**Supplementary Methods**

Experiments were performed using standard whole cell patch clamp recordings from CA1 pyramidal neurons in acute hippocampal slices from 2-3 week old rats or mice as described\(^1\). The whole-cell solution contained 0.1 mM spermine (except for data in Fig. 1e) and 5 mM QX-314. The extracellular solution contained 2.5 mM Ca\(^{2+}\) and 1.3 mM Mg\(^{2+}\). EPSCs were evoked at a frequency of 0.1 – 0.5 Hz and LTP was induced by pairing 50 or 100 stimuli at 0.5-2 Hz with a holding potential of -10 or 0 mV. For calculation of the rectification index, in some experiments a negative holding potential of -70 mV was used (data shown in figure 1 a-c), while in others -60 mV was used (figure 1 d-f). In all cases the positive holding potential was +40 mV. Rectification index was calculated as ratio of the amplitudes: \(\frac{\text{EPSC}_{\text{hyperpolarized}}}{\text{EPSC}_{\text{depolarized}}}\). In experiments in which the NMDAR-mediated component was not blocked, the EPSCs at +40 mV appear to be outwardly rectifying. However, it is the additional NMDAR-mediated component contributing to the EPSC peak at +40 mV that is responsible for this apparent outward rectification\(^3\).  

For experiments in Fig. 1d a total of 19 recordings were made. We initially collected RI values for only one or two time points following LTP induction to control for the possibility that repeated measurements at +40 mV might influence LTP stability. Upon the realization that LTP remained stable following repeated measures at +40 mV, we sequentially measured RI values at each time point in the same recording (n = 12); in 10 of these recordings the RI of a control unpaired pathway was simultaneously monitored. Experiments in Fig. 1e were sequential measurements from the same recordings made in single pathway experiments.

For the analysis of the effects of PhTx application on EPSC amplitude following LTP induction (bar graph in Fig. 2c), EPSC amplitude at 27-30 minutes after PhTx
application was plotted for the experiments in which PhTx was applied 3 or 10 min post pairing. For the experiments in which PhTx was applied 20 minutes after LTP induction, EPSC amplitude at 20 minutes following PhTx application was plotted. Experiments in which PhTx was applied 3 and 20 minutes after LTP induction were single pathway experiments. For the experiments in which PhTx was applied at 10 minutes after LTP induction, two-pathways were used. In comparing the data in Fig. 2a and Fig. 2e, the PhTx block of the potentiation following LTP induction is faster in the continued presence of PhTx (Fig. 2e) than when PhTx is washed on after LTP induction (Fig. 2a). This is likely due to the fact that in Fig. 2e, PhTx is already present in the slice when the CP-AMPARs are incorporated during LTP induction, compared with Fig. 2a in which PhTx is washed on after LTP induction. Bearing this in mind, it is likely that the residual potentiation at 25 min in Fig. 2a is due to a small fraction of GluR2-containing receptors that had already replaced the GluR2-lacking CP-AMPARs while PhTx was still washing into the slice.

For the experiments in which stimulation was stopped after LTP induction, a paring protocol of 60-100 stimuli at 2Hz paired with -10 mV holding potential was used; baseline stimulation rate was 0.5Hz. Statistical significance throughout the study was assessed using paired or unpaired t-tests, as appropriate (** P < 0.01, *** P<0.005).

References: