Supplementary Material

1 MODEL EQUATIONS AND PARAMETERS

The asymptotic functions m_∞ and w_∞ for the calcium and potassium conductances, respectively, are given by

$$m_\infty(v_i) = \frac{1}{2}\left(1 + \tanh\left((v_i - v_A)/v_B\right)\right), \tag{S1}$$

$$w_\infty(v_i) = \frac{1}{2}\left(1 + \tanh\left((v_i - v_C)/v_D\right)\right). \tag{S2}$$

Model parameters were adapted from Bose and Booth (2011) and are given in table S1:

Table S1. Default parameters for coupled Morris-Lecar model.

Parameter	value
g_L	0.15 mS/cm^2
g_Ca	0.3 mS/cm^2
g_K	0.6 mS/cm^2
v_L	-50 mV
v_Ca	100 mV
v_K	-70 mV
v_A	1 mV
v_B	14.5 mV
v_C	4 mV
v_D	15 mV
I	3.8 μA/cm^2
τ_w	100 ms
τ_a	1000 ms
τ_b	100 ms
τ_κ	100 ms
τ_γ	0.0001 ms
v_θ	0 mV
v_s	-80 mV
T	376 ms
T_{act}	49 ms
T_{inact}	327 ms
$g^\star$	0.0036 mS/cm^2
$\lambda := \exp(-T_{act}/\tau_b)$	0.612
$\rho := \exp(-T_{inact}/\tau_a)$	0.721

2 COMPUTING BIFURCATION DIAGRAM NUMERICALLY

The bifurcation diagram of stable $n-n$ solutions of the two-cell network in ?? is obtained numerically as follows: We initialise the coupling strength at parameter values associated with one type of $n-n$ solution, that is we choose the values $\bar{g} = 0.4, 0.7, 0.8, 0.9, 0.98$ for the $1-1$, $2-2$, $3-3$, $4-4$, and $5-5$ solutions respectively. For each $\bar{g}$ the system is then numerically integrated sufficiently long for any transients to fully subside. We then identify one period of the solution by finding the first return

of the depression variable d_1. That is, we choose some value d_k at a spike time t_k, and by iterating from spike to spike find some subsequent value d_{k+1} at spike time such that $|d_{k+1} - d_k| < \epsilon$. If a periodic solution of type $n-n$ is found in such way, $\bar{g}$ is step-wise increased/decreased, and the above algorithm is repeated. Otherwise, the set of all previously found solutions and the corresponding values $\bar{g}$ are returned.

Note that applying conventional methods of numerical continuation is not straightforward for our model, as the discontinuous resets in ?? and (??) make the root finding challenging (e.g. see Kuznetsov, 2004, for continuation methods).

REFERENCES

Bose A, Booth V. Co-existent activity patterns in inhibitory neuronal networks with short-term synaptic depression. Journal of Theoretical Biology 272 (2011) 42–54. doi:10.1016/j.jtbi.2010.12.001.

Kuznetsov A. Elements of applied bifurcation theory (Springer Science & Business Media) (2004). doi:10.1007/978-1-4757-3978-7.