Electronic supplementary material for Andrec, et al. "Inference of Signaling and Gene Regulatory Networks..."

For purposes of generating synthetic data, the following detailed kinetic model for the MAPK cascade shown in Figure 1 was used:

$$d[MKKKPP]/dt = k_{cat2}\,[RasGTP]\,[MKKKP]/[(K_{11} + [MKKK] + K_{11}\,[MKKKP]/K_{12})\,(1 + [MAPKPP]/K_i)] - V_{max3}\,[MKKKPP]/(K_{31} + [MKKKPP] + K_{31}\,[MKKKP]/K_{32} + K_{31}\,[MKKK]/K_{33}),$$

$$d[MKKKP]/dt = k_{cat1}\,[RasGTP]\,[MKKK]/[(K_{11} + [MKKK] + K_{11}\,[MKKKP]/K_{12})\,(1 + [MAPKPP]/K_i)] - k_{cat2}\,[RasGTP]\,[MKKKP]/[(K_{11} + [MKKK] + K_{11}\,[MKKKP]/K_{12})\,(1 + [MAPKPP]/K_i)] + V_{max3}\,[MKKKPP]/(K_{31} + [MKKKPP] + K_{31}\,[MKKKP]/K_{32} + K_{31}\,[MKKK]/K_{33}) - V_{max4}\,[MKKKP]/(K_{31} + [MKKKPP] + K_{31}\,[MKKKP]/K_{32} + K_{31}\,[MKKK]/K_{33}),$$

$$d[MKKPP]/dt = k_{cat6}\,[MKKP]\,[MKKKPP]/(K_{51} + [MKK] + K_{51}\,[MKKP]/K_{52}) - V_{max7}\,[MKKPP]\,(1+A\,[MAPKPP]/K_{mp})/[(K_{71} + [MKKPP] + K_{71}\,[MKKP]/K_{72} + K_{71}\,[MKK]/K_{73})\,(1+[MAPKPP]/K_{mp})],$$

$$d[MKKP]/dt = k_{cat5}\,[MKK]\,[MKKKPP]/(K_{51} + [MKK] + K_{51}\,[MKKP]/K_{52}) - k_{cat6}\,[MKKP]\,[MKKKPP]/(K_{51} + [MKK] + K_{51}\,[MKKP]/K_{52}) + V_{max7}\,[MKKPP]\,(1+A\,[MAPKPP]/K_{mp})/[(K_{71} + [MKKPP] + K_{71}\,[MKKP]/K_{72} + K_{71}\,[MKK]/K_{73})\,(1+[MAPKPP]/K_{mp})] - V_{max8}\,[MKKP]\,(1+A\,[MAPKPP]/K_{mp})/[(K_{71} + [MKKPP] + K_{71}\,[MKKP]/K_{72} + K_{71}\,[MKK]/K_{73})\,(1+[MAPKPP]/K_{mp})],$$

$$d[MAPKPP]/dt = k_{cat10}\,[MKKPP]\,[MAPKP]/(K_{91} + [MAPK] + K_{91}\,[MAPKP]/K_{92}) - V_{max11}\,[MAPKPP]/(K_{111} + [MAPKPP] + K_{111}\,[MAPKP]/K_{112} + K_{111}\,[MAPK]/K_{113}),$$

$$d[MAPKP]/dt = k_{cat9}\,[MKKPP]\,[MAPK]/(K_{91} + [MAPK] + K_{91}\,[MAPKP]/K_{92}) - k_{cat10}\,[MKKPP]\,[MAPKP]/(K_{91} + [MAPK] + K_{91}\,[MAPKP]/K_{92}) + V_{max11}\,[MAPKPP]/(K_{111} + [MAPKPP] + K_{111}\,[MAPKP]/K_{112} + K_{111}\,[MAPK]/K_{113}) - V_{max12}\,[MAPKP]/(K_{111} + [MAPKPP] + K_{111}\,[MAPKP]/K_{112} + K_{111}\,[MAPK]/K_{113}),$$

along with the following kinetic parameters:

$$[MKKK]_{tot} = [MKKK] + [MKKKP] + [MKKKPP] = 200 \text{ nM},$$

$$[MKK]_{tot} = [MKK] + [MKKP] + [MKKPP] = 180 \text{ nM},$$

$$[MAPK]_{tot} = [MAPK] + [MAPKP] + [MAPKPP] = 360 \text{ nM},$$

$$k_{cat1} = k_{cat5} = k_{cat9} = 1 \text{ s}^{-1},$$

$$k_{cat2} = k_{cat6} = k_{cat10} = 15 \text{ s}^{-1},$$

$$V_{max3} = V_{max7} = 18.8 \text{ nM s}^{-1},$$

$$V_{max4} = V_{max8} = 16.4 \text{ nM s}^{-1},$$

$$V_{max11} = 8.4 \text{ nM s}^{-1},$$

$$V_{max12} = 7.3 \text{ nM s}^{-1},$$

$$[RasGTP] = 20 \text{ nM},$$

$$K_{11} = 300 \text{ nM}, K_{12} = 20 \text{ nM}, K_i = 100 \text{ nM},$$

$$K_{31} = 22 \text{ nM}, K_{32} = 18 \text{ nM}, K_{33} = 80 \text{ nM},$$

$$K_{51} = 300 \text{ nM}, K_{52} = 20 \text{ nM},$$

$$K_{71} = 22 \text{ nM}, K_{72} = 18 \text{ nM}, K_{73} = 80 \text{ nM}, K_{mp} = 100 \text{ nM},$$

$$K_{91} = 300 \text{ nM}, K_{92} = 20 \text{ nM},$$

$$K_{111} = 22 \text{ nM}, K_{112} = 18 \text{ nM}, K_{113} = 80 \text{ nM}, A = 5.$$