Where do pale and yellow signals go in the *Drosophila* brain?

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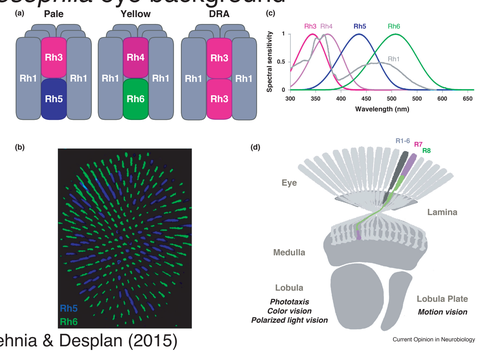
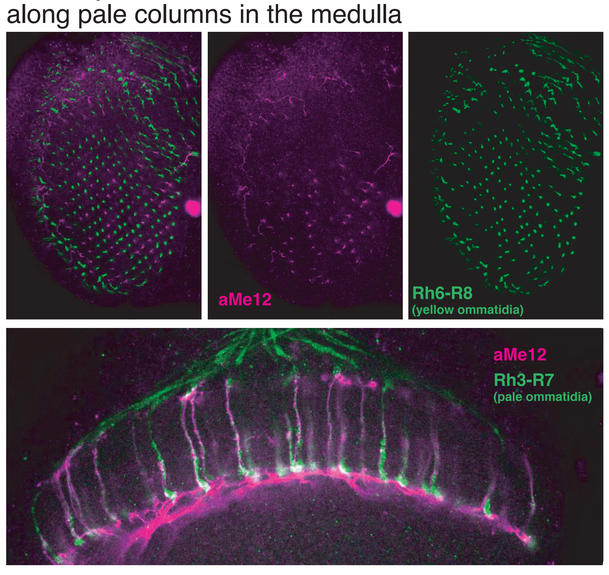
Drosophila eye background

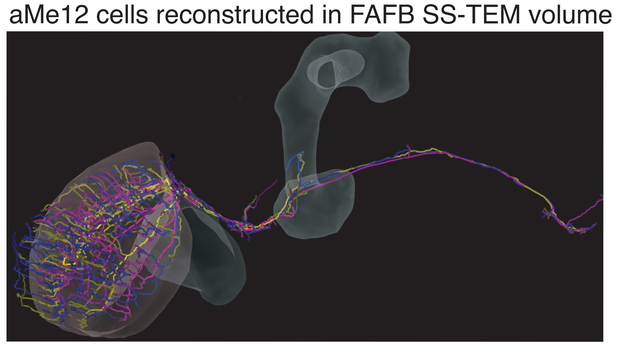


Behnia & Desplan (2015)

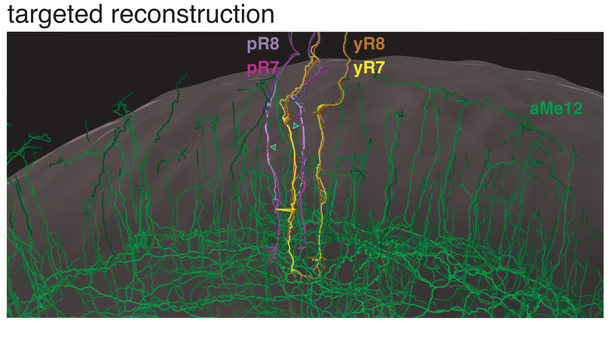
Recently characterized aMe12 cells extend along pale columns in the medulla

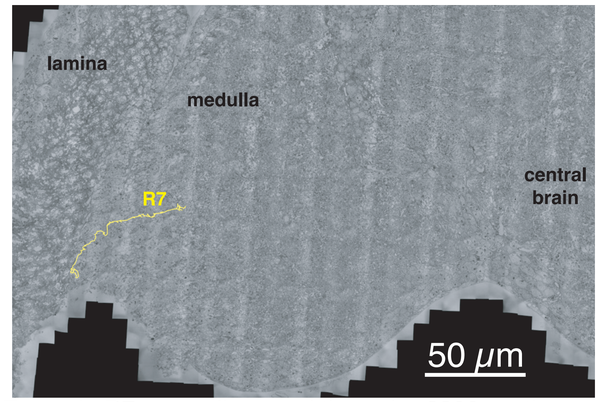


aMe12 cells reconstructed in FAFB SS-TEM volume

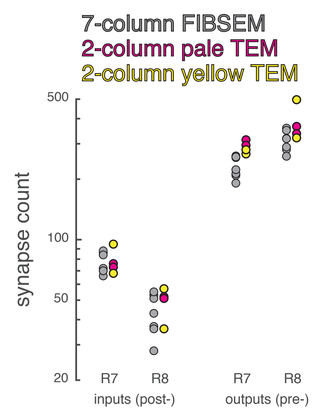


aMe12 cells identify pale and yellow columns for targeted reconstruction





Example R7 manually traced through ~2200 sections
Full adult fly brain (Zheng, et al. 2018; temca2data.org)
CATMAID environment (Saalfeld, Cardona, et al. 2009)



Comparing the synapse counts from our 4-column reconstruction to those of Janelia FlyEM's 7-column FIBSEM (Takemura, et al. 2015). Surprisingly we find a similar number of synapses. A partial explanation is that the TEM volume contains the lamina and connections. 15.4% of input and 7.4% of output synapses are found outside of the medulla. In the 7-column reconstruction, only 57% of R8's pre-synapse partners could be identified; 48% for R7's partners.

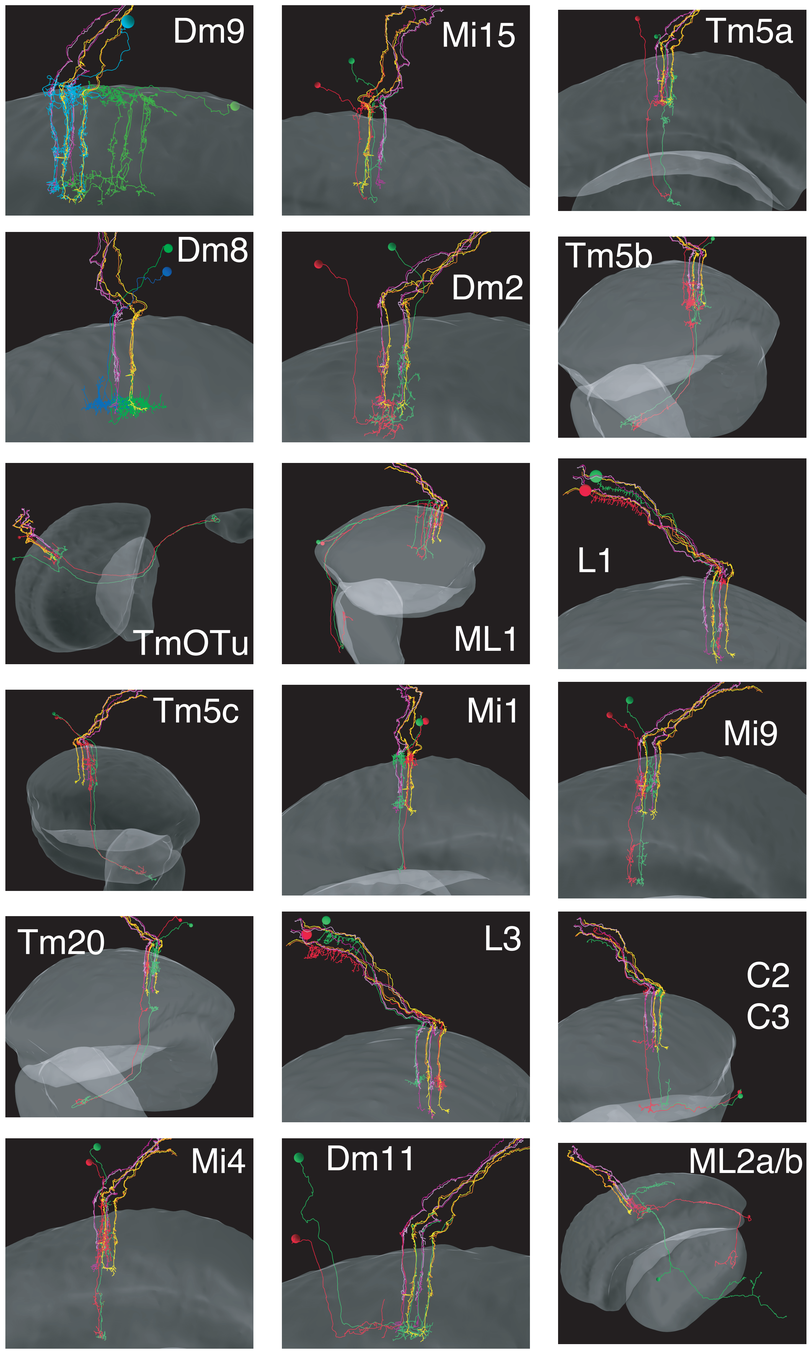
Connectivity summary

pre-synaptic cell types

post-synaptic cell types

	pR7	yR7	pR8	yR8	total	% of total	% of R7	% of R8	% of pale	% of yellow
Dm9 (6)	70	61	98	170	399	14.90	12.19	18.97	42.11	57.89
Dm8 (14)	226	151	0	0	377	14.08	35.07	0.00	59.95	40.05
Tm_unc (14)	59	17	50	46	172	6.43	7.07	6.79	63.37	36.63
Tm_OTu (6)	75	90	0	0	165	6.16	15.35	0.00	45.45	54.55
Tm5c (6)	8	4	20	110	142	5.30	1.12	9.20	19.72	80.28
Tm20 (4)	5	2	65	62	134	5.01	0.65	8.99	52.24	47.76
Mi4 (4)	0	0	56	57	113	4.22	0.00	8.00	49.56	50.44
Mi15 (4)	6	6	27	73	112	4.18	1.12	7.08	29.46	70.54
Dm2 (4)	21	3	55	15	94	3.51	2.23	4.95	80.85	19.15
ML1 (4)	0	0	56	38	94	3.51	0.00	6.65	59.57	40.43
yR7 (3)	0	3	0	80	83	3.10	0.28	5.66	0.00	100.00
pR7 (2)	0	0	68	0	68	2.54	0.00	4.81	100.00	0.00
Mi1 (4)	0	0	30	29	59	2.20	0.00	4.18	50.85	49.15
L3 (4)	18	15	11	12	56	2.09	3.07	1.63	51.79	48.21
Dm11 (2)	23	26	3	2	54	2.02	4.56	0.35	48.15	51.85
Tm5a (2)	0	52	0	0	52	1.94	4.84	0.00	0.00	100.00
Mt_unc (7)	2	11	11	18	42	1.57	1.21	2.05	30.95	69.05
Tm5b (3)	20	5	2	11	38	1.42	2.33	0.92	57.89	42.11
L1 (4)	2	1	19	14	36	1.34	0.28	2.34	58.33	41.67
Mi9 (4)	3	8	24	0	35	1.31	1.02	1.70	77.14	22.86
aMe12 (2)	4	0	24	0	28	1.05	0.37	1.70	100.00	0.00
yR8 (2)	0	27	0	0	27	1.01	2.51	0.00	0.00	100.00
C2 (3)	7	13	6	0	26	0.97	1.86	0.42	50.00	50.00
pR8 (2)	25	0	1	0	26	0.97	2.33	0.07	100.00	0.00
ML2b (3)	0	0	25	0	25	0.93	0.00	1.77	100.00	0.00
Dm_unc (3)	5	1	9	5	20	0.75	0.56	0.99	70.00	30.00
Mi10 (1)	0	0	0	6	6	0.22	0.00	0.42	0.00	100.00
C3 (1)	0	0	0	3	3	0.11	0.00	0.21	0.00	100.00
ML2a (1)	0	0	0	2	2	0.07	0.00	0.14	0.00	100.00
unknown (143)	30	51	43	65	189	7.06	7.53	7.64	38.62	61.38
total	579	496	660	753	2677	100.00	100.00	100.00	46.28	46.66

Examples of major R7 and R8 target neurons reconstructed to identification



- 'Greedy' approach to targeted connectome of R7/R8 shown to be practical; propose to use as test case for new analysis methods.
- Unique identity for many Tm cells proving difficult only using morphology -- more extensive reconstruction and connectivity required.
- Several candidate pale or yellow 'specialist' target neurons identified. Ongoing work to verify these and search for evidence of potential opponency mechanism.
- What would you do next?