Supporting Information

Text S1 Model equations

The basic neural column described in Methods is given by the following set of equations:

$$\begin{aligned}
\tau_e \dot{V}_e &= -I_L - I_{AMPA}(s_{ee}) - I_{GABA}(s_{ie}) - \tau_e C_m^{-1} I_{\mathrm{KNA}},\\
\tau_i \dot{V}_i &= -I_L - I_{AMPA}(s_{ei}) - I_{GABA}(s_{ii}),\\
\ddot{s}_{ee} &= \gamma_e^2 \left(N_{ee} Q_e(V_e) + \phi_n - s_{ee}\right) - 2\gamma_e \dot{s}_{ee},\\
\ddot{s}_{ie} &= \gamma_i^2 \left(N_{ie} Q_i(V_i) \qquad - s_{ie}\right) - 2\gamma_i \dot{s}_{ie},\\
\ddot{s}_{ei} &= \gamma_e^2 \left(N_{ei} Q_e(V_e) + \phi_n' - s_{ei}\right) - 2\gamma_e \dot{s}_{ei},\\
\ddot{s}_{ii} &= \gamma_i^2 \left(N_{ii}\, Q_i(V_i) \qquad - s_{ii}\right) - 2\gamma_i \dot{s}_{ii},\\
\dot{[\mathrm{Na}]} &= \left(\alpha_{\mathrm{Na}} Q_e(V_e) - \mathrm{Na}_{\mathrm{pump}}([\mathrm{Na}])\right)/\tau_{\mathrm{Na}}.
\end{aligned}$$

The currents are given by the following equations:

$$\begin{aligned}
I_L &= g_L(V_k - E_L),\\
I_{AMPA} &= g_{AMPA} s_{ek}(V_k - E_{AMPA}),\\
I_{GABA} &= g_{GABA} s_{ik}(V_k - E_{GABA}),\\
I_{\mathrm{KNa}} &= g_{\mathrm{KNa}} \frac{0.37}{1 + \left(\frac{38.7}{[\mathrm{Na}]}\right)^{3.5}} (V_e - E_K).
\end{aligned}$$

The sodium pump is described by:

$$\mathrm{Na}_{\mathrm{pump}}([\mathrm{Na}]) = R_{\mathrm{pump}} \left(\frac{[Na]^3}{[Na]^3 + 3375} - \frac{[Na]_{eq}^3}{[Na]_{eq}^3 + 3375} \right).$$