

Parameter	Value	Units	Description
N	100	-	Number of neurons per population
dt	1	ms	Integration time step
T	50	ms	Stimulus pulse duration
$\tau_{stim}$	50	ms	Decay constant of stimulus
$\tau_w$	40	ms	Time window for firing rate integration
$p_r$	40	Hz	Rate of Poisson stimulus pulse
$\rho$	1/7	-	Fractional change of synaptic activation
$\tau_s^E, \tau_s^I$	80, 10	ms	Time constant for synaptic activation for excitatory (EE) and inhibitory (EI, IE) connections
$g_L$	.01	$\mu S$	Leak conductance
$C_m$	20 x $g_L$	nF	Membrane capacitance
$E_L$	-60	mV	Leak reversal potential
$E_E, E_I$	-5, -70	mV	Excitatory and inhibitory reversal potentials
$v_{th}$	-55	mV	Spiking threshold potential
$v_{rest}$	-60	mV	Resting potential
$v_{hold}$	-61	mV	Reset potential
$t_{ref}$	2	ms	Absolute refractory period
$\tau_p, \tau_d$	2000, 1000	ms	LTP/LTD eligibility trace time constant
$T_p^{max}, T_d^{max}$	0.95, 1	-	Saturation level, LTP/LTD eligibility trace (scaled relative to $T_d^{max} = 1$ )
$\eta_p, \eta_d$	1, 0.55	$ms^{-1}$	Activation rate, LTP/LTD eligibility trace (scaled relative to $\eta_p = 1$ )
$\tau_p^{FF}, \tau_d^{FF}$	200, 800	ms	LTP/LTD eligibility trace time constant, feed forward connections
$T_p^{max,FF}, T_d^{max,FF}$	0.98, 1	-	Saturation level, LTP/LTD eligibility trace, feed forward connections (scaled relative to $T_d^{max} = 1$ )
$\eta_p^{FF}, \eta_d^{FF}$	0.44, 0.33	$ms^{-1}$	Activation rate, LTP/LTD eligibility trace, feed forward connections (scaled relative to $\eta_p = 1$ )
$T_{reward}$	25	ms	Duration of neuromodulator presentation upon change in stimulus
$T_{tr}$	25	ms	Duration of refractory period for traces following neuromodulator presentation
$\eta$	.0045(recurrent) , .08 (feed-forward)	$ms^{-1}$	Learning rates, recurrent and feed forward connections
$\phi$	0.3	-	Sparsity of fixed connections
$W_{EE}^{MT}, W_{EI}^{MT}$	.02, .7	$\mu S$	Synaptic connection strength, Timer to Messenger excitatory to excitatory (EE) and inhibitory to excitatory (EI) connections
$W_{EI}^{TT}, W_{EI}^{MM}$	1, 1	$\mu S$	Synaptic connection strength, intercolumnar Timer-Timer and Messenger-Messenger inhibitory to excitatory (EI) connections
$W_{IE}^{TT}, W_{IE}^{MM}$	.002, .01	$\mu S$	Synaptic connection strength, intracolumnar Timer-Timer and Messenger-Messenger excitatory to inhibitory (IE) connections

**Supplementary File 1. Table of Main Model Parameters.** For full code, see <http://modeldb.yale.edu/266774>