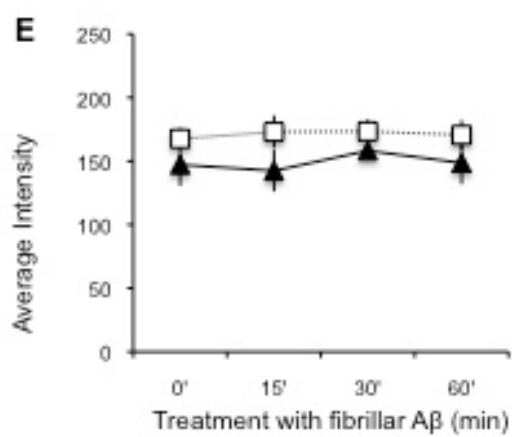
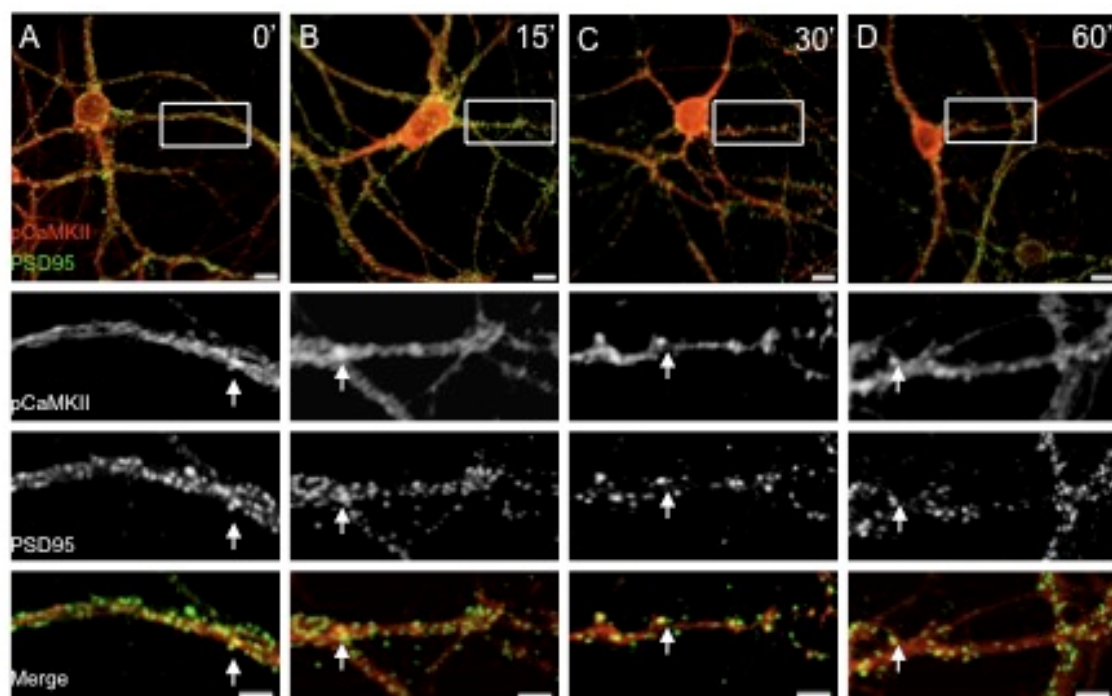
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Supplementary Figure 4



Supplementary Figure 5



Supplementary Table 1

Status	Case#	Age	Sex	PMI	Braak Stage	Plaque Score	MMSE	MMSE – years before death
AD	1673	81	F	5.5	6	2	17	0.5
AD	1678	76	F	25	6	2	1	0.8
AD	1688	75	M	17	6	1	0	2.2*
AD	1746	61	M	4	6	1	2	1.4
AD	1756	68	M	11.5	6	1	7	2.2*
AD	1766	63	F	3.5	6	1	18	5.2*
AD	1770	82	F	6.5	6	1	15	1.2
AD	1774	>89	M	3.25	6	1	2	0.1
AD	1776	>89	F	6.25	6	2	6	1.2
AD	1777	67	F	20.5	6	1	9	1
AD	1811	>89	M	18	6	2	21	0.6
MCI	781	89	F	20	3	2	22	0.1
MCI	811	>89	F	12	5	1	20	0.3
MCI	975	>89	F	4	2	3	25	0.8
Control	1104	86	F	16	2	3	29	0.6
Control	1229	>89	F	12	2	3	30	0.3
Control	1563	80	M	2	1	3	30	1
Control	1731	74	F	7.5	2	3	29	2.8

Supplementary Table 2

	Condition	pCaMKII	PSD95	Puncta Area	# neurons	# synapses
Fig. 6	0' Untreated	113.4 ± 7.8	177.8 ± 4.8	2.13 ± 0.28	10	100
	15' Oligomer	90.4 ± 11.8	166.8 ± 8.0	1.79 ± 0.21	9	90
	30' Oligomer	58.5 ± 2.8	155.8 ± 12.0	1.66 ± 0.27	9	90
	60' Oligomer	87.8 ± 14.8	147.2 ± 5.4	1.59 ± 0.23	10	100
Fig. 7	30' 1µM FK	199.3 ± 7.8	133.0 ± 3.0	1.85 ± 0.11	4	40
	FK + 15' Oligomer	191.5 ± 10.9	163.2 ± 5.9	1.75 ± 0.08	4	40
	FK + 30' Oligomer	187.3 ± 23.6	151.3 ± 11.2	1.83 ± 0.23	4	40
	FK + 60' Oligomer	176 ± 10.7	140.0 ± 4.4	2.03 ± 0.26	5	50
S. Fig. 5	0' Untreated	147.2 ± 16.6	167.6 ± 8.8	2.16 ± 0.21	5	50
	15' Fibrillar	142.4 ± 16.4	173 ± 12.9	1.98 ± 0.14	5	50
	30' Fibrillar	158.2 ± 2.9	173.4 ± 9.5	1.98 ± 0.13	5	50
	60' Fibrillar	148.6 ± 16.7	170.6 ± 11.6	2.16 ± 0.12	5	50