Supplementary

Channel Exclusion Criterion.

It was discovered throughout the study that certain carbon fiber channels showed signs of breakage, mostly likely at the point where the fibers initially extended off of the PCB. To prevent these channels from skewing the impedance analysis, an elimination criterion was created. If a recording channel's 10 Hz impedance magnitude closely matched that of a known broken channel on the same device, for three consecutive days, the channel was removed from the study from the start of the three day period onwards.

In addition, there were instances where only impedance values were taken incorrectly and not discovered until later. In these cases, impedance values indicated an open circuit at every channel and were removed; however, the recorded electrophysiology data from the same day, which used a different headstage connector, remained in the study as they still showed unit activity, indicating a functioning electrode.

Lastly, at one point in the study it was noticed that the headstage used to record electrophysiology from the silicon electrodes was partially damaged. To ensure the fidelity of the data analysis, all data from those damaged channels were removed. Once the silicon electrode's headstage was repaired all channels were again included in the study.

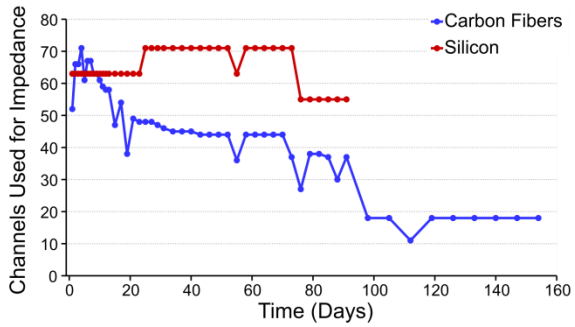

Figure S1. Number of channels used for impedance results. For the silicon electrodes, the jump in channel count from day 23 to 25 was due to eight channels from ZCR22 being incorporated after a headstage had been repaired. The brief dip at day 55 was due to a missed time point. The decline at day 73 was due to another animal being removed from the study with four remaining until day 91. For the carbon fibers all dips and immediate recoveries, except at day 55 which was a missed time point, were due to impedance values that indicated a poor connection. Drops that occur without an immediate recovery are from channels being removed from the study due to breakage. The drop-off at day 91 is from the sacrificing of all remaining animals except for two that continued to day 154.

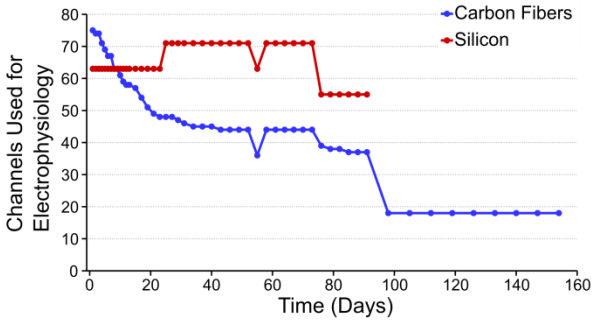

Figure S2. Number of channels used for electrophysiology and noise results. For the silicon electrodes, the jump in channel count from day 23 to 25 was due to eight channels from ZCR22 being incorporated after a headstage had been repaired. The brief dip at day 55 was due to a missed time point. The decline at day 73 was due to another animal being removed from the study with four remaining until day 91. For the carbon fibers, the

continual decline in channel count was due to channels being removed as their 10 Hz impedance magnitudes matched those of known broken channels. The two exceptions to this were day 55, which was a missed time point, and after day 91 when only two animals remained.

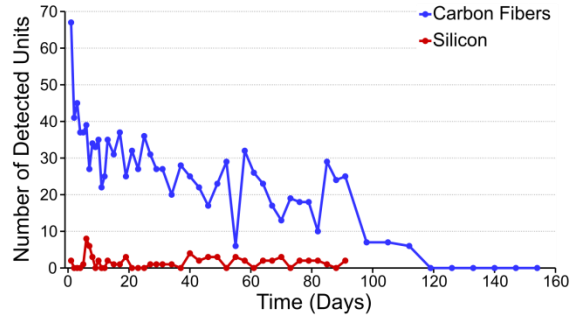

Figure S3. Number of units detected for each probe type. For each probe type, the number of units detected on the valid electrophysiology channels from figure S2, is plotted over time.

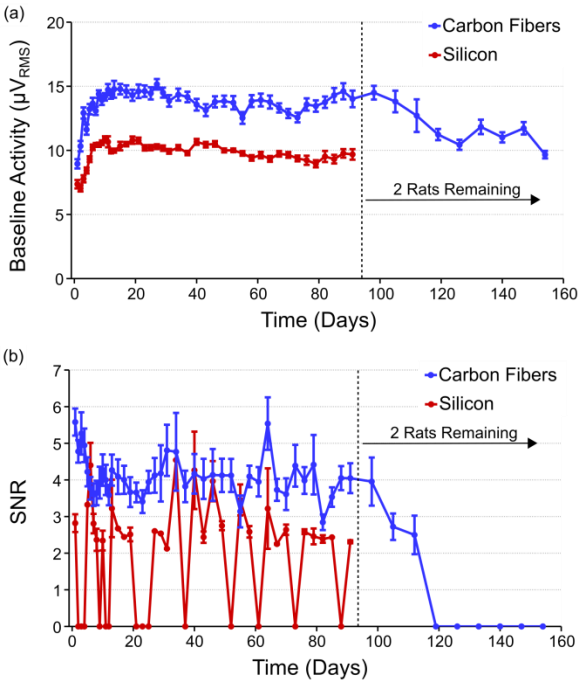

Figure S4. Chronic baseline activity and SNR to day 154. (a) Recorded baseline activity levels (mean ± standard error of the mean) for both carbon fiber and silicon electrodes for all 154 days. (b) The SNR (mean ± standard error of the mean) for all units detected on the carbon fiber electrodes for all 154 days.

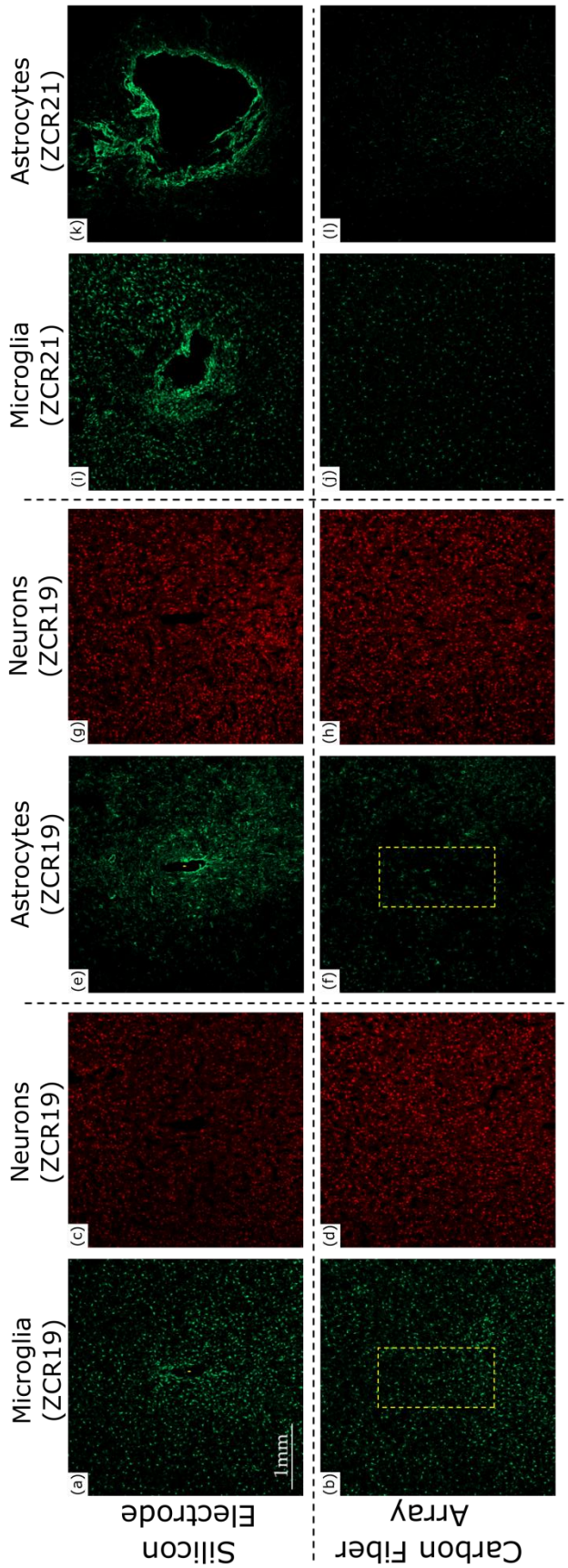

Figure S5. Chronic histology from carbon fiber arrays and silicon electrodes. The yellow reactangle depicted in the silicon electrode images show the approximate size and position of the electrode. In the images for the carbon fiber array the outlined yellow profile depicts the footprint of the array. (a), (b), (i), & (j) Microglia staining around implanted electrodes. More elevated responses can be seen around the silicon

electrodes. (e), (f), (k), & (l) Astrocyte staining around implanted electrodes. More elevated responses can be seen around the silicon electrodes. (c), (d), (g), & (h) Neuron staining around implanted electrodes. Decreased intensity can be seen around the silicon electrodes and no obvious decreases in the carbon fiber array images.