

**FIGURE LEGENDS OF SUPPLEMENTAL INFORMATION:**

**Supplemental Figure 1. Intermittent photostimulation of ChR2 expressing spinal neurons can lead to a pattern of EMG hemidiaphragmatic activity that persists for at least 24 hrs albeit reduced in amplitude.**

**Video S1. Normal hemidiaphragmatic EMG activity is rhythmic.** Each breath results in a burst of hemidiaphragmatic activity that can be electronically recorded. Audio is of each breath taken. The moving vertical line represents the point in the trace in which the audio is taking place.

**Video S2. There is no respiratory related activity ipsilateral to the lesion in ChR2 expressing animals prior to prolonged intermittent photostimulation.** Top trace is of the EMG activity of the hemidiaphragm ipsilateral to the lesion. The bottom trace represents the contralateral intact side. Audio is of the ipsilateral lesioned side and only EKG is audible. The moving vertical line represents the point in the trace in which the audio is taking place.

**Video S3. There is a small amount of diaphragmatic EMG activity ipsilateral to the lesion at the onset of the oscillatory waxing and waning period.** The top trace is of the EMG activity of the hemidiaphragm ipsilateral to the lesion. The bottom trace represents the contralateral intact side. Audio is of the ipsilateral lesioned side. The

moving vertical line represents the point in the trace in which the audio is taking place. This is the same animal from Video S2.

**Video S4. The waxing and waning of the diaphragmatic EMG activity reaches maximal levels.** The top trace is of the EMG activity of the hemidiaphragm ipsilateral to the lesion. The bottom trace represents the contralateral intact side. Audio is of the ipsilateral lesioned side. The moving vertical line represents the point in the trace in which the audio is taking place. This is the same animal from Video S2.

**Video S5. After waxing and waning of diaphragmatic EMG activity the pattern of breathing is synchronous and closer to normal.** The top trace is of the EMG activity of the hemidiaphragm ipsilateral to the lesion. The bottom trace represents the contralateral intact side. Audio is of the ipsilateral lesioned side. The moving vertical line represents the point in the trace in which the audio is taking place. This is the same animal from Video S2.