**Supplemental figure 1.** Sequential patching of interneurons in perforated patch and whole cell mode. Putative non-pyramidal cells were patched in stratum(s.) oriens in perforated patch. A₁) DIC infrared-image of a cell at the end of a perforated patch recording (50 min). A₂) Membrane potential steps generated by DC current injection (500 ms) in current clamp at the end of perforated patch recording. Suprathreshold current steps were injected intermittently throughout the recording to check membrane integrity. Action potential blocker QX-314 (5 mM) was included in all filling solution. This irreversibly blocks action potentials in whole cell mode, but does not enter the cell in perforated patch. The occurrence of action potentials (cut) indicate integrity of membrane. Bridge balance compensation adjusted. Schematic shows experimental design and current injection in current clamp. B₁) Image of the same cell when re-patched with a new pipette. When the image was taken, the patch was in gigaseal configuration. Images were regularly taken in gigaseal configuration as well as in whole cell since somatic morphology under infrared may change during whole cell mode. B₂) Action potentials are readily blocked after break-in to whole cell (5 min). Current traces in whole-cell voltage clamp during incrementally increasing voltage steps (300 ms) up to somatic membrane potential of 0 mV (from -60 mV) shows no action currents. Whole cell recording was also characteristically associated with an increase in cell input resistance as can be seen from reduced amount of current needed for depolarization (filling solution CsCl). Initial amplitude of the current step (Ic) is cut in the traces. C) Epifluorescence image of the same cell following visualization of biocytin with Streptavidin-Alexa 488. Images at these three stages were systematically used in the re-patching experiments to verify that the correct cell was re-patched. Scale bars in panels A and C; 25 µm.

**Supplemental figure 2.** Currents evoked by depolarizing and hyperpolarizing steps in voltage clamp during the three different LTP induction protocols.
A) Specimen current traces ($I_c$) from individual experiments showing pairing of presynaptic stimulation with postsynaptic voltage steps in the three different LTP induction protocols. The somatic membrane potential was stepped in voltage clamp mode from -60 mV. s indicates the timing of afferent stimulation. Left, 1 Hz (120 pulses) stimulation with postsynaptic depolarization to 0 mV (step duration 300 ms). The onset of the depolarizing current was synchronous with the electrical stimulation. The action currents (downward deflections in the trace) are small because of the uncompensated series resistance of the perforated patch. Middle and right; tetanic stimulation at 100 Hz for 1 s accompanied by postsynaptic voltage steps to 0 mV (1200-2000 ms) or to a hyperpolarized membrane potential (-70 to -90 mV). For the depolarizing steps stimulation was simultaneous with the onset of the voltage step. For hyperpolarizing steps stimulation was either simultaneous or delivered with a 100 ms delay following the voltage step onset. Upward deflections in the hyperpolarizing current trace are stimulus artifacts.

B) Table showing current amplitudes ($I_{step}$) during voltage steps. Amplitudes are measured 2-3 ms from the step onset and before the first action current. $n$ indicates the number of cells. $R_m$ is cell input resistance measured during depolarization to 0 mV in bridge balanced current clamp mode. ACs during the first 100 ms indicates the average number of action currents measured during the first 100 ms of the step.

Supplemental figure 3. Prior to mEPSC analysis, recordings were band-pass filtered between 5 Hz and 5 kHz. The analysis was repeated on unfiltered data in three cells to verify that this procedure did not influence the results. Figure compares results of analysis of unfiltered and band-pass filtered recordings of mEPSCs (recorded at a holding potential of -60mV) in three cells (A-C). Upper black trace: Unfiltered; Lower red trace: bi-directionally band-pass filtered (red, 5 Hz-5 kHz). Below: Histograms of decay time constants ($\tau$) for detected events of filtered and unfiltered recordings. Analysis was carried out on the
filtered and unfiltered recordings using the same input parameters. While fewer events were detected
in the analysis of the unfiltered recordings, the distributions derived from the two methods of analysis
were qualitatively comparable.

**Supplemental figure 4.** To minimize the number of missed events and false positives, the amplitude
detection threshold was set below the noise level and the automatically detected events were
individually selected by visual inspection. Other input parameters for event detection were adjusted as
follows: A 20 s epoch with a large number of events was selected for each 120 s baseline sweep. Events
in the 20 s epoch were identified by visual inspection. The minifit procedure was then run, and
parameters adjusted to reduce the number of missed events relative to the visually identified events
(missed events ≈ 7 %). The same parameters were then used for event detection in all conditions for the
same cell. Single exponential functions were fit to the decay of the events between the detected peak
and 70% return to baseline. To determine whether the results were dependent on the choice of
parameters, recordings were re-analyzed by setting the detection threshold above the noise level with
two different parameter sets. The latter two methods sampled a smaller and differing subpopulation of
events. The three methods of analysis yielded comparable results.

Figure shows decay time constants (τ) histograms obtained from analysis using three sets of detection
parameters (Supplemental table 1) for mEPSCs recorded in four cells (A-D) at a holding potential of -
60mV (see Methods). All three parameter sets resulted in an asymmetric uni-modal distribution of τ
supporting the conclusion that missed events are not likely to account for a mis-identification of the
distribution of event kinetics.

**Supplemental table 1.** Global variable input used in analysis in Supplemental figure 4.

Variables as defined in minifit Igor Pro procedures (Hwang and Copenhagen, 1999).
**Supplemental figure 5.** Cumulative probabilities (left axis) and average normalized histograms (right axis) of event amplitudes (A) and interevent intervals (B) of mEPSCs recorded in 14 O-LM cells at holding potential of -60 mV. Histograms normalized by detected event number in each cell.

**Supplemental table 2.** Out of all cells recorded from and subsequently processed histologically in this study (n=212), 83 cells were identified as O-LM interneurons. Out of those, 66 cells were identified on the basis of their axonal pattern with the main axon ascending from *stratum oriens* and being mostly distributed in *stratum lacunosum-moleculare*. In the remaining 18 cells with similar horizontal dendritic arborization, the main axon was cut before reaching *stratum lacunosum-moleculare*. In these cases, the cell type was confirmed by immunoreactivity for mGluR1α in the somatodendritic plasma membrane and/or somatostatin (SM) immunoreactivity of the soma. In 11 cells immunoreactivity was confirmed for both molecules; 5 cells with characteristic dendritic arborization were positive for mGluR1α but SM was either not tested (n=2) or could not be evaluated (n=3) because the soma was lost or damaged. The remaining two cells were immunopositive for SM but not for mGluR1α (1 negative; 1 not testable). Cells with a horizontal somato-dendritic appearance suggestive of O-LM interneurons (n=27; not listed) were rejected either if the axo-dendritic information was insufficient or if it differed from O-LM cells at higher resolution (e.g. lack of dense filopodia and spines on dendrites in *stratum oriens*, or showing axonal features such as large varicosities or extensive branching in *stratum radiatum*). Some cells with insufficient axon were rejected because they were immunonegative for both mGluR1α and SM.

Abbreviations in Supplemental table 2: s=soma, d=dendrites, ax=axon. Identification based on axonal pattern: X=yes, blank=no; Immunoreactiviy: blank= immunoreactivity was not investigated, +=positive, - =negative, nt=not testable (e.g. reacted but with inconclusive evaluation ).
Supplemental Methods. Identification of oriens-lacunosum moleculare interneurons. In 18 cells (see Supplemental table 2) with similar dendritic patterns, the primary ascending axon was cut before the main arborization in stratum lacunosum-moleculare. The identity of these cells was confirmed by a high level of metabotropic glutamate receptor subtype 1α (mGluR1α) immunoreactivity in the somato-dendritic plasma membrane and characteristic somatostatin immunoreactivity in the soma (Baude et al., 1993; Blasco-Ibanez and Freund, 1995; Maccaferri and McBain, 1995; Sik et al., 1995; Ali and Thomson, 1998). Two cells were identified based on the characteristic dendritic spines and mGluR1α immunoreactivity only. For immunofluorescence experiments, sections were blocked in normal horse serum (Vector Laboratories, Burlingame, CA) for 1 h and incubated in mixtures of primary antibodies to mGluR1a raised in guinea pig (Nakamura et al., 2004) and to somatostatin raised in rat (MAB354, Chemicon, raised to cyclic somatostatin 1-14) diluted in TBS with 0.3% Triton-X for 48 h at 4°C. After washing, sections were incubated in a mixture of appropriate secondary antibodies conjugated either with indocarbocyanine (Cy3; Jackson ImmunoResearch) or indodicarbocyanine (Cy5; Jackson ImmunoResearch) overnight at 4°C. Sections were then washed in PB, mounted in Vectashield (Vector Laboratories, Burlingame, CA) and analysed with the Leica fluorescence microscope as specified above. Selected sections were examined with a confocal laser-scanning microscope (LSM510, Zeiss, Oberkochen, Germany) using sequential multitrack single channel operation mode. Hence, only one laser was applied to the section at any one time. Biocytin was visualized with streptavidin-Alexa-488, which was excited using 488 nm laser line and detected with a 505 nm long pass filter. Antibodies to mGluR1α were visualized by Cy3-conjugated donkey anti-guinea pig antibodies using the 543 nm laser line for excitation and 560 nm long pass filter for detection. Antibodies to somatostatin were visualized by Cy5-conjugated donkey anti-rat antibodies using the 633 nm laser line for excitation and 650 nm long pass filter for detection. Potential cross-excitation and/or cross-detection of fluorophores was checked.
using specimens having only one fluorophore of high intensity in all three excitation and detection modes. No cross-talk between channels was found under our conditions. In particular, the 543 nm laser line, used at the power to excite Cy3, did not detectably excite Alexa 488. All secondary antibodies were highly cross-absorbed and purchased from Jackson ImmunoResearch Labs, Baltimore, USA. Control incubations using two primary antibodies and only one secondary antibody resulted in the detection of only the appropriate primary antibody. When fluorescence was not detectable in the relevant part of the cell in an area where similar parts of other unfilled cells were immunopositive, cells were considered immunonegative. If a decision about immunoreactivity could not be clearly made by several investigators, the test was considered inconclusive (indicated as “not testable” in the Supplemental table 2).

Supplemental data references: