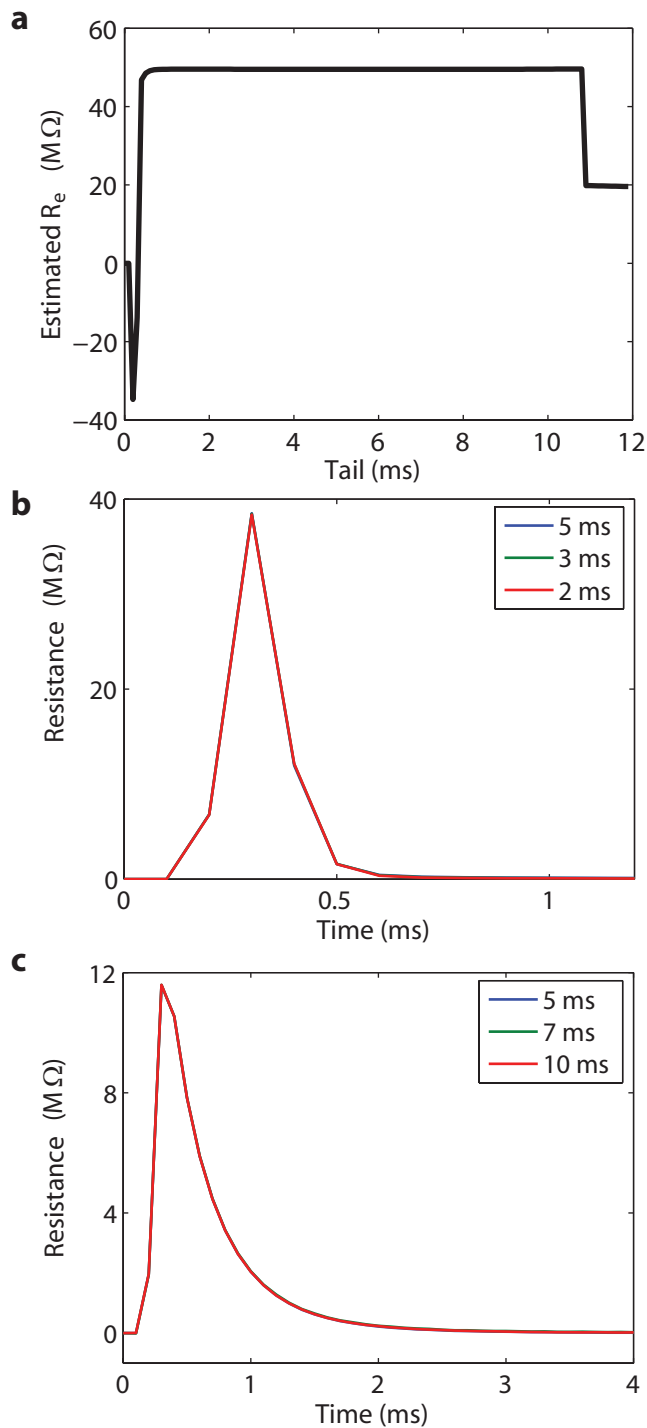## Supplementary Figure 1 - Sensitivity of electrode kernel to estimation parameters

We tested the sensitivity of the electrode kernel estimation to the precise choice of the Tail parameter: this parameter corresponds to the time from which the full kernel is considered as corresponding to the membrane response only, and it has to be chosen prior to the separation of the full kernel into a membrane kernel and an electrode kernel. **(a)** Simulations show that there is a broad plateau for which the kernel estimation is correct, as represented here by a plot of estimated electrode resistance R_e vs. Tail parameter (target R_e = 50 MΩ, electrode time constant τ_e = 0.2 ms, membrane time constant τ_m = 15 ms). If Tail is too small, part of the electrode

kernel is removed together with the membrane kernel and estimated R_e is too small (left). If Tail is too close to the total size of the full kernel (15 ms in this case), the fit of the membrane response by an exponential fails and this also leads to a wrong estimation (right). **(b, c)** Two examples of real electrodes, showing that the estimated kernels are very similar for 3 different values of Tail used in each case, confirming the existence of a broad plateau (top: typical electrode with full capacitance compensation; bottom: less capacitance compensation is used, the electrode is slower). In 6 systematic comparisons (5 electrodes) of kernels estimated for Tail = 5 ms vs. Tail = 3 ms, the difference R_{e_5ms}- R_{e_3ms} was of 1.4 MΩ only on average (range 0.5-2.3 MΩ), and in 7 comparisons (6 electrodes) of kernels estimated for Tail = 5 ms vs. Tail = 2 ms, the difference R_{e_5ms}- R_{e_2ms} was similarly of 1.4 MΩ on average (range 0.7-2.3 MΩ). In these experiments, R_e was between 60 and 108 MΩ.

In addition, for 3 electrodes, we tested the impact of the duration of white noise injection on the electrode kernel estimation (not shown). We found no significant difference between injections of 5, 10 or 20 s duration, when comparing, for each electrode, kernel parameters obtained during repeated white noise injections of different durations. For one electrode, 1 s white noise injections provided significantly different kernel parameters, compared to 5, 10 and 20 s injections (ANOVA followed by post hoc PLSD Fischer test, $P<0.001$). We used 5 s of white noise injection in most subsequent experiments.