Supporting Information

Altimus *et al.* 10.1073/pnas.0808312105

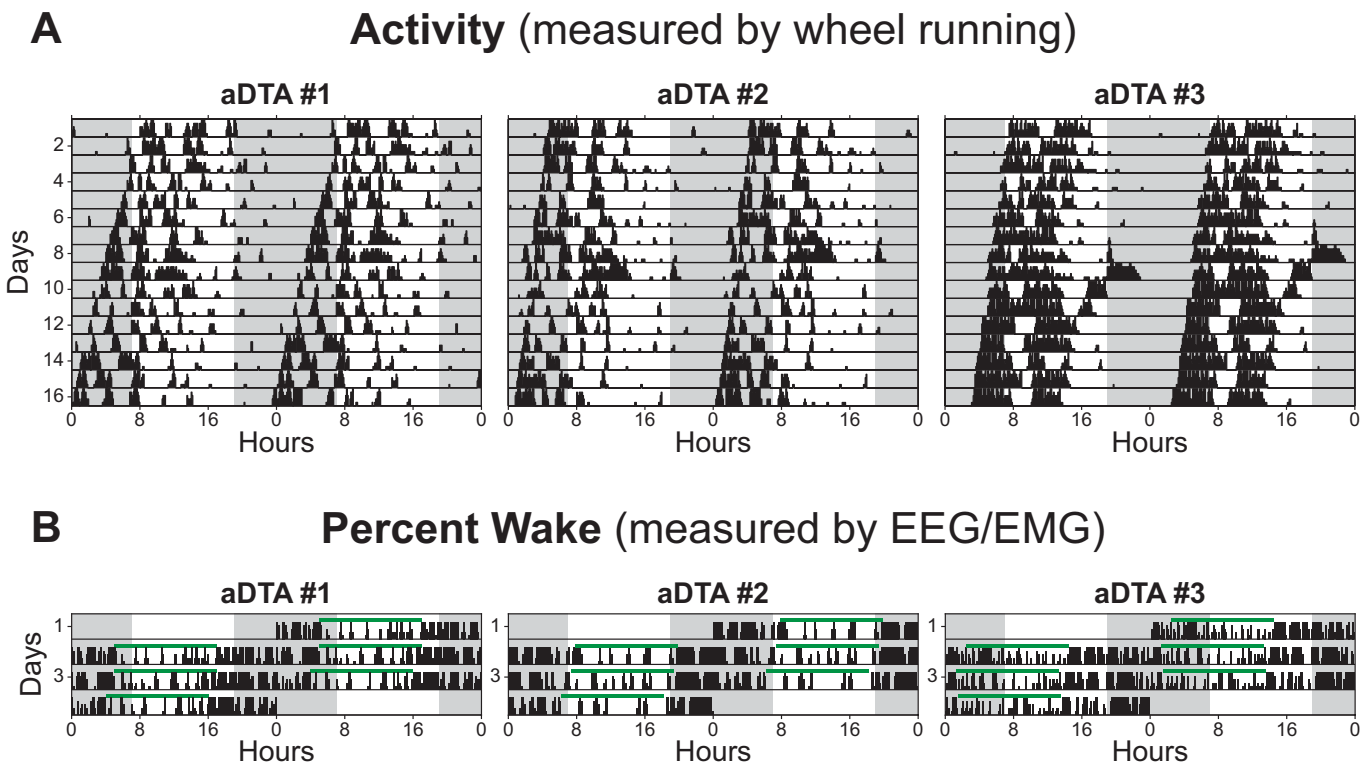
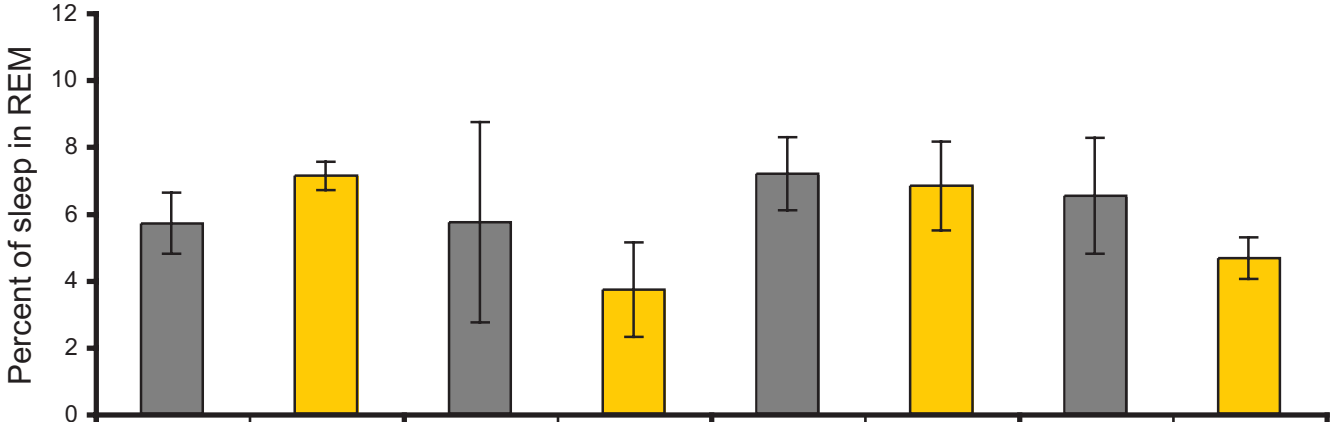


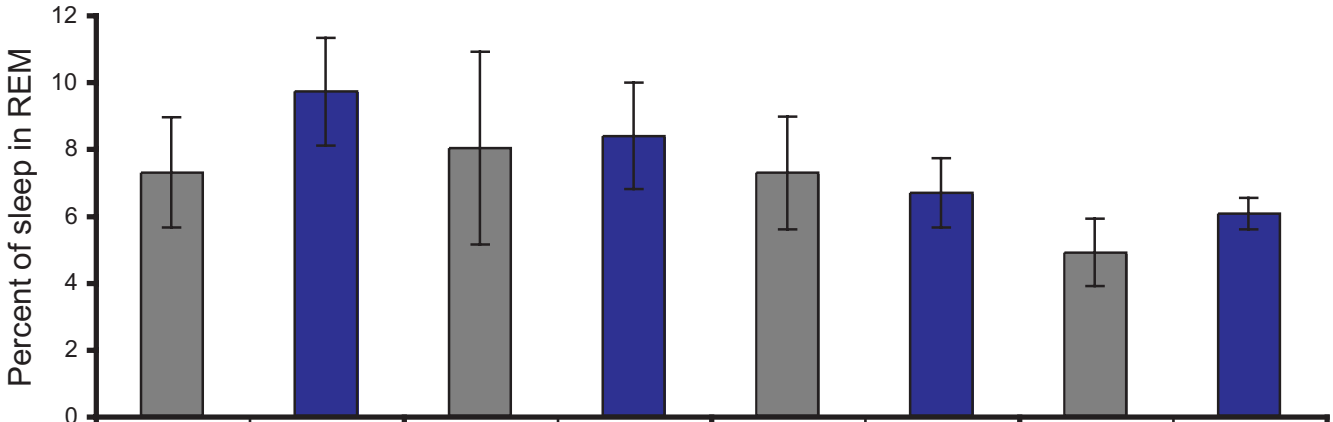
Fig. S1. aDTA mice are unable to photo-entrain their sleep or wheel running activity rhythms. (*A*) Wheel running activity from three representative aDTA mice recorded before sleep study shows that these mice are free-running throughout LD cycle and do not show residual light effects. (*B*) Graphs depicting wake as recorded by EEG/EMG in the mice shown in *A*. Proportion of time awake in a 10-min interval is shown by black bar. Gray box depicts lights off in both *A* and *B*. Green lines in *B* show a 12-h period of sleep percentage greater than 60%.

A



	Control	Light Pulse	Control	Light Pulse	Control	Light Pulse	Control	Light Pulse
	WT		aDTA		MKO		MO	
mean	5.69	7.12	5.73	3.71	7.17	6.82	6.52	4.65
SEM	0.91	0.42	3.00	1.42	1.09	1.33	1.73	0.62
n	5		3		5		4	
p	0.27		0.34		0.68		0.24	

B



	Control	Light Pulse	Control	Light Pulse	Control	Light Pulse	Control	Light Pulse
	WT		aDTA		MKO		MO	
mean	7.28	9.70	8.01	8.37	7.27	6.66	4.89	6.06
SEM	1.64	1.61	2.88	1.60	1.69	1.03	1.01	0.47
n	5		3		4		4	
p	0.35		0.80		0.47		0.33	

Fig. S2. Proportion of REM sleep is not affected by light or dark pulses. (*A* and *B*) Proportion of REM sleep calculated by dividing REM sleep by total sleep is shown for all control, light pulse (*A*), and dark pulse periods (*B*). No significant changes were found.

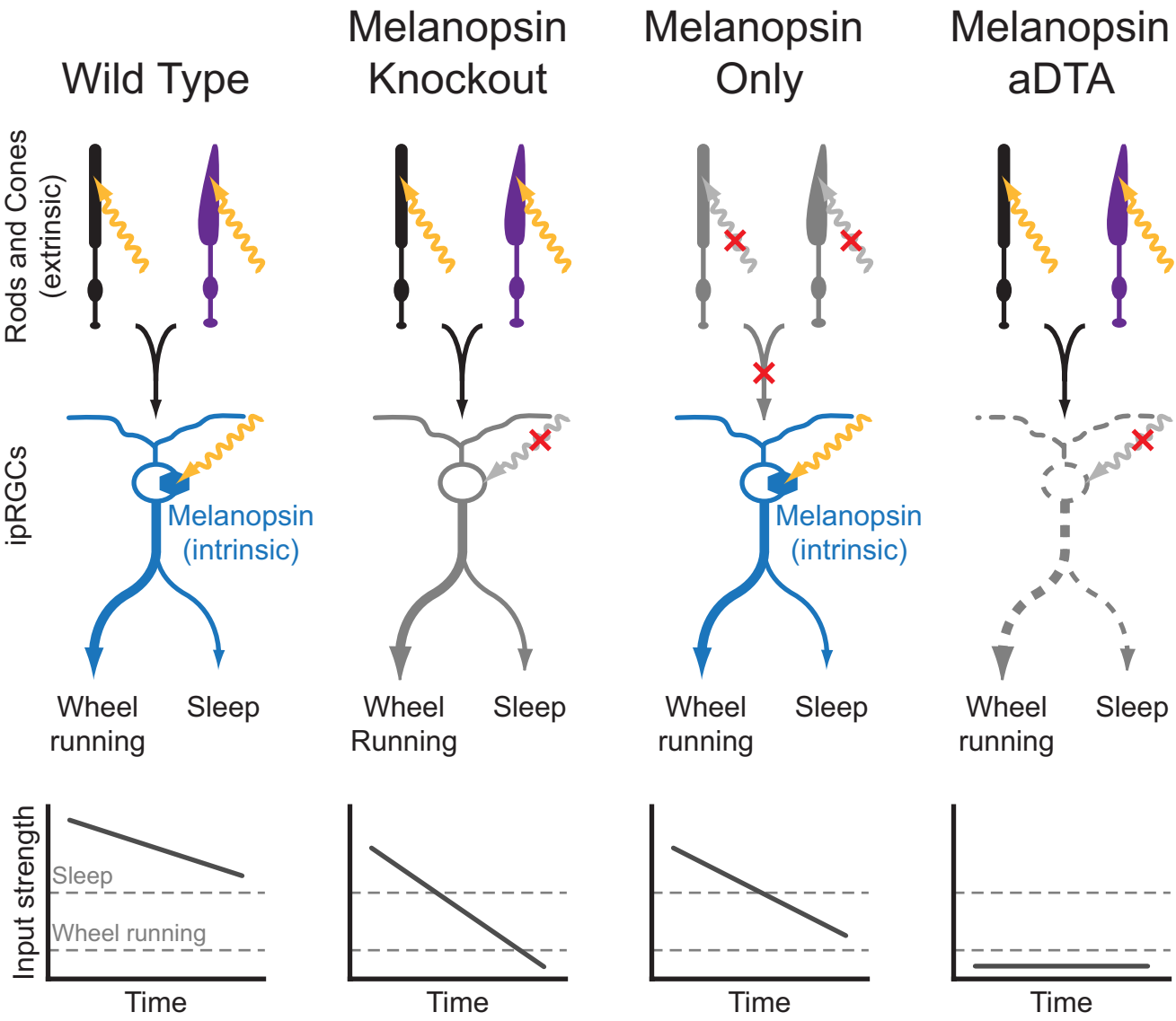


Fig. S3. Model for how the effects of light on sleep and wheel running activity in WT and mutant retinas lead to different behavioral outcomes. From our ultradian studies, dashed lines indicate higher threshold for light to induce sleep compared with wheel running activity. Solid lines show adaptation responses to light input with time. In WT mice, rod-cone and melanopsin-based photoreception combine to produce higher input strength and elicit sustained circadian, masking, and sleep responses. MKO mice have an initial transient response to acute light in both sleep and wheel running activity. In MO mice, acute light exposure elicits a similar transient sleep response but is still able to sustain inhibition of wheel running activity. These differences could result from weakened retinal input to circadian, masking, and sleep centers falling below thresholds necessary to drive these behavioral outputs. The melanopsin-aDTA mice, which lack ipRGCs, have no change in wheel running or sleep in response to light.