

Differential equations of the PTEN kinetic model

Association & dissociation reactions

$$\frac{\partial[Grp1 - PI(3,4,5)P3]_m}{\partial t} = k_a^{Grp1}[Grp1]_{comp_sol}[PI(3,4,5)P3]_m - k_d^{Grp1}[Grp1 - PI(3,4,5)P3]_m \quad [S1]$$

$$\begin{aligned} \frac{\partial[Grp1]_{comp_sol}}{\partial t} = & \frac{1}{h} \{ k_{tr}(Grp1_{B_sol} - Grp1_{comp_sol}) + k_d^{Grp1}[Grp1 - PI(3,4,5)P3]_m \\ & - k_a^{Grp1}[Grp1]_{comp_sol}[PI(3,4,5)P3]_m \} \end{aligned} \quad [S2]$$

$$\frac{\partial[PTEN]_m}{\partial t} = k_a^{PTEN}[PTEN]_{comp_sol} - k_d^{PTEN}[PTEN]_m \quad [S3]$$

$$\frac{\partial[PTEN]_{comp_sol}}{\partial t} = \frac{1}{h} \{ k_{tr}(PTEN_{B_sol} - PTEN_{comp_sol}) - k_a^{PTEN}[PTEN]_{comp_sol} + k_d^{PTEN}[PTEN]_m \} \quad [S4]$$

$$\begin{aligned} \frac{\partial[PTEN - PI(4,5)P2]_m}{\partial t} = & k_a^{PTEN - PI(4,5)P2}[PTEN]_{comp_sol}[PI(4,5)P2]_m \\ & - k_d^{PTEN - PI(4,5)P2}[PTEN - PI(4,5)P2]_m \end{aligned} \quad [S5]$$

Enzyme dephosphorylation reactions

$$\begin{aligned} \frac{\partial[PI(3,4,5)P3]_m}{\partial t} = & -k_{cat}^{PTEN}[PTEN]_m \left\{ \frac{[PI(3,4,5)P3]_m}{K_M^{PTEN} + [PI(3,4,5)P3]_m} \right\} \\ & - k_{cat}^{eff}[PTEN - PI(4,5)P2]_m \left\{ \frac{[PI(3,4,5)P3]_m}{K_M^{PTEN - PI(4,5)P2} + [PI(3,4,5)P3]_m} \right\} \\ & + k_d^{Grp1}[Grp1 - PI(3,4,5)P3]_m - k_a^{Grp1}[Grp1]_{comp_sol}[PI(3,4,5)P3]_m \end{aligned} \quad [S6]$$

$$\frac{\partial[PI(4,5)P2]_m}{\partial t} = k_{cat}^{PTEN}[PTEN]_m \left\{ \frac{[PI(3,4,5)P3]_m}{K_M^{PTEN} + [PI(3,4,5)P3]_m} \right\}$$

$$\begin{aligned}
& + k_{cat}^{eff} [PTEN - PI(4,5)P2]_m \left\{ \frac{[PI(3,4,5)P3]_m}{K_M^{PTEN-PI(4,5)P2} + [PI(3,4,5)P3]_m} \right\} \\
& - k_a^{PTEN-PI(4,5)P2} [PTEN]_{comp_sol} [PI(4,5)P2]_m + k_d^{PTEN-PI(4,5)P2} [PTEN - PI(4,5)P2]_m
\end{aligned} \tag{S7}$$

where $k_{cat}^{eff} = k_{cat}^{PTEN-PI(4,5)P2} \left\{ \frac{[PI(4,5)P2]_m^n}{(K_{PTEN,PI(4,5)P2})^n + [PI(4,5)P2]_m^n} \right\}$

Meaning of subscripts:

- a. m: protein or lipids are on the membrane
- b. comp_sol: protein in the inner compartment of chamber
- c. B_sol: protein in the bulk solution

a. Allosteric only model (S1-S4, S8, S9 Eqs.)

$$\begin{aligned}
\frac{\partial [PI(3,4,5)P3]_m}{\partial t} & = -k_{cat}^{PTEN} [PTEN]_m \left\{ \frac{[PI(3,4,5)P3]_m}{K_M^{PTEN} + [PI(3,4,5)P3]_m} \right\} \\
& - k_{cat}^{PTEN-PI(4,5)P2} \left(\frac{[PI(4,5)P2]_m^n}{(K_{PTEN,PI(4,5)P2})^n + [PI(4,5)P2]_m^n} \right) \left(\frac{[PTEN]_m [PI(3,4,5)P3]_m}{K_M^{PTEN-PI(4,5)P2} + [PI(3,4,5)P3]_m} \right) \\
& + k_d^{Grp1} [Grp1 - PI(3,4,5)P3]_m - k_a^{Grp1} [Grp1]_{comp_sol} [PI(3,4,5)P3]_m
\end{aligned} \tag{S8}$$

$$\frac{\partial [PI(4,5)P2]_m}{\partial t} = k_{cat}^{PTEN} [PTEN]_m \left\{ \frac{[PI(3,4,5)P3]_m}{K_M^{PTEN} + [PI(3,4,5)P3]_m} \right\}$$

$$+ k_{cat}^{PTEN-PI(4,5)P2} \left(\frac{[PI(4,5)P2]_m^n}{(K_{PTEN,PI(4,5)P2})^n + [PI(4,5)P2]_m^n} \right) \left(\frac{[PTEN]_m [PI(3,4,5)P3]_m}{K_M^{PTEN-PI(4,5)P2} + [PI(3,4,5)P3]_m} \right) \quad [S9]$$

b. Recruitment only model (S1-S5, S10, S11 Eqs.)

$$\begin{aligned} \frac{\partial [PI(3,4,5)P3]_m}{\partial t} = & -k_{cat}^{PTEN} \{ [PTEN]_m + [PTEN - PI(4,5)P2]_m \} \left\{ \frac{[PI(3,4,5)P3]_m}{K_M^{PTEN} + [PI(3,4,5)P3]_m} \right\} \\ & + k_d^{Grp1} [Grp1 - PI(3,4,5)P3]_m - k_a^{Grp1} [Grp1]_{comp_sol} [PI(3,4,5)P3]_m \end{aligned} \quad [S10]$$

$$\begin{aligned} \frac{\partial [PI(4,5)P2]_m}{\partial t} = & k_{cat}^{PTEN} \{ [PTEN]_m + [PTEN - PI(4,5)P2]_m \} \left\{ \frac{[PI(3,4,5)P3]_m}{K_M^{PTEN} + [PI(3,4,5)P3]_m} \right\} \\ & - k_a^{PTEN-PI(4,5)P2} [PTEN]_{comp_sol} [PI(4,5)P2]_m + k_d^{PTEN-PI(4,5)P2} [PTEN - PI(4,5)P2]_m \end{aligned} \quad [S11]$$