S2 Table: **Details of positive feedback loop motif for JNK module.**

Species	Equation	Ref.
ATF2	$\dot{X}_1 = V_{y_1}^{x_1} \cdot f(Y_1, K_{y_1}^{x_1}) + V_{c_1}^{x_1,x_2} \cdot f(C_1, K_{c_1}^{x_1,x_2}) - k_{x_1}^{y_1} \cdot f(X_1, K_{x_1}^{y_1}) \cdot f_s^{\text{JNK}}$	
pATF2	$\dot{Y}_1 = k_{x_1}^{y_1} \cdot f(X_1, K_{x_1}^{y_1}) \cdot f_s^{\text{JNK}} + V_{z_1}^{y_1} \cdot f(Z_1, K_{z_1}^{y_1}) - V_{z_1}^{x_1} \cdot f(Y_1, K_{y_1}^{x_1}) - k_{y_1}^{z_1} \cdot f(Y_1, K_{y_1}^{z_1}) \cdot f_s^{\text{JNK}}$	
ppATF2	$\dot{Z}_1 = k_{y_1}^{z_1} \cdot f(Y_1, K_{y_1}^{z_1}) \cdot f_s^{\text{JNK}} - V_{z_1}^{y_1} \cdot f(Z_1, K_{z_1}^{y_1}) - k_{z_1,z_2}^{c_1} Z_2 Z_1 + k_{c_1}^{z_1 z_2} C_1$	
ppATF2:ppc-JUN	$\dot{C}_1 = k_{z_1,z_2}^{c_1} Z_2 Z_1 - k_{c_1}^{z_1,z_2} C_1 - V_{c_1}^{x_1,x_2} \cdot f(C_1, K_{c_1}^{x_1,x_2}) - k_{c_1}^{c_2} X_2^{pr} C_1 + k_{c_1}^{c_1} C_2$	
c-Jun$_{\text{pr}}$:ppATF2:ppc-JUN	$\dot{C}_2 = k_{c_1}^{c_2} X_2^{pr} C_1 - k_{c_2}^{c_1} C_2$	[1]
c-Jun$_{\text{pre-mRNA}}$	$\dot{X}_2^{pre_m RNA} = R_0 + k_{c_2}^{pre_m RNA} C_2 - \frac{V_c}{V_n} \cdot k_{pre_m RNA}^{mRNA} X_2^{pre_m RNA}$	
c-Jun$_{\text{mRNA}}$	$\dot{X}_2^{mRNA} = \frac{V_n}{V_c} \cdot k_{pre_m RNA}^{mRNA} X_2^{pre_m RNA} - k_{mRNA}^{\phi} X_2^{mRNA}$	
c-JUN$_{\text{p}}$	$\dot{X}_2^{p} = k_{mRNA}^{p} X_2^{mRNA} - k_{cyt}^{n} X_2^{p}$	
c-JUN	$\dot{X}_2 = \frac{V_c}{V_n} \cdot k_{cyt}^{n} X_2^{p} + V_{c_1}^{x_1 x_2} \cdot f(C_1, K_{c_1}^{x_1 x_2}) + V_D^{x_2, x_2^*} \cdot f(D, K_D^{x_2, x_2^*}) + 2 \cdot V_D^{x_2} \cdot f(D, K_D^{x_2})$ $+ V_{y_2}^{x_2} \cdot f(Y_2, K_{y_2}^{x_2}) - k_{x_2}^{y_2} \cdot f(X_2, K_{x_2}^{y_2}) \cdot f_s^{\text{JNK}} - k_{x_2}^{\phi} X_2$	
pc-JUN	$\dot{Y}_2 = k_{x_2}^{y_2} \cdot f(X_2, K_{x_2}^{y_2}) \cdot f_s^{\text{JNK}} + V_{z_2}^{y_2} \cdot f(Z_2, K_{z_2}^{y_2}) - k_{y_2}^{z_2} \cdot f(Z_2, K_{y_2}^{z_2}) \cdot f_s^{\text{JNK}} - V_{y_2}^{x_2} \cdot f(Y_2, K_{y_2}^{x_2}) - k_{y_2}^{\phi} Y_2$	
ppc-JUN	$\dot{Z}_2 = k_{y_2}^{z_2} \cdot f(Z_2, K_{y_2}^{z_2}) \cdot f_s^{\text{JNK}} - V_{z_2}^{y_2} \cdot f(Z_2, K_{z_2}^{y_2}) - k_{z_2}^{\phi} Z_2 - k_{z_1,z_2}^{c_1} Z_2 Z_1 + k_{c_1}^{z_1,z_2} C_1 - 2 \cdot k_{z_2}^{D} Z_2 Z_2 + 2 \cdot k_D^{z_2} D$ $- k_{z_2,z_2^*}^{D^*} Z_2 Z_2^* + k_{D^*}^{z_2,z_2^*} D^*$	
ppc-JUN:ppc-JUN	$\dot{D} = k_{z_2}^{D} Z_2 Z_2 - k_D^{z_2} D - V_D^{x_2} \cdot f(D, K_D^{x_2}) - k_D^{\phi} D$	

$V_{y_1}^{x_1} = 17.7672$ nM s^{-1}, $\quad K_{y_1}^{x_1} = 1.7933$ nM, $\quad V_{c_1}^{x_1,x_2} = 125.3660$ nM s^{-1}, $\quad K_{c_1}^{x_1,x_2} = 56.3667$ nM, $\quad k_{x_1}^{y_1} = 1.3369$ s^{-1}

$K_{x_1}^{y_1} = 21.5017$ nM, $\quad V_{z_1}^{y_1} = 8.485$ nM s^{-1}, $\quad K_{z_1}^{y_1} = 3.3207$ nM, $\quad k_{y_1}^{z_1} = 1.3369$ s^{-1}, $\quad K_{y_1}^{z_1} = 21.5017$ nM

$k_{z_1,z_2}^{c_1} = 0.9128$ nM s^{-1}, $\quad k_{c_1}^{z_1 z_2} = 1.7441$ s^{-1}, $\quad k_{c_1}^{c_2} = 0.2352$ nM s^{-1}, $\quad k_{c_2}^{c_1} = 14.6428$ s^{-1}, $\quad R_0 = 8.1524 \times 10^{-4}$ nM s^{-1}

$k_{c_2}^{pre_m RNA} = 0.4267$ s^{-1}, $\quad k_{pre_m RNA}^{mRNA} = 0.6621$ s^{-1}, $\quad k_{mRNA}^{\phi} = 0.068$ s^{-1}, $\quad k_{mRNA}^{p} = 59.9722$ s^{-1}

$k_{cyt}^{n} = 2.5531$ s^{-1}, $\quad V_{y_2}^{x_2} = 69.5154$ nM s^{-1}, $\quad K_{y_2}^{x_2} = 112.334$ nM, $\quad V_D^{x_2,x_2^*} = 55.9578$ nM s^{-1}, $\quad K_D^{x_2,x_2^*} = 8.947$ nM

$k_{x_2}^{y_2} = 6.5615$ nM s^{-1}, $\quad K_{x_2}^{y_2} = 27.1651$ nM, $\quad k_{x_2}^{\phi} = 0.0214$ s^{-1}, $\quad k_{y_2}^{z_2} = 1.3943$ s^{-1}, $\quad K_{y_2}^{z_2} = 2.069$ nM

$V_{z_2}^{y_2} = 11.9303$ nM s^{-1}, $\quad K_{z_2}^{y_2} = 110.6230$ nM, $\quad k_{z_2,z_2^*}^{D^*} = 0.2867$ nM s^{-1}, $\quad k_{D^*}^{z_2,z_2^*} = 1.2753$ s^{-1}, $\quad k_{z_2}^{\phi} = 0.00090396$ s^{-1}

$k_{y_2}^{\phi} = 0.0053$ s^{-1}, $\quad k_D^{\phi} = 0.0498$ s^{-1}, $\quad V_D^{x_2} = 105.164$ nM s^{-1}, $\quad K_D^{x_2} = 60.7342$ nM, $\quad k_{z_2}^{D} = 0.0546$ nM s^{-1}, $\quad k_D^{z_2} = 428.219$ s^{-1}

$f(x, K) = \dfrac{x}{K + x}$, $f_s = f_s(\alpha, \tau, t)$, $X_2^* = $ c-FOS, $Z_2^* = $ ppc-FOS, $D^* = $ ppc-FOS:ppc-JUN, $V_c = $ cell volume, $V_n = $ nucleus volume

[1] Miller GM, Ogunnaike BA, Schwaber JS, Vadigepalli R (2010) Robust dynamic balance of AP-1 transcription factors in a neuronal gene regulatory network. BMC Systems Biology 4: 171.