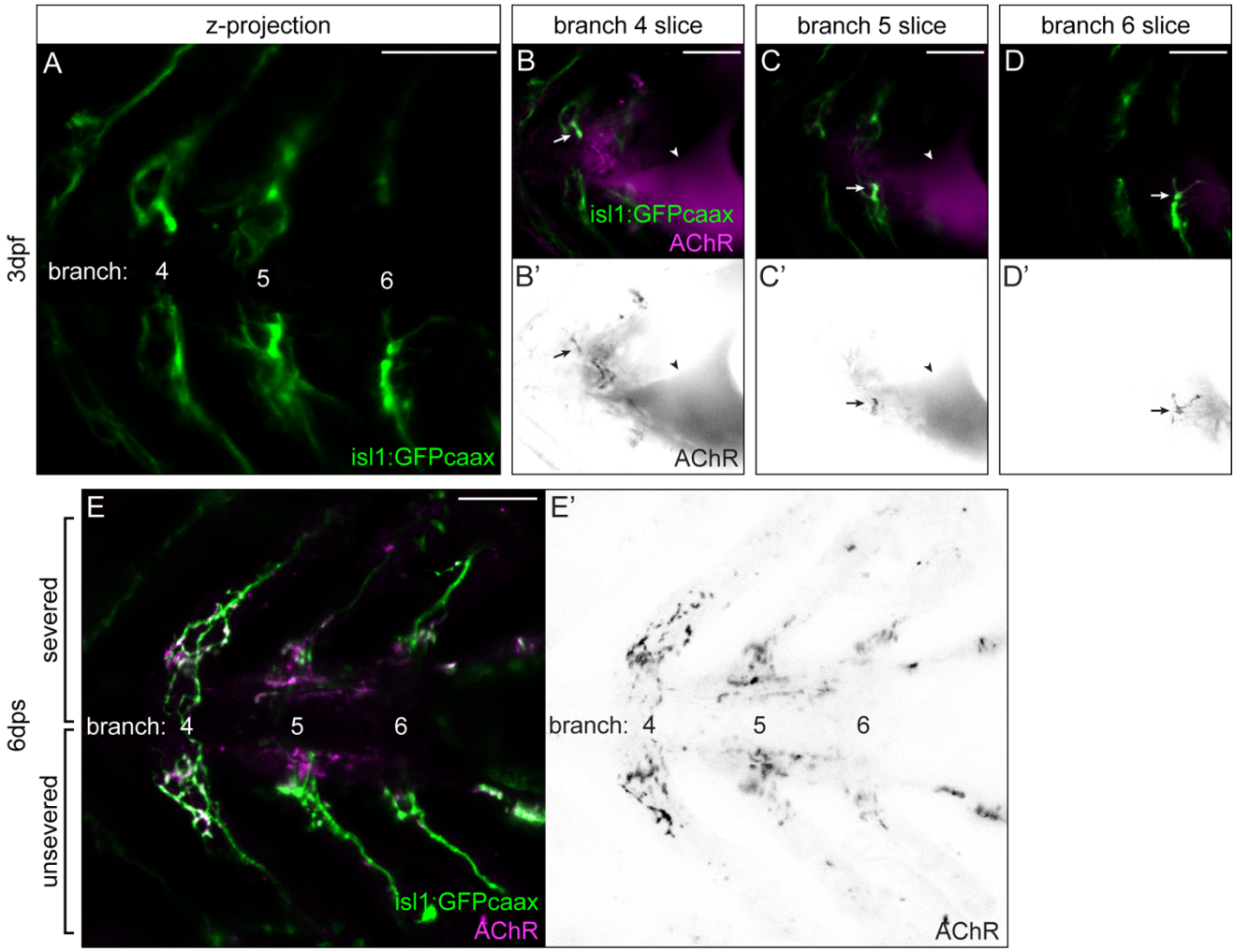


Fig. S1. Vagus neuromuscular synapses before and after regeneration. (A-D) Ventral view of vagus neuromuscular synapses in 3dpf uninjured larvae. (A) Maximum Intensity Projection of vagus branches 4, 5, and 6. (B-D) Individual slices showing branches 4 (B), 5 (C), and 6(D) (green) and associated nicotinic acetylcholine receptor (AChR) clusters, labeled with α-Bungarotoxin, at neuromuscular synapses (magenta in B-D, black in B'-D') (arrows). Individual slices are shown to avoid obscuring specific signal (arrows) with non-specific, soluble α-Bungarotoxin signal in the heart cavity (arrowheads). (E) AChR staining in 6dps larvae showing unsevered branches (left side, bottom) and severed and recovered branches (right side, top). Neuromuscular synapses recover after injury. All images are ventral views with anterior to left. Scale bars: 50 μm.

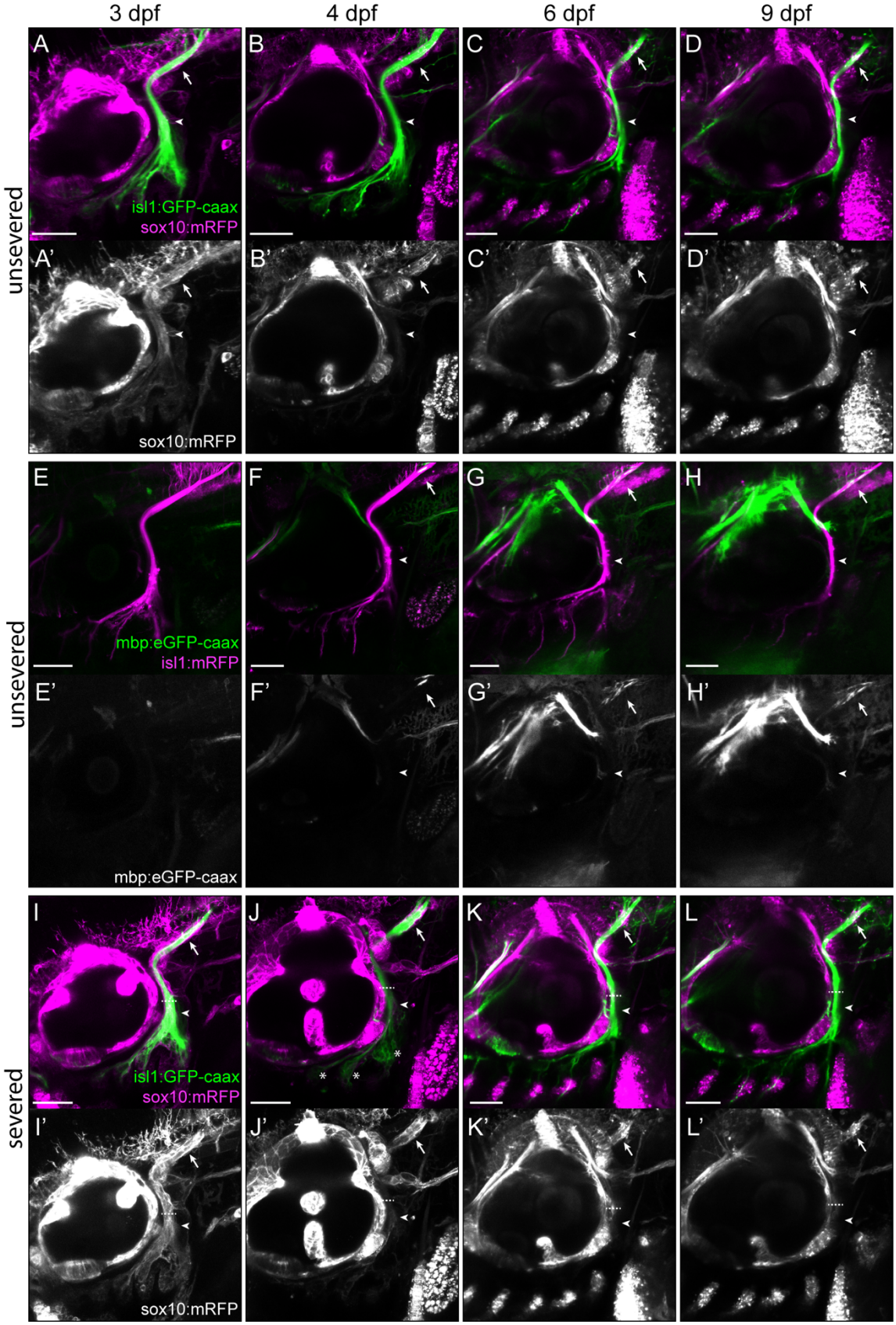


Fig. S2. Vagus-glia associations before and during regeneration.

(A-D) Association of glia (*sox10:mRFP*, magenta A-D & white A'-D') with the vagus nerve (green) in unsevered 3dpf (A), 4dpf (B), 6dpf (C), and 9dpf (D) larvae. Glia associate with the proximal region of the fascicle (arrows) from 3-9dpf, but are only transiently associate with the peripheral vagus fascicle (arrowheads) at 3dpf (A) and are absent from the peripheral fascicle from 4-9dpf (B-D). (E-H) Association of myelinating glia (*mbp:eGFP-caax*, green E-H & white E'-H') with the vagus nerve (magenta) in unsevered 3dpf (E), 4dpf (F), 6dpf (G), and 9dpf (H) larvae. Beginning at 4dpf, myelinating glia are associated with the most proximal region of the vagus fascicle (arrows), but not with the peripheral regions of the nerve (arrowheads), suggesting this nerve is largely unmyelinated in the early larva. (I-L) Association of glia (*sox10:mRFP*, magenta I-L & white I'-L') with the vagus nerve (green) immediately prior to severing at 3dpf (I) and during regeneration at 4dpf (J), 6dpf (K), and 9dpf (L). As in unsevered controls, glia associate with the proximal region of the fascicle (arrows) from 3-9dpf but only transiently associate with the peripheral vagus fascicle (arrowheads) at 3dpf (I) and do not associate with regenerating axons from 4-9 dpf (J-L). Note that in *isl1:GFP-caax* larvae, unlike in *isl1:mRFP* larvae, vagus sensory neurons are seen in vagus branches after severing (asterisks). Dashed lines: approximate sever site. All images are lateral views with anterior to left. Scale bars: 50 μm.

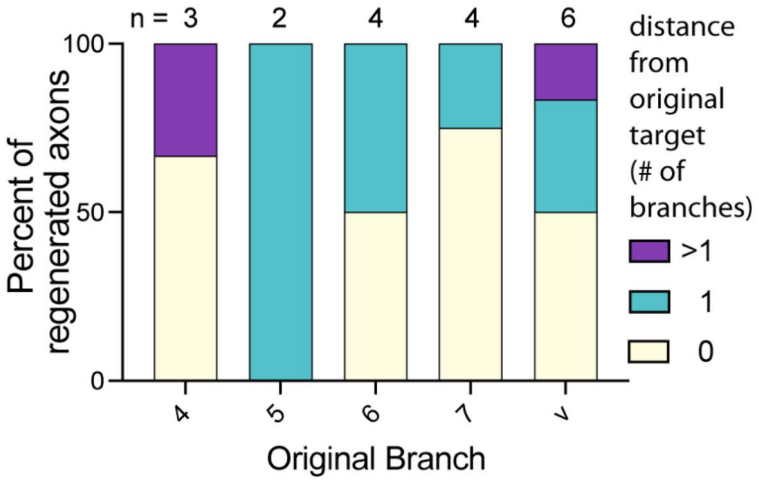
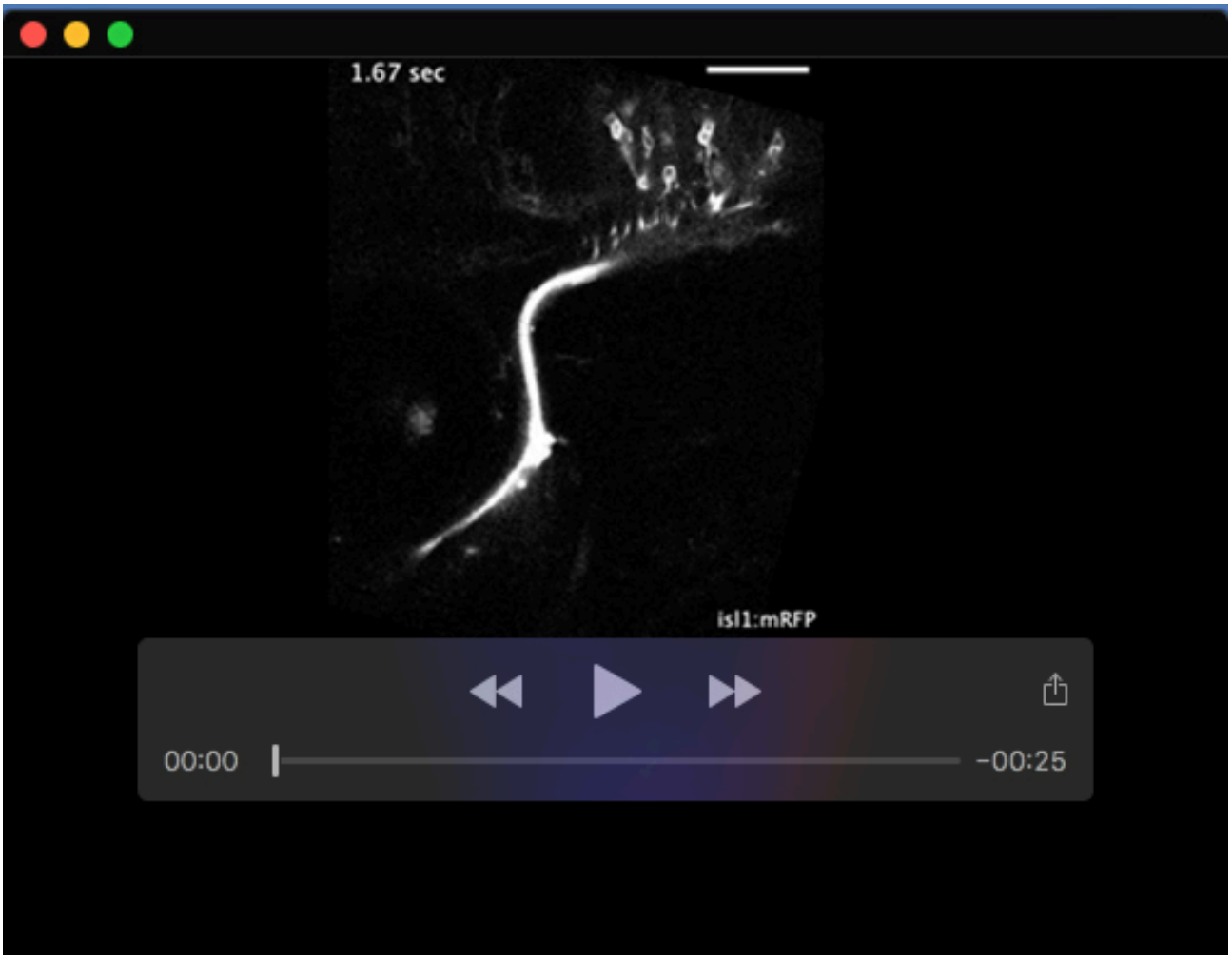
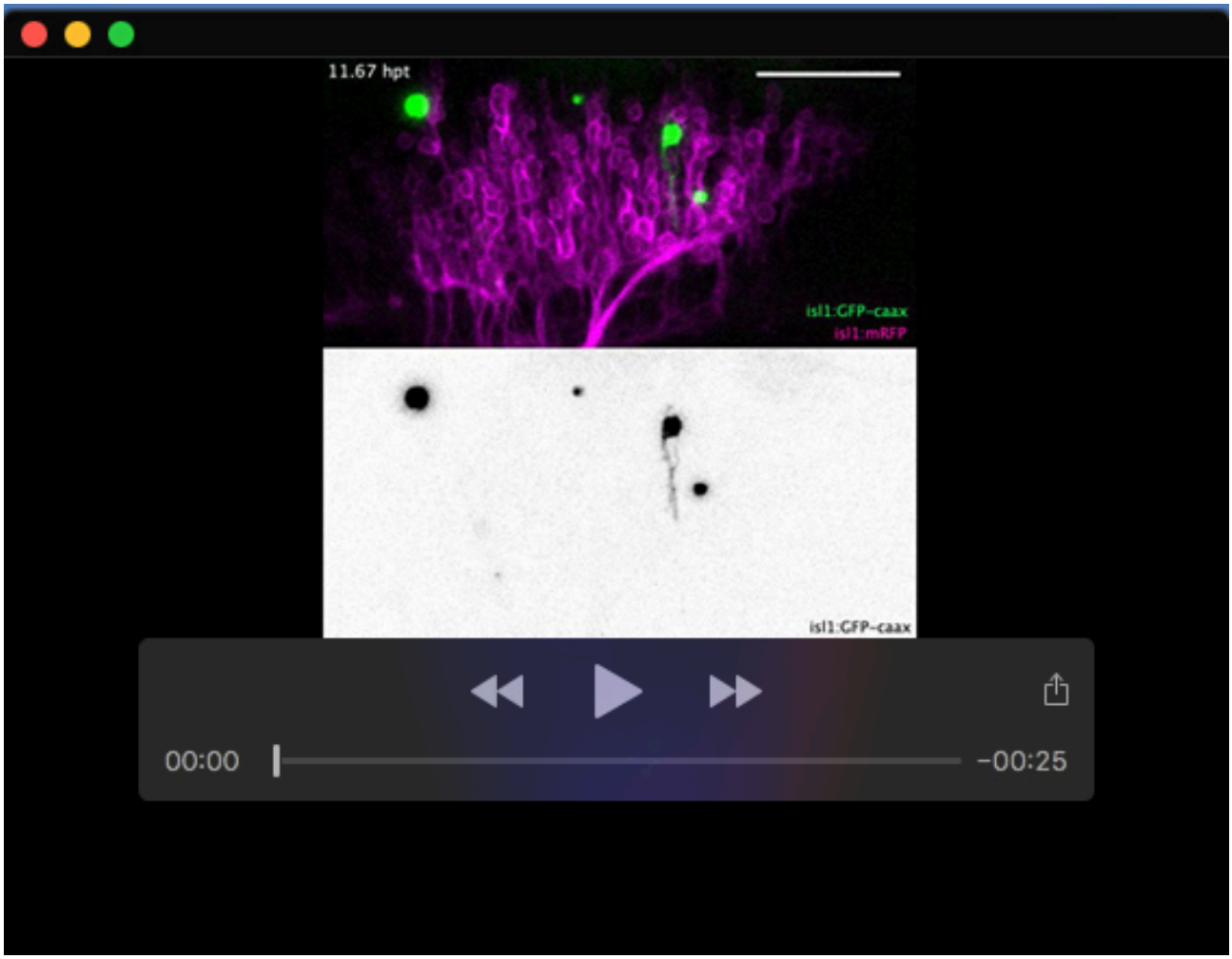


Fig. S3. branch-specific target-specificity data.

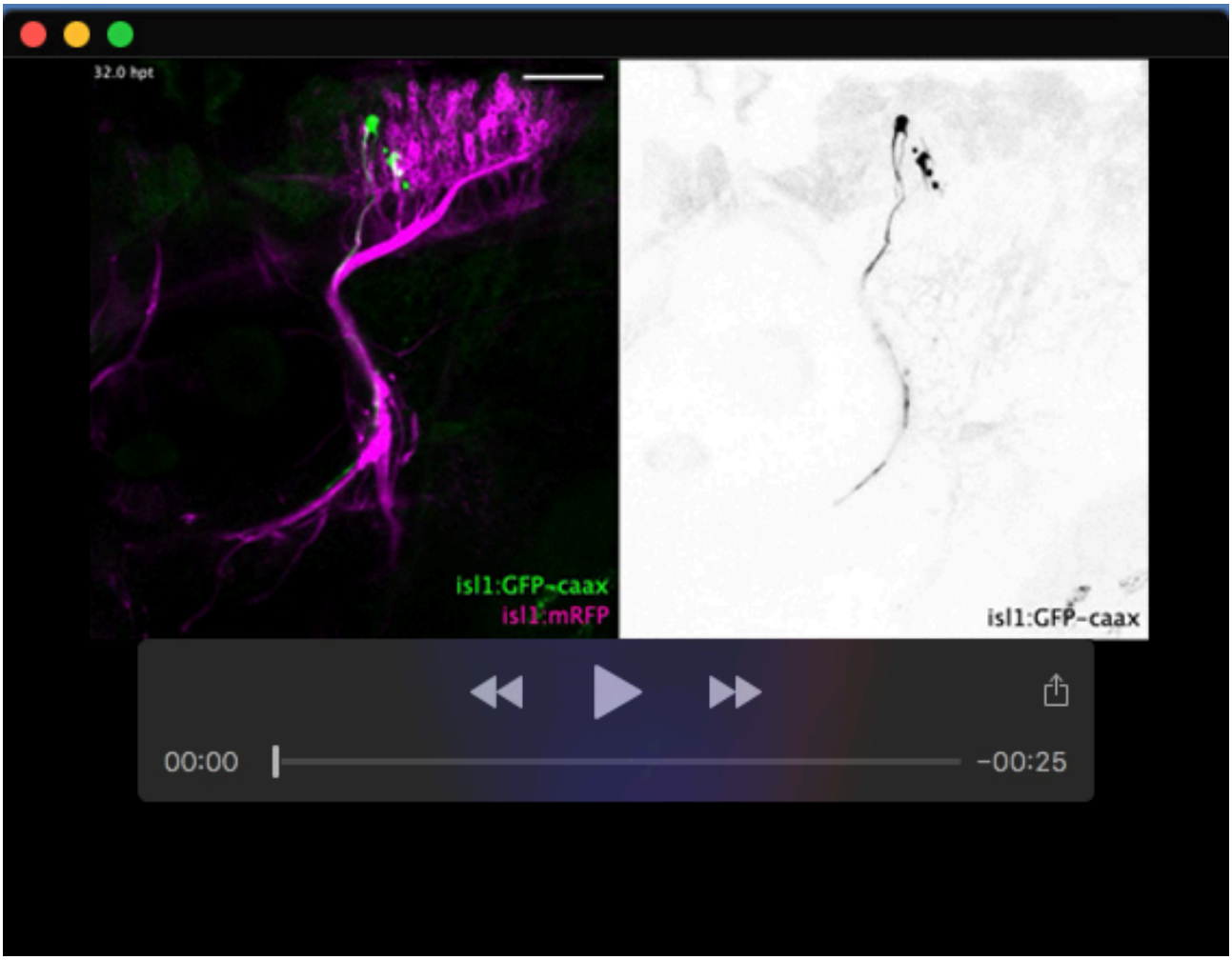
(A) Frequency of re-targeting of spasely-labeled regenerated axons to a branch 0, 1, or >1 branches away from the original target, binned by the original target branch. Neurons targeting all branches show an equivalent capacity for target-specific regrowth. This graph represents the same data presented in Figure 2E.



Movie 1. Vagus laser axon severing. Laser pulse occurred between 5.01 and 6.68 seconds. Single plane lateral view with anterior to the left. Scale bar: 50 μm.



Movie 2. Axon re-formation after neuron transplantation. Transplanted donor neuron (green (top), black & white (bottom)) in the host nucleus (magenta) beginning 5 hours after transplantation. Transplanted neurons initially round up, then exhibit multipolar protrusive activity before extending an axon ventrally by ~24hpt. Maximum intensity projection of lateral view with anterior to left. Scale bar: 50 μm.



Movie 3. Axon re-extension after neuron transplantation. Transplanted donor neurons (green (left), black & white (right) extending axons in the host (magenta) beginning at 24hpt. The axon grows along the pre-existing host vagus nerve and into PA5 by 37.5hpt. Maximum intensity projection of lateral view with anterior to left. Scale bar: 50 μm.