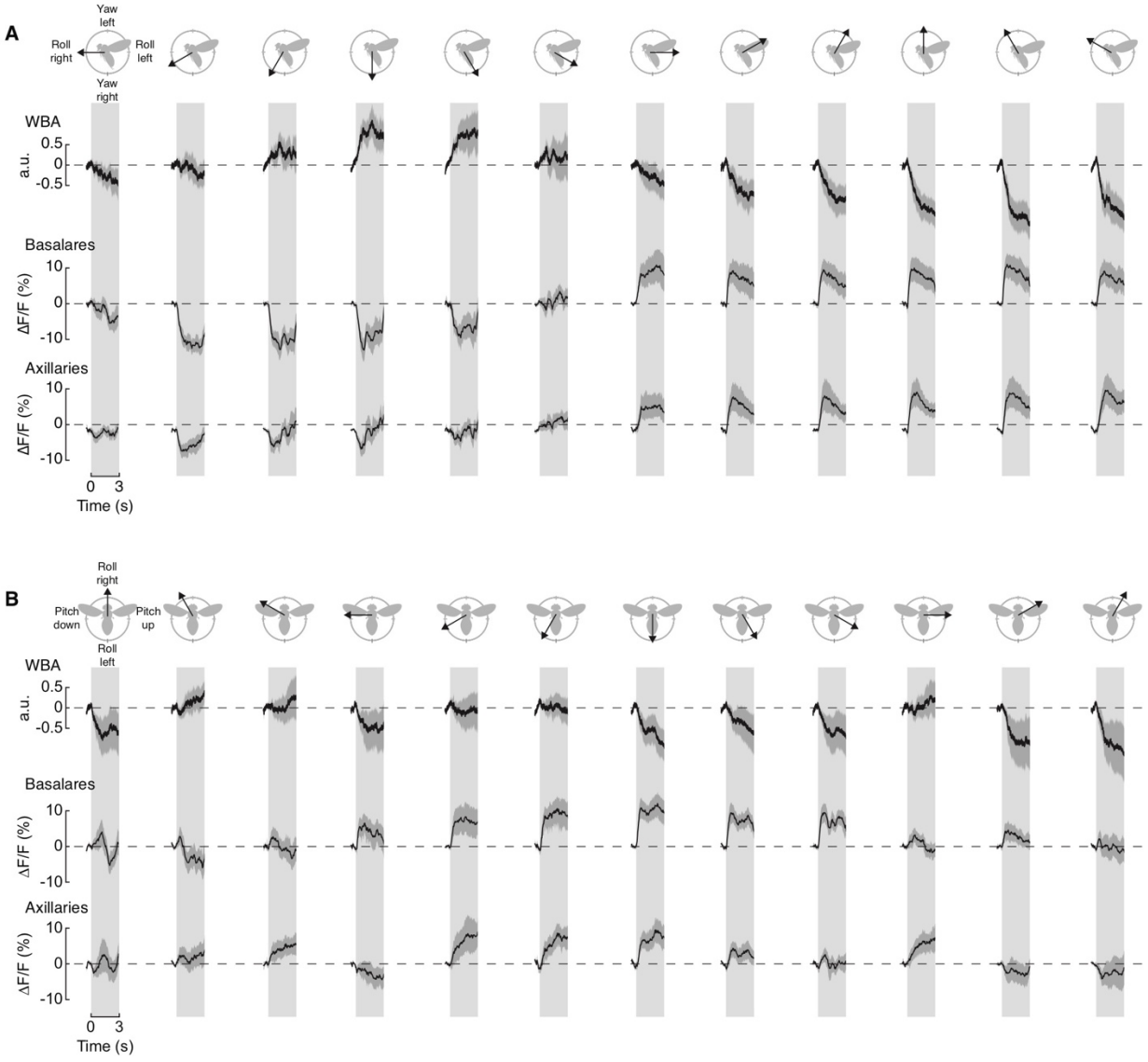

Figure S1. Haltere muscle tuning dynamics about the yaw-roll and pitch-roll axes. Related to Figure 1. (A and B) Direction of stimulus (arrows) with wing beat amplitude responses and fluorescent signals in basalar and axillary muscles in response to 3 second presentations of wide-field motion where the center of rotation shifted in 30° increments about the yaw-roll (A) or pitch-roll (B) plane. Stimulus direction follows the right-hand rule. Data shown represent mean ± 95% CI (n = 15 flies each).

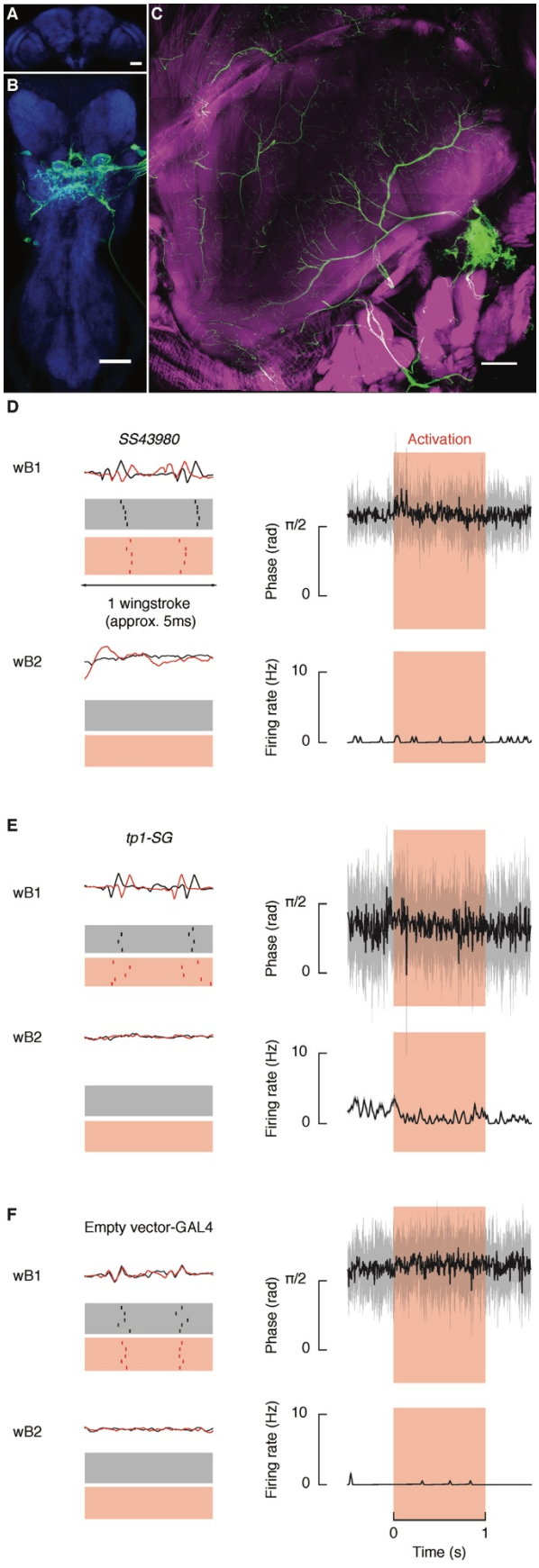
A
B
C
D
SS43980
wB1
1 wingstroke
(approx. 5ms)
wB2
Activation
Phase (rad)
π/2
0
Firing rate (Hz)
10
0
E
tp1-SG
wB1
wB2
Phase (rad)
π/2
0
Firing rate (Hz)
10
0
F
Empty vector-GAL4
wB1
wB2
Phase (rad)
π/2
0
Firing rate (Hz)
10
0
0
1
Time (s)

Figure S2. Activation of wing power muscle motor neurons. Related to Figure 4. (A and B) Maximum intensity projections of the brain (A) and ventral nerve cord (B) showing GFP expression driven by *SS43980-GAL4*. The wing power muscle motor neurons are in the mesothoracic segment of the VNC. Blue channel shows nc-82 staining. (C) *SS43980-GAL4* labels the dorsolongitudinal and dorsoventral wing muscle motor neurons. Magenta channel shows phalloidin staining of muscle. For anatomy of *tp1-SG*, see [S1]. Scale bars: 50µm (A, B); 100 µm (C). (D to F) Left: Example muscle action potentials and rasters of wB1 and wB2 before (black) and after (red) optogenetic activation of *SS43980-GAL4* (D), *tp1-SG* (E), and *empty vector-GAL4*. Rasters similar to those in Fig. 4. Right: Instantaneous wB1 phase or wB2 firing rate of each driver line in response to optogenetic activation. Data shown represent circular mean ± circular STD, n = 8 (D, wB1); 5 (D, wB2); 6 (E, wB1); 4 (E, wB2), 7 (F, wB1); 5 (F, wB2).

Supplemental References

S1. O'Sullivan, A., Lindsay, T., Prudnikova, A., Erdi, B., Dickinson, M., and von Philipsborn, A.C. (2018). Multifunctional wing motor control of song and flight. Curr. Biol. *28*, 2705-2717.