$$\frac{dA}{dt} = -k_1 * A$$

$$\frac{dA}{dt} = -k_{2f} * A + k_{2r} * B$$
$$\frac{dB}{dt} = k_{2f} * A - k_{2r} * B$$

Karin's

$$Ssk2 + ATP \xrightarrow{k_1^{MAP}} SskP + ADP$$
$$Ssk2P \xrightarrow{k_{-1}^{MAP}} Ssk2$$
$$Ssk2P + Pbs2 \xrightarrow{k_2^{MAP}} Ssk2 + Pbs2P$$
$$Pbs2P \xrightarrow{k_{-2}^{MAP}} Pbs2$$
$$Ssk2P + Pbs2P \xrightarrow{k_3^{MAP}} Ssk2 + Pbs2P_2$$
$$Pbs2P_2 \xrightarrow{k_{-3}^{MAP}} Pbs2P$$
$$Hog1 + Pbs2P_2 \xrightarrow{k_4^{MAP}} Hog1P + Pbs2P$$
$$Hog1P \xrightarrow{k_v - 4^{MAP}} Hog1$$
$$Hog1P + Pbs2P_2 \xrightarrow{k_5^{MAP}} Hog1P_{2cyt} + Pbs2P$$
$$Hog1P_{2cyt} \xrightarrow{k_{-5}^{MAP}} Hog1P$$
$$Hog1P_{2cyt} \xrightarrow{k_{trans}} Hog1P_{2nuc}$$
$$Hog1P_{2nuc} \xrightarrow{k_{dephos}} Hog1_{nuc}$$
$$Hog1_{nuc} \xrightarrow{k_{trans1}} Hog1$$
$$Hog1 \xrightarrow{k_{trans2}} Hog1_{nuc}$$

Paper's

$$Ssk2 + ATP \xrightarrow{k_1^{MAP}} SskP + ADP$$
$$Ssk2P \xrightarrow{k_{-1}^{MAP}} Ssk2$$
$$Pbs2 + ATP \xrightarrow{k_2^{MAP}} ADP + Pbs2P$$
$$Pbs2P \xrightarrow{k_{-2}^{MAP}} Pbs2$$
$$Pbs2P + ATP \xrightarrow{k_3^{MAP}} Pbs2P_2 + ADP$$
$$Pbs2P_2 \xrightarrow{k_{-3}^{MAP}} Pbs2P$$
$$Hog1 + ATP \xrightarrow{k_4^{MAP}} Hog1P + ADP$$
$$Hog1P \xrightarrow{k_v - 4^{MAP}} Hog1$$
$$Hog1P + ATP \xrightarrow{k_5^{MAP}} Hog1P_{2cyt} + ADP$$
$$Hog1P_{2cyt} \xrightarrow{k_{-5}^{MAP}} Hog1P$$
$$Hog1P_{2cyt} \xrightarrow{k_{trans}} Hog1P_{2nuc}$$
$$Hog1P_{2nuc} \xrightarrow{k_{dephos}} Hog1_{nuc}$$
$$Hog1_{nuc} \xrightarrow{k_{trans1}} Hog1$$
$$Hog1 \xrightarrow{k_{trans2}} Hog1_{nuc}$$

$$v_1^{MAP} = k_1^{MAP} * Ssk2 * Ssk1$$
$$v_{-1}^{MAP} = k_{-1}^{MAP} * Ssk2P$$
$$v_2^{MAP} = k_2^{MAP} * Ssk2 * Pbs2$$
$$v_{-2}^{MAP} = k_{-2} * Pbs2P$$
$$v_3^{MAP} = k_3^{MAP} * Ssk2P * Pbs2P$$
$$v_{-3}^{MAP} = k_{-3} * Pbs2P_2$$
$$v_4^{MAP} = k_4^{MAP} * Hog1 * PbsP_2$$
$$v_{-4}^{MAP} = k_{-4} * Hog1P$$
$$v_5^{MAP} = k_5 * Hog1P * Pbs2P_2$$
$$v_{-5}^{MAP} = k_{-5} * Hog1P_{2cyt}$$
$$v_{trans} = k_{trans} * Hog1P_{2cyt}$$
$$v_{dephos} = k_{dephos} * Hog1P_{2nuc} * Ptp2$$
$$v_{trans1} = k_{trans1} * Hog1_{nuc}$$
$$v_{trans2} = k_{trans2} * Hog1$$

Karin's

$$\frac{dSsk2}{dt} = -v_1^{MAP} + v_{-1}^{MAP} + v_2^{MAP} + v_3^{MAP}$$
$$\frac{dSsk2P}{dt} = v_1^{MAP} - v_{-1}^{MAP} - v_2^{MAP} - v_3^{MAP}$$
$$\frac{dPbs2}{dt} = -v_2^{MAP} + v_{-2}^{MAP}$$
$$\frac{dPbs2P}{dt} = v_2^{MAP} - v_{-2}^{MAP} - v_3^{MAP} + v_{-3}^{MAP} + v_4^{MAP}$$
$$\frac{dPbs2P_2}{dt} = v_3^{MAP} - v_{-3}^{MAP} - v_4^{MAP} - v_5^{MAP}$$
$$\frac{dHog1}{dt} = -v_4^{MAP} + v_{-4}^{MAP} + v_{trans1} - v_{trans2}$$
$$\frac{dHog1P}{dt} = v_4^{MAP} - v_{-4}^{MAP} - v_5^{MAP} + v_{-5}^{MAP}$$
$$\frac{dHog1P_{2cyt}}{dt} = v_5^{MAP} - v_{-5}^{MAP} - v_{trans}$$
$$\frac{dHog1P_{2nuc}}{dt} = v_{trans} - v_{dephos}$$
$$\frac{dHog1_{nuc}}{dt} = -v_{trans1} + v_{dephos} + v_{trans2}$$

Paper

$$\frac{dSsk2}{dt} = -v_1^{MAP} + v_{-1}^{MAP}$$
$$\frac{dSsk2P}{dt} = v_1^{MAP} - v_{-1}^{MAP}$$
$$\frac{dPbs2}{dt} = -v_2^{MAP} + v_{-2}^{MAP}$$
$$\frac{dPbs2P}{dt} = v_2^{MAP} - v_{-2}^{MAP} - v_3^{MAP} + v_{-3}^{MAP}$$
$$\frac{dPbs2P_2}{dt} = v_3^{MAP} - v_{-3}^{MAP}$$
$$\frac{dHog1}{dt} = -v_4^{MAP} + v_{-4}^{MAP} + v_{trans1} - v_{trans2}$$
$$\frac{dHog1P}{dt} = v_4^{MAP} - v_{-4}^{MAP} - v_5^{MAP} + v_{-5}^{MAP}$$
$$\frac{dHog1P_{2cyt}}{dt} = v_5^{MAP} - v_{-5}^{MAP} - v_{trans}$$
$$\frac{dHog1P_{2nuc}}{dt} = v_{trans} - v_{dephos}$$
$$\frac{dHog1_{nuc}}{dt} = -v_{trans1} + v_{dephos} + v_{trans2}$$

(1) $$\mathrm{Sln_1} \xrightarrow{k_1^{TCS}} \mathrm{Sln_1P}$$

(2) $$\mathrm{Sln_1P} + \mathrm{Ypd_1} \underset{k_{-2}^{TCS}}{\overset{k_2^{TCS}}{\rightleftharpoons}} \mathrm{Sln_1} + \mathrm{Ypd_1P}$$

(3) $$\mathrm{Ypd_1P} + \mathrm{Ssk_1} \xrightarrow{k_3^{TCS}} \mathrm{Ypd_1} + \mathrm{Ssk_1P}$$

(4) $$\mathrm{Ssk_1P} \xrightarrow{k_4^{TCS}} \mathrm{Ssk_1}$$

$$\frac{dVolume}{dt} = -v_0^{TCS}$$
$$\frac{dSln1}{dt} = -v_1^{TCS} + v_2^{TCS}$$
$$\frac{dSln1P}{dt} = v_1^{TCS} - v_2^{TCS}$$
$$\frac{dYpd1}{dt} = -v_2^{TCS} + v_3^{TCS}$$
$$\frac{dYpd1P}{dt} = v_2^{TCS} - v_3^{TCS}$$
$$\frac{dSsk1}{dt} = -v_3^{TCS} + v_4^{TCS}$$
$$\frac{dSsk1P}{dt} = v_3^{TCS} - v_4^{TCS}$$

$$v_0^{TCS} = k_0^{TCS} * SSk1$$
$$v_1^{TCS} = k_1^{TCS} * Sln1$$
$$v_2^{TCS} = k_2^{TCS} * Sln1 * Ypd1 - k_{-2}^{TCS} * Sln1 * Ypd1P$$
$$v_3^{TCS} = k_3^{TCS} * Ssk1 * Ypd1P$$
$$v_4^{TCS} = k_4^{TCS} * Ssk1P$$

$$v0 = k0 * Receptor$$
$$v1 = k1 * MAPKKK * Receptor$$
$$v2 = k2 * MAPKKKP * Phosphotase$$
$$v3 = k3 * MAPKK * MAPKKKP$$
$$v4 = k4 * MAPKKP * Phosphotase$$
$$v5 = k5 * MAPK * MAPKKP$$
$$v6 = k6 * MAPKP * Phosphotase$$

$$\frac{dReceptor}{dt} = -v0$$
$$\frac{dMAPKKKP}{dt} = v1 - v2$$
$$\frac{dMAPKKP}{dt} = v3 - v4$$
$$\frac{dMAPKP}{dt} = v5 - v6$$
$$\frac{dMAPKKK}{dt} = -dMAPKKKP$$
$$\frac{dMAPKK}{dt} = -dMAPKKP$$
$$\frac{dMAPK}{dt} = -dMAPKP$$
$$\frac{dPhosphotase}{dt} = 0$$

$$v_0 = k_0 * Ssk1$$
$$v_1^{MAP} = k_1^{MAP} * Ssk2 * Ssk1$$
$$v_{-1}^{MAP} = k_{-1}^{MAP} * Ssk2P$$
$$v_2^{MAP} = k_2^{MAP} * Ssk2 * Pbs2$$
$$v_{-2}^{MAP} = k_{-2} * Pbs2P$$
$$v_3^{MAP} = k_3^{MAP} * Ssk2P * Pbs2P$$
$$v_{-3}^{MAP} = k_{-3} * Pbs2P_2$$
$$v_4^{MAP} = k_4^{MAP} * Hog1 * PbsP_2$$
$$v_{-4}^{MAP} = k_{-4} * Hog1P$$
$$v_5^{MAP} = k_5 * Hog1P * Pbs2P_2$$
$$v_{-5}^{MAP} = k_{-5} * Hog1P_2$$

$$\frac{dSsk1}{dt} = -v_0^{MAP}$$
$$\frac{dSsk2}{dt} = -v_1^{MAP} + v_{-1}^{MAP}$$
$$\frac{dSsk2P}{dt} = v_1^{MAP} - v_{-1}^{MAP}$$
$$\frac{dPbs2}{dt} = -v_2^{MAP} + v_{-2}^{MAP}$$
$$\frac{dPbs2P}{dt} = v_2^{MAP} - v_{-2}^{MAP} - v_3^{MAP} + v_{-3}^{MAP}$$
$$\frac{dPbs2P_2}{dt} = v_3^{MAP} - v_{-3}^{MAP}$$
$$\frac{dHog1}{dt} = -v_4^{MAP} + v_{-4}^{MAP}$$
$$\frac{dHog1P}{dt} = v_4^{MAP} - v_{-4}^{MAP} - v_5^{MAP} + v_{-5}^{MAP}$$
$$\frac{dHog1P_2}{dt} = v_5^{MAP} - v_{-5}^{MAP}$$

$$vts = kts_1 * Hog_1P_{2nuc}$$
$$vex = kex * mRNA_{nuc}$$
$$vrd = kts * mRNA_{cyt}$$
$$vtl = ktl * mRNA_{cyt}$$
$$vpd = kpd * Protein$$

$$\frac{dmRNA_{nuc}}{dt} = vts - vex$$
$$\frac{dmRNA_{cyt}}{dt} = vex - vrd$$
$$\frac{dProtein}{dt} = vtl - vpd$$

$$f(E, S, ES)$$