

Figure S1. Gravitaxis circuit. Related to Figure 1. Minimal gravitaxis circuit as derived from 21-hpf *Ciona* larva, showing both chemical (A) and electrical synapses (B). Putative excitatory chemical synapses are in green and inhibitory are in red. Abbreviations: Ant: antenna cells; ARN: antenna relay neurons; MGIN: motor ganglion interneurons; MN: motor neurons; R: right; L: left.

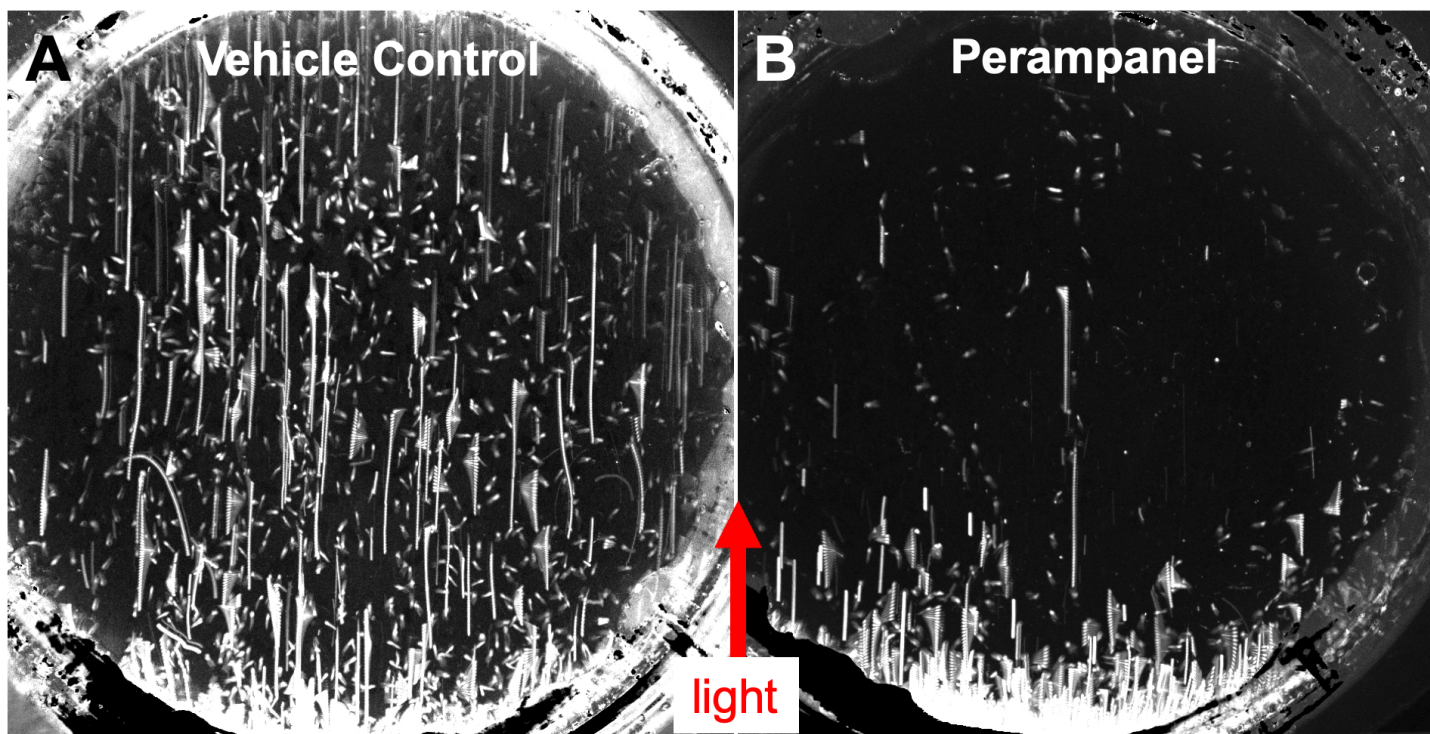


Figure S2. Perampanel disrupts phototaxis behavior. Related to Figure 5. Eleven-second projection images from time lapse videos are shown. In this control larvae were allowed to settle on the bottom of the petri dish and illuminated from below. Control larvae were observed to swim up and away from the light then drift down (white lines).

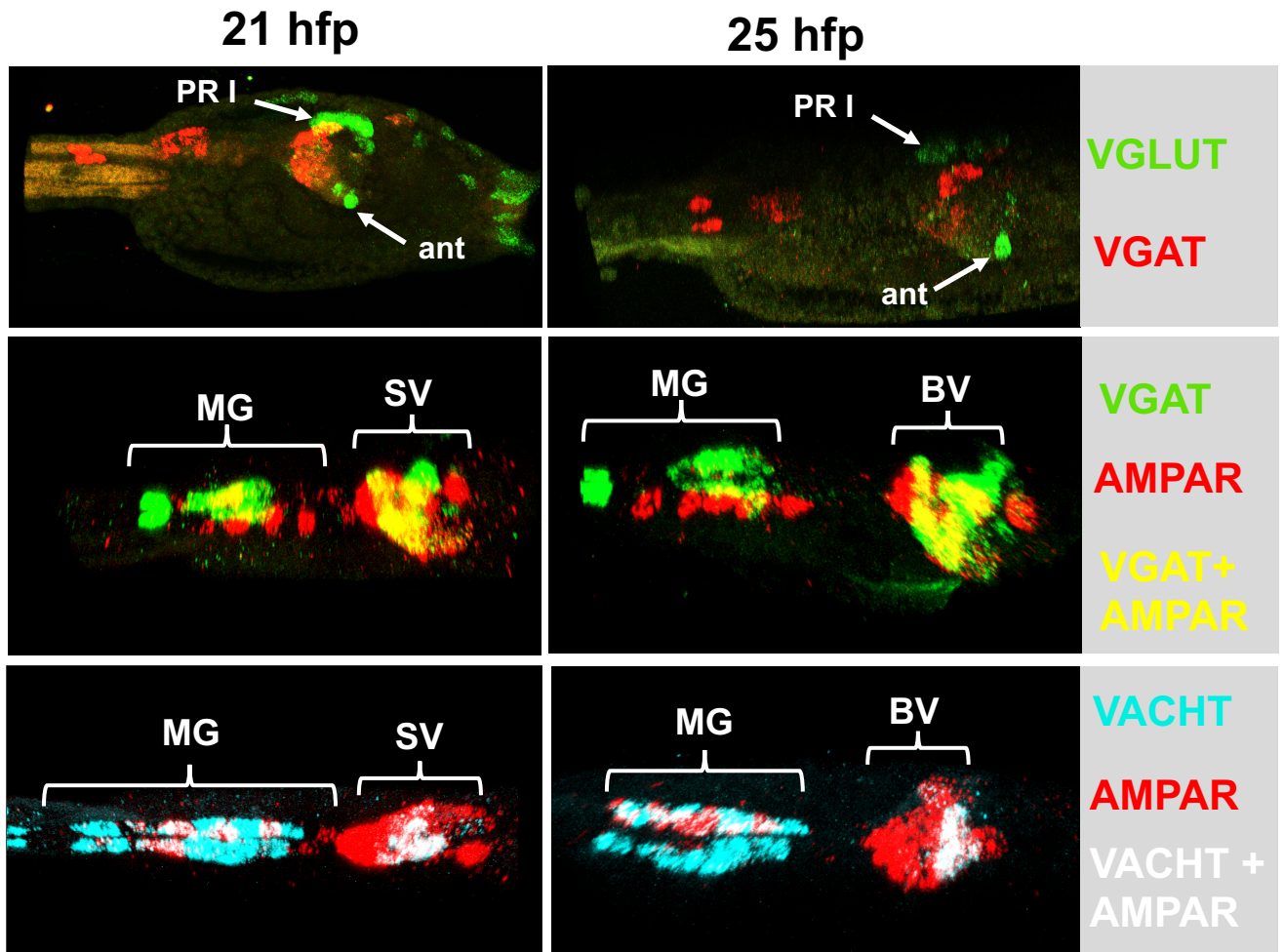


Figure S3. Expression of vesicular glutamate transporter (VGLUT), vesicular GABA transporter (VGAT), vesicular acetylcholine transporter (VACHT), and AMPA receptor (AMPAR) is similar in 21- and 25- hours post fertilization larvae. Related to Figure 5. Images show hybridization chain reaction (HCR) *in situ* hybridization results in the brain vesicle (BV) and motor ganglion (MG) for indicated paired probes. Anterior is to the right for all images (the top two images where flipped horizontally to make them congruent with the other images). Other abbreviations: PR I: photoreceptor group I; ant: antenna cells.

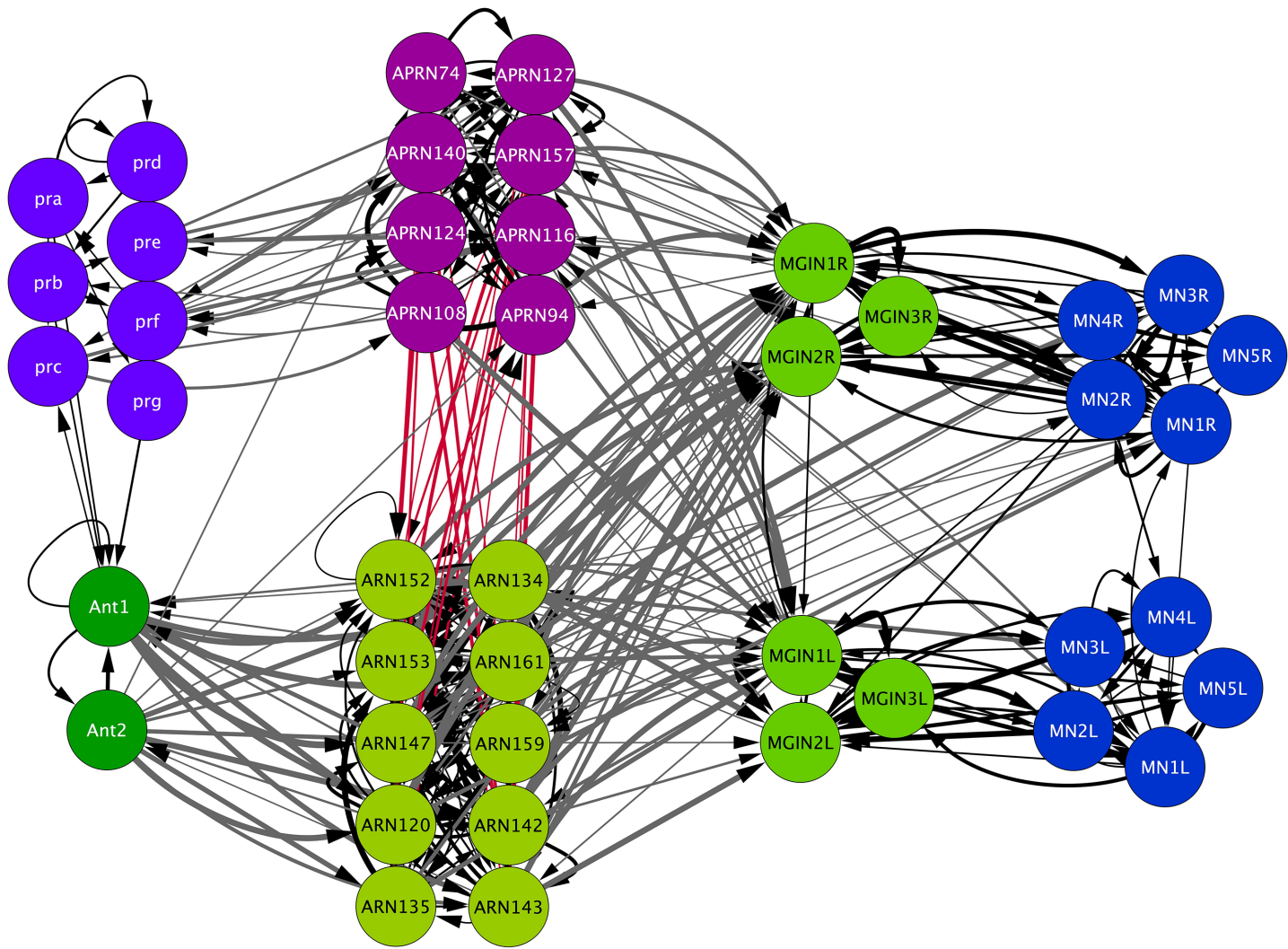


Figure S4. Synaptic connectivity between the photoreceptor-ascending motor ganglion relay neurons (APRNs) and the antenna relay neurons (ARNs). Related to Figure 6. Chemical synapses between the APRNs and ARNs are indicated in red. Other abbreviations: Ant: antenna cell; pra-prg: Group II Photoreceptors, MGIN: motor ganglion interneurons; MN: motor neurons; R: right; L: left.