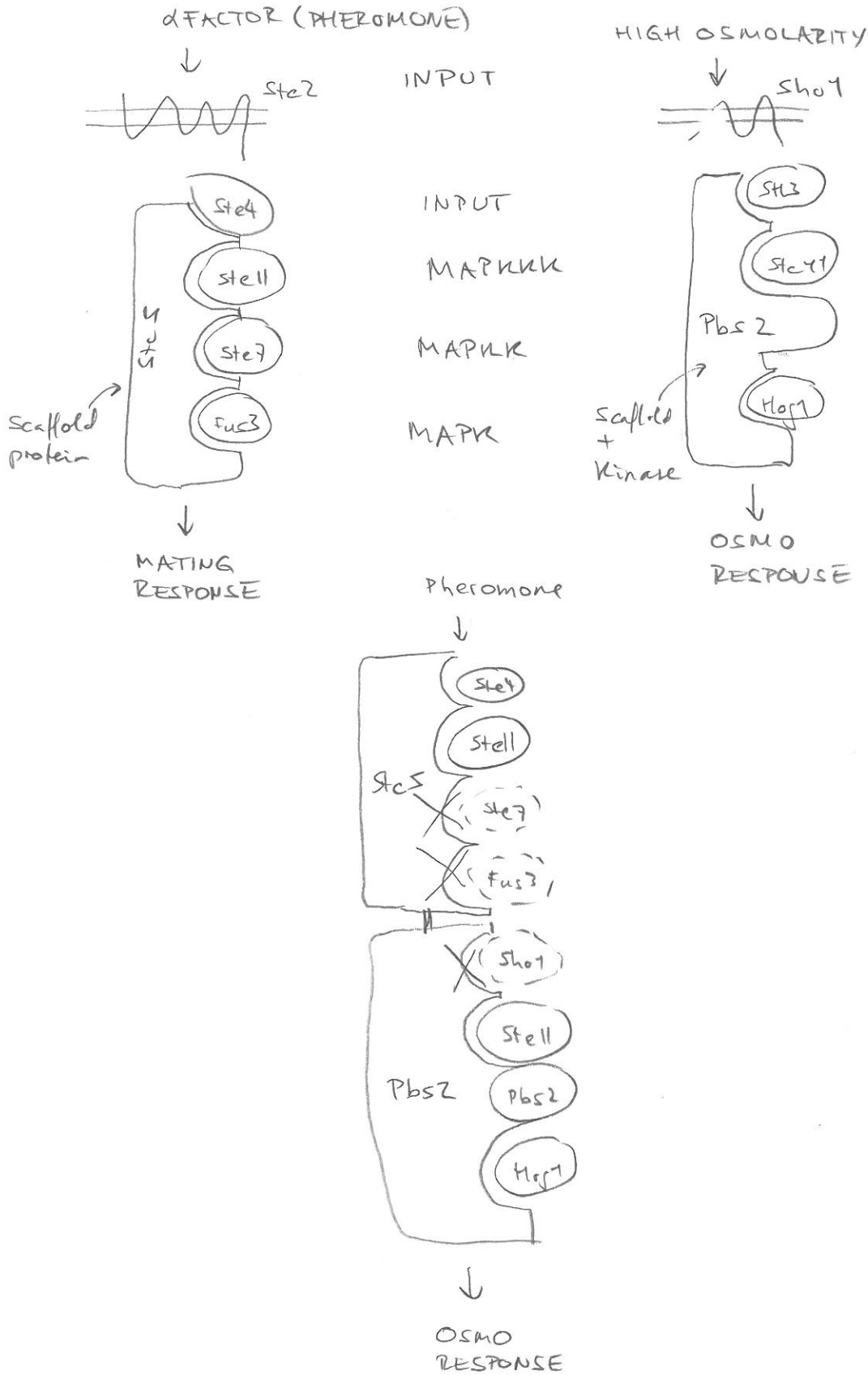


SYNTHETIC MAPK SIGNALING IN YEAST (EXAMPLE)

(WENDELL LIM GROUP, 2003)



ENZYME LOGIC



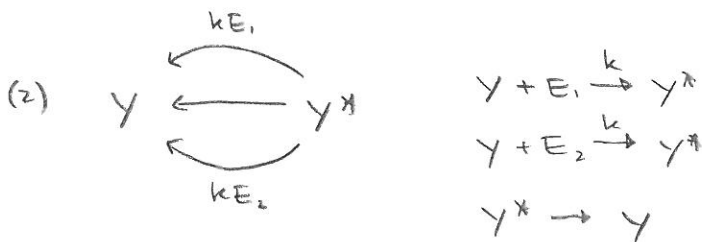
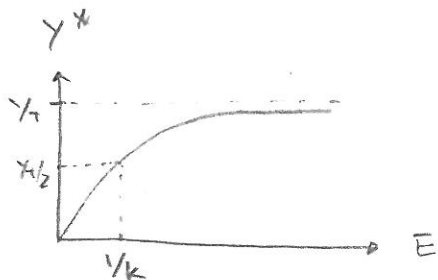
E: KINASE

Y (Y*) : (UN)PHOSPHORYLATED / (IN)ACTIVE

$$Y_T = Y + Y^*$$

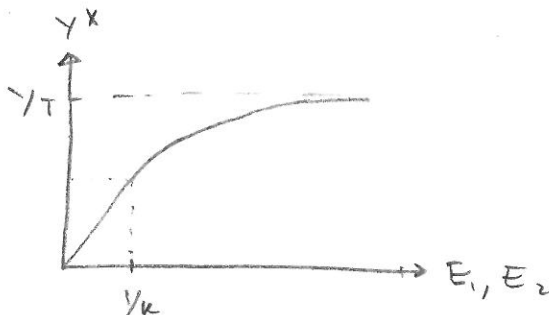
$$\dot{Y}^* = kEY - Y^* = kE(Y_T - Y^*) - Y^* \stackrel{!}{=} 0 \quad (\text{STEADY STATE})$$

$$\Rightarrow Y^* = \frac{kE Y_T}{1 + kE}$$



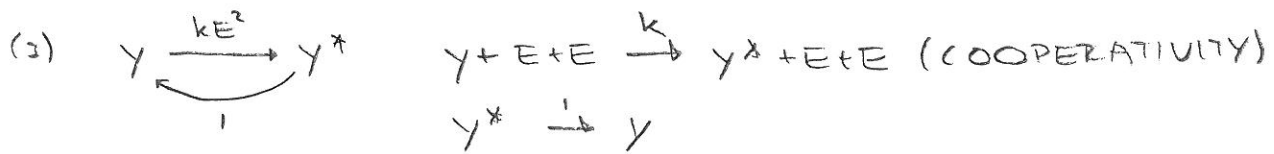
$$\dot{Y}^* = k(E_1 + E_2)Y - Y^* = k(E_1 + E_2)(Y_T - Y^*) - Y^* \stackrel{!}{=} 0$$

$$\Rightarrow Y^* = \frac{k(E_1 + E_2) Y_T}{1 + k(E_1 + E_2)}$$



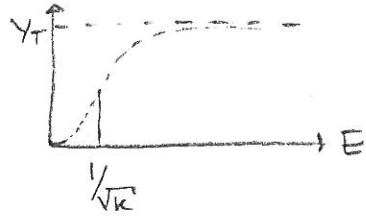
OR LOGIC: E_1, E_2 ARBITRARY

AND LOGIC: $0 < E_1, E_2 < 1/k$



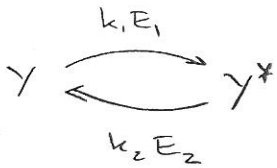
$$\dot{Y}^* = kE^2 Y - Y^* k_1 = kE^2 (Y_T - Y^*) - Y^* k_1 = 0$$

$$Y^* = \frac{kE^2 Y_T}{1 + kE^2 Y_T}$$

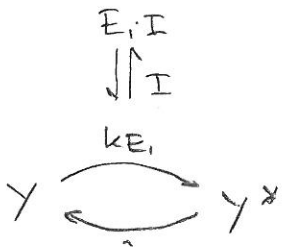


SIGMOIDAL

(4) ZERO ORDER ULTRASENSITIVITY



(5) INHIBITOR ULTRASENSITIVITY



(6) CASCADING

