S1_Text. Model of type I LNs with sodium spikes

We reconstruct the LNI by the following equation

$$C_m \frac{dV}{dt} = -I_{Na} - I_{Ca} - I_{Kd} - g_L(V - E_L) - I_A - I_{K(Ca)} - I_{nACh}, \quad \text{(S1)}$$

where, the intrinsic ionic currents, gating variables and their steady-state activation and inactivation are described by Eq. (5) to (9); The voltage dependency of the time constants of m and h of the voltage-activated currents is described by functions as Eqs. (10) and (11) in the main text except that the τ_m of Ca^{2+} current takes the form of Eq. (S2) (Laurent, et al., 1993)

$$\tau_{mCa}(V) = 1 + 0.014(V + 30). \quad \text{(S2)}$$

The values of various parameters of the LNI model are given in Table S1. The cholinergic synaptic currents from ORNs and PN to LNI and the GABAergic synaptic currents mediated by fast $GABA_A$ receptors from LNI to PN are described by Eq. (15) to (17) in the main text. Where reversal potential E_{GABAA} = -70 mV, t_{max} = 0.3 ms, A = 0.8 and α = 1.0 ms^{-1}. The slow GABAergic synaptic currents mediated by metabotropic $GABA_B$ receptors from LNI to PN are given by Eq. (S3) (Destexhe et al., 1996; Bazhenov et al., 1998)

$$I_{slow-inh} = \bar{g}_{slow-inh} \frac{[G]^4}{[G]^4 + K}(V - E_{GABA-slow}),$$

$$\frac{d[R]}{dt} = r_1(1 - [R])[T] - r_2[R], \quad \text{(S3)}$$

$$\frac{d[G]}{dt} = r_3[R] - r_4[G],$$

where $E_{GABA\text{-}slow}$ = -91.6 mV is the potassium reversal potential, $[R]$ the fraction of activated receptors, $[G]$ the concentration of G proteins, The rate constants are $r_1 = 1.0\ mM^{-1}ms^{-1}$, $r_2 = 0.0025\ ms^{-1}$, $r_3 = 0.1ms^{-1}$, $r_4 = 0.06ms^{-1}$, and $K = 100\ \mu M^4$.

Table S1. Parameter values of the LNI model given or calculated from patch-clamp data

Passive parameter values	C_m(pF)		E_L (mV)	g_L (nS)	Ref.		
	36.8		-53.0	19.76[a]	Husch et al., 2009		
Steady-state functions of I_{Na}	$\bar{g}_{Na}$(nS)	$V_{0.5act}$ (mV)	S_m	$V_{0.5inact}$ (mV)	S_h	E_{Na} (mV)	Ref.
	206 modified 2500	-25.8	9.32 modified 11	-41.1 modified 50.34	9.75 modified 5.5	+48.2(RP) +47.9(EP)	Lapied et al., 1990
Time constant functions of I_{Na}	$a_{\tau m,up}$	$V_{\tau m,0.5up}$ (mV)	$S_{\tau m,up}$	$a_{\tau m,dn}$	$V_{\tau m,0.5dn}$	$S_{\tau m,dn}$	Ref.
	0.5	-30	3.7	0.5	-15	13.7	Fitted to Lapied et al., 1990
	$a_{\tau h,up}$	$V_{\tau h,0.5up}$	$S_{\tau h,up}$	$a_{\tau h,dn}$	$V_{\tau h,0.5dn}$	$S_{\tau h,dn}$	
	2.1	-55	5	0.7	-10	11	

Steady-state functions of I_{Ca}	$\bar{g}_{Ca}$(nS)	$V_{0.5act}$ (mV)	S_m	$V_{0.5inact}$ (mV)	S_h	E_{Ca}(mV)	Ref.
	10.4 modified 100	-10.6 modified -11.6	8.5 modified 10.0	-29.6 modified -30	8.4 modified 18.3	160	Husch et al., 2009
Time constant functions of I_{Ca}	$a_{\tau h,up}$	$S_{\tau h,up}$	$a_{\tau h,dn}$	$V_{\tau h,dn}$	$S_{\tau h,dn}$	--	Ref.
	0.002	29	0.3	40	13	--	Laurent, et al., 1993
Ca ynamics	Ca_{∞}(nM)	τ_{Ca} (ms)		f_{Ca} --		--	Ref.
	113.0	656 modified 2000		1.6 modified 1.0		--	Roper et al., 2003
Steady-state function of $I_{k(Ca)}$	a_{msk}	b_{msk}		S_{msk}	--	--	Ref.
	1.120	2.508		1000	--	--	Roper et al., 2003
Steady tate function of I_{Kd}	$\bar{g}_{Kd}$ (nS)	$V_{0.5act}$ (mV)		S_m	E_K (mV)		Ref.
	8.17[b] modified 1000	-18.5		22.5 modified 20.0	-91.6	--	Kloppenburg et al., 1999
Time constant functions of I_{Kd}	$a_{\tau m,up}$	$V_{\tau m,0.5up}$		$S_{\tau m,up}$	--	--	Ref.
	0.125	-40		11.0	--	--	Fitted to Mercer et al.,1995
	$a_{\tau m,dn}$	$V_{\tau m,0.5dn}$		$S_{\tau m,dn}$	--	--	
	0.15	25		45.7	--	--	
Steady-state functions of I_A	$\bar{g}_A$ (nS)	$V_{0.5act}$ (mV)	S_m	$V_{0.5inact}$ (mV)	S_h	E_K(mV)	Ref.
	17.35[c] modified 600	-32.69 modified -9	17.5	-53.3	7.23	-91.6	Kloppenburg et al., 1999
Time constant functions of I_A	$a_{\tau m,up}$	$V_{\tau m,0.5up}$	$S_{\tau m,up}$	$a_{\tau m,dn}$	$V_{\tau m,0.5dn}$	$S_{\tau m,dn}$	Fitted to Mercer et al., 1995
	0.5	-30	13.7	0.42	-15	46	
	$a_{\tau h,up}$	$V_{\tau h,0.5up}$	$S_{\tau h,up}$	$a_{\tau h,dn}$	$V_{\tau h,0.5dn}$	$S_{\tau h,dn}$	
	0.04	-55	25	0.045	40	55	

[a]Calculated by $g_L = 1/R_M = 1/50.6\ M\Omega = 0.01976\ \mu S = 19.76$ nS.
[b,c]Calculated from Kloppenburg et al.,1999.

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