Supplementary material

Assessment of neuronal transfer function. The transfer function of neurons was quantified in control and isoelectric conditions as the relation between the intensity of intracellularly injected currents and firing responses (*F-I* relationships) (Silver, 2010; Mahon and Charpier, 2012; Altwegg-Boussac *et al*., 2014). The firing rate was measured in response to depolarizing current pulses of increasing intensity (200 ms, 0.1–2 nA) with an inter-stimulus interval of 1.25–2.25s. Each current intensity was applied 15–25 times and the corresponding firing responses were averaged. From the linear regressions applied to the *F-I* relations, we determined the neuronal gain (γ), defined as the slope of the linear regression, and the current threshold for AP generation (I_{th}), extrapolated as the *x* intercept of the linear fit.

Assessment of reversal potentials of intracellularly-recorded sensory responses. Sensory stimulations (n = 30–50) were applied at rest and after displacing V*m* with steady current injections. The reversal potentials (E_{rev}) over the response were calculated by measuring the amplitude of the evoked synaptic potential, with respect to the baseline V*m*, at three time points: the peak of the dPSP at the most depolarized V*m* level, the peak of the depolarizing response at the most hyperpolarized V*m* level and a point close to the peak of the late hyperpolarizing response (Wilent and Contreras, 2004) (Supplementary Fig. 2A2, B2 and C2). The amplitude of the synaptic response at each time point was plotted as a function of baseline V*m* and E_{rev} was extrapolated as the *x* intercept of the best linear fit.

Neuronal labeling. Recorded neurons were labeled by intracellular injection of neurobiotin (1.5% added to the pipette solution; Vector Laboratories). To generate reliable labeling of neuronal processes, positive current pulses (0.5-1 nA, 200 ms) were applied at 2.5 Hz during 15 min (Polack *et al.*, 2007). At the end of the experiment, rats were euthanized with sodium pentobarbital (200 mg/kg) and perfused with 0.3% glutaraldehyde and 4 % paraformaldehyde in 0.1 M phosphate-buffered saline solution (PBS, pH 7.4). Brains were post-fixed into 4%

paraformaldehyde for at least 2 hours. After cryoprotection with 30% sucrose, brains were frozen in isopentane (-50 ± 5°C). 50-µm-thick sections were cut on a freezing microtome and incubated overnight in PBS 0.4% Triton X-100 (Sigma-Aldrich) + 0.4% of each reagent from Vectastain ABC Elite kit (Vector Laboratories) to create an avidin-biotin complex on labelled neurons. After three washes in PBS, brain sections were pre-incubated 10 min in 0.5 mg/ml diaminobenzidine (DAB dissolved in PBS; Sigma-Aldrich) and 0.02% nickel sulfate. 0.04% hydrogen peroxide (30% aqueous solution) was subsequently added for 15 min to stain labeled neurons. Finally, sections were washed four times in PBS, mounted on slides and air dried. Counterstaining was accomplished with safranin (RAL Diagnostics). Slides were dehydrated in ethanol baths and cover-slipped in Eukitt (Sigma-Aldrich). Microphotographs of labeled neurons were taken with a Zeiss Axioskop 2 Plus microscope coupled to a Leica DFC 310 FX camera (Leica Application Suite software) and neuronal reconstruction was performed using PaintNet software. The position and depth of labeled neurons were confirmed using the atlas of Paxinos and Watson (1986).

References

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