Figure S1. Automated UP-state detection algorithm. A. A voltage trace (top) and the smoothed, rectified differential of the voltage trace (bottom) were created for each UP-state. The cell in A is an RS cell. The action potentials in the voltage trace were truncated at -45 mV and the mean of the entire trace was subtracted. Horizontal dashed line in the top panel represents the voltage threshold, and horizontal dashed line in lower panel represents the variance threshold. B. A simultaneous UP-state in a second cell, an FS cell, with panels as described for A. Vertical dashed lines running through A and B indicate calculated start and end times for each cell for the displayed UP-state. C. UP-state start times as defined by an RS cell, plotted against those for a simultaneously recorded FS cell (each circle represents start times for 1 UP-state). D. Similar plot for RS and FS cell end times. Solid lines indicate unity.

Figure S2. Distribution of membrane voltage levels during low-divalent ACSF application. A. Membrane potential during application of normal ACSF (*i.e.* 2 mM Ca^{2+} and Mg^{2+}) from RS cell in Fig. 1A, B (60 sec of baseline activity). B. Membrane potential distribution from cell in A during application of low divalent ACSF (*i.e.* 1 mM Ca^{2+} and Mg^{2+}; n = 9 UP-states plus 1 sec before and after each UP-state). C. Membrane potential during normal ACSF application for cell in Fig 1C. (60 sec of baseline activity). D. Membrane potential distribution for cell in C during low divalent ACSF (n = 10 UP-states plus 1 sec before and after UP-states). E. Membrane potential distribution from GIN cell in Fig. 1A, B during normal ACSF application (60 sec of baseline activity). F. Membrane potential distribution from cell in E during low-divalent ACSF (n = 8 UP-states plus 1 sec before and after UP-states). Action potentials were not truncated for these measurements, but data were plotted here only for membrane

potential levels from -80 to -40 mV in order to show the distribution of the vast majority of membrane potential values.

Figure S3. Interspike interval distributions for individual cells differ by cell type (RS, FS and GIN) as well as by state (UP or DOWN) for GIN cells. Shown are interspike interval histograms for 2 cells of each cell type and for each state during which the respective cell types fired.

Figure S4. Average interspike interval distributions across cells differ by cell type (RS, FS and GIN) as well as by state (UP or DOWN) for GIN cells. Vertical dotted lines indicate median values. Conventions for box-and-whisker plots as in Fig. 3. All distribution medians were significantly different from one another ($p < 1 \times 10^{-5}$). In addition, the distributions themselves were significantly different from one another, as determined by the Kolmogorov-Smirnov test ($p < 1 \times 10^{-4}$). All plots are averages across all recorded cells (numbers of cells analyzed: RS, 20; FS, 12; GIN, 21).

Figure S5. Distribution of firing during the first and last seconds of the UP-states. Only the first and last seconds of each UP-state lasting more than 2 seconds was used to create these plots. Numbers of cells analyzed: RS, 20; FS, 12; GIN, 21.