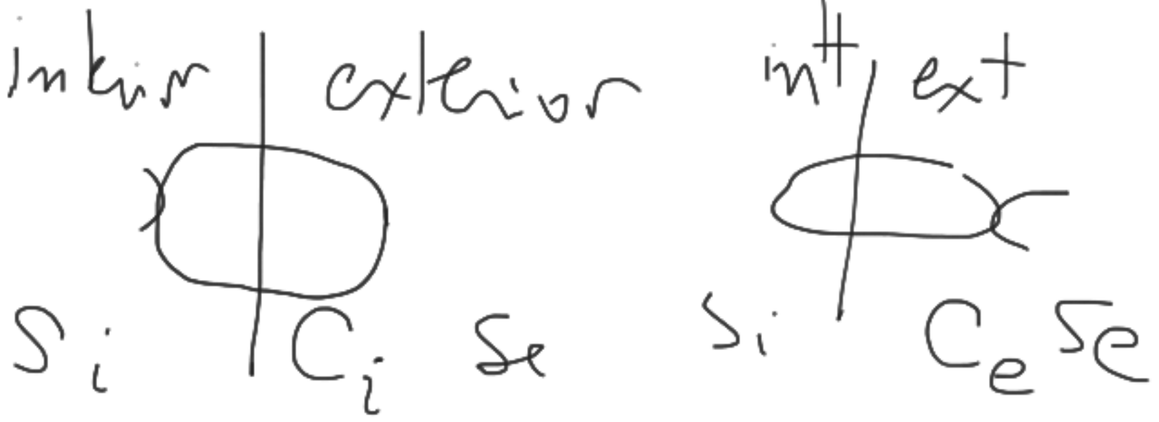
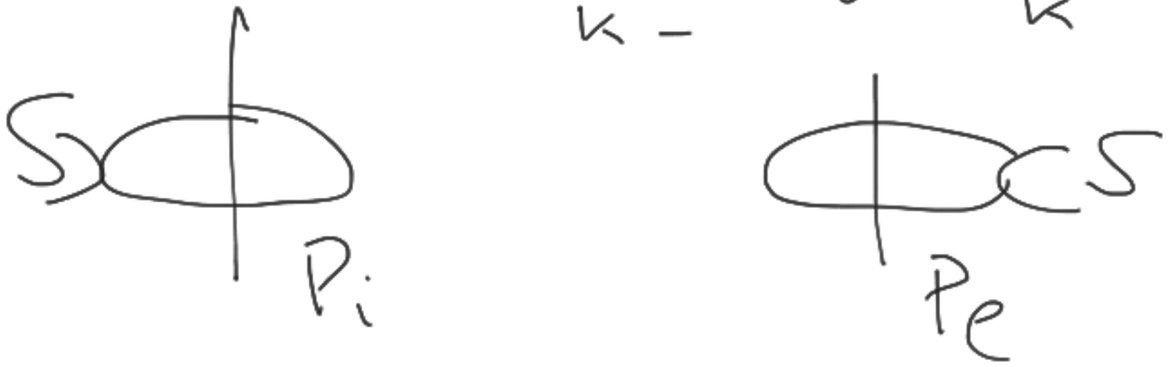
Uniport. Modelo tenchillo

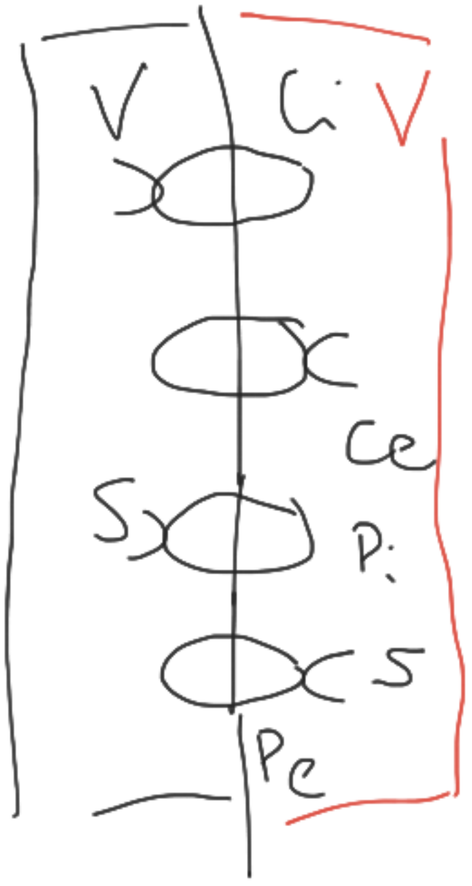


Transporta una especie S

$$S_i + C_i \underset{k-}{\overset{k+}{\rightleftharpoons}} P_i \overset{k}{\rightleftharpoons} P_e \underset{k+}{\overset{k-}{\rightleftharpoons}} S_e + C_e$$

$$C_i \overset{k}{\rightleftharpoons} C_e$$





N_{Ci} = # de canes Ci

Análogam N_{Ce}, N_{Pi}, N_{Pe}

$$N_{Ci} + N_{Ce} + N_{Pi} + N_{Pe} = cons^t = N_0$$

Si S está en V del lado de adentro y hay algún Ci ahí, lo "mira" y análogam, si S está en V del lado de afuera y hay algún Ce → lo "mira"

Prob que unidad de tiempo de que un S que está en V se pegue a 1 C_i = α_+ · Análogam, infer → α_+ del lado adentro

$S_i + C_i \underset{k_-}{\overset{k_+}{\rightleftharpoons}} P_i \quad \underset{k}{\overset{k}{\rightleftharpoons}} \quad P_e \underset{k_+}{\overset{k_-}{\rightleftharpoons}} S_e + C_e$

$C_i \underset{k}{\overset{k}{\rightleftharpoons}} C_e$

$V[S_i]$ = # de moléculas de S del lado de adentro que pueden pegarse al caver

$$0 = \frac{d}{dt}\left(V[S_i]\right) = -\alpha_+ V [S_i] N_{Ci} + k_- N_{Pi} - f_i$$

k_+

$$0 = \frac{d}{dt}\left(V[S_e]\right) = -k_+ [S_e] N_{Ce} + k_- N_{Pe} + f_e$$

$$0 = \frac{d N_{Ci}}{dt} = -k_+ [S_i] N_{Ci} + k_- N_{Pi} - k N_{Ci} + k N_{Ce}$$

$= f_i$

$$0 = \frac{dN_{Pi}}{dt} = k_+ [S_i] N_{Ci} - k_- N_{Pi} - k N_{Pi} + \cancel{k} N_{Pe}$$

$\Rightarrow -f$

$$f_i = f_e = f$$

$$N_0 = N_{Ci} + N_{Ce} + N_{Pi} + N_{Pe}$$

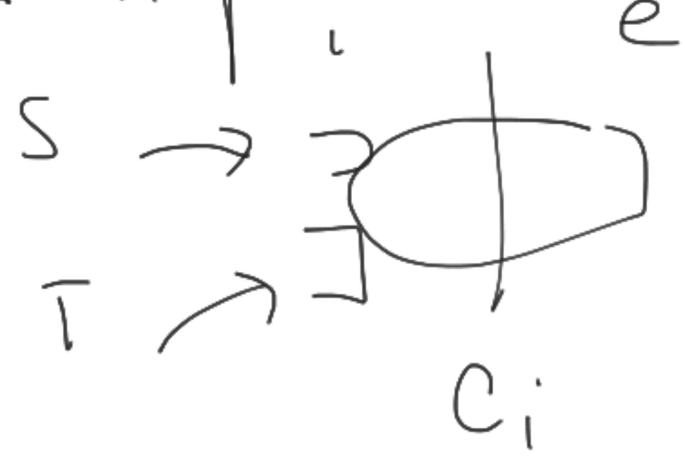
Resolviendo: $f > 0 \Rightarrow$ transp de atrás hacia adentro

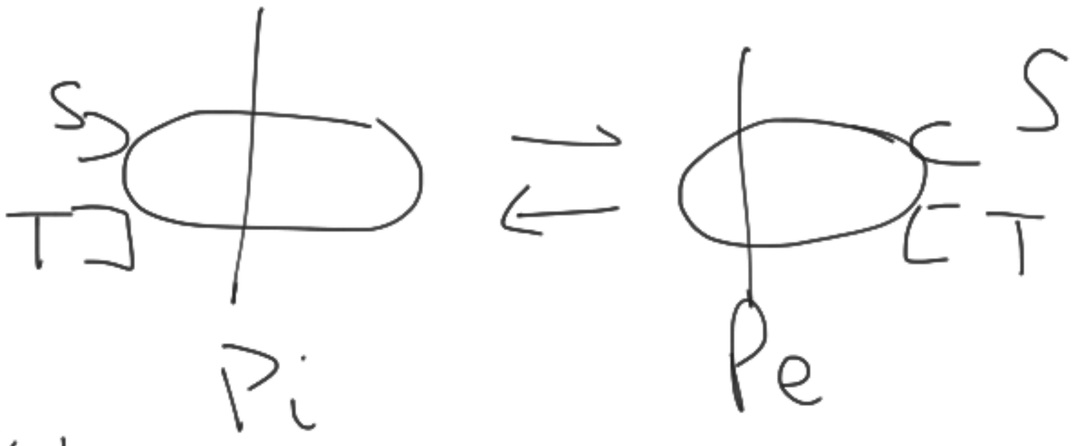
$$f = \frac{([S_e] - [S_i])/2 \; N_0 \; \frac{k_-}{k_+} \; \frac{k}{k_+} \; k_+}{[S_i][S_i] + [S_i]\left(\frac{k_-}{k_+} + \frac{k}{k_+}\right) + [S_e]\left(\frac{k_-}{k_+} + \frac{k}{k_+}\right) + \left(\frac{k_-}{k_+}\right)^2 + 2\frac{k_-}{k_+}\frac{k}{k_+}}$$

Saturac con concentrac de lo que se transp.

Análogamente se pueden plantear modelos de cotransporte y contratransporte - Ejemplo más sencillo → 1 solo sitio de ligadura para c/especie.

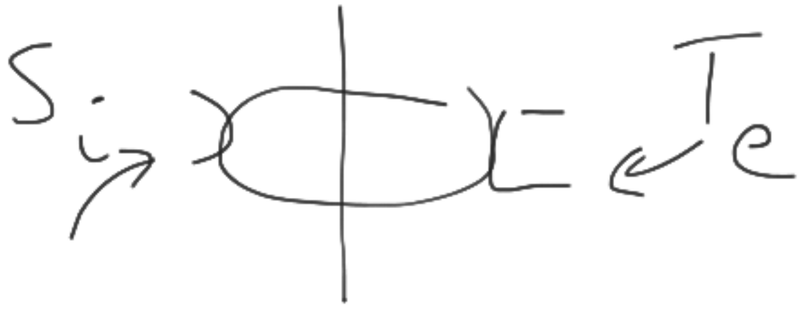
Cotransp.:



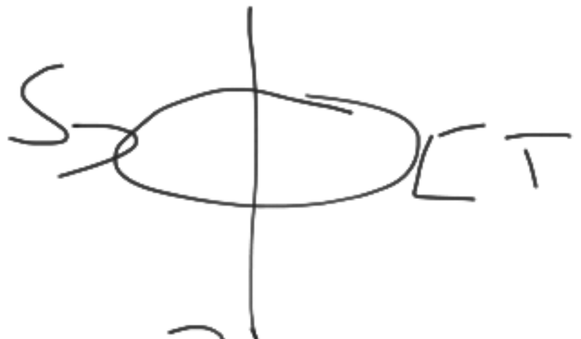


$$S_i + T_i + C_i \underset{k-}{\overset{k+}{\rightleftharpoons}} P_i \underset{k}{\overset{k}{\rightleftharpoons}} P_e \underset{k+}{\overset{k-}{\rightleftharpoons}} S_e + T_e + C_e$$

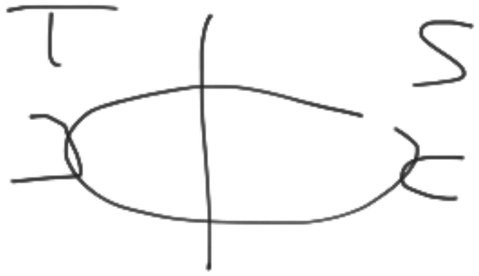
$$C_i \overset{K}{\rightleftharpoons} C_e$$



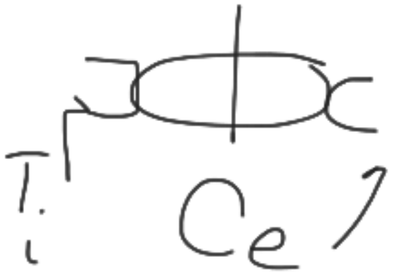
Ci



Pi



Pe



$$Si + Te + Ci \underset{K-}{\overset{K+}{\rightleftharpoons}} Pi \overset{K}{\rightleftharpoons} Pe \underset{K+}{\overset{K-}{\rightleftharpoons}} Se + Ti + Ce$$

Si hay n moléculas de S y n de T

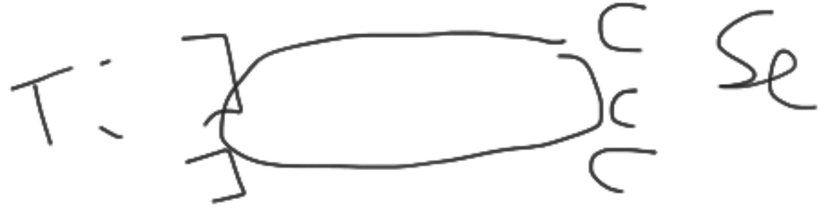
Con Entratransp

$$nSi + nTe + Ci \underset{K-}{\overset{K+}{\rightleftharpoons}} Pi \rightleftharpoons Pe \underset{K+}{\overset{K-}{\rightleftharpoons}} Se + Ti + Ce$$

$$\frac{d}{dt}(V[S_i]) = -m\,\underbrace{K_+ [S_i]^m [Te]^n}_{\text{unid de } 1/\text{tempo}}\, N_{Ci} + m K_- N_{Pi} - f_{Si}$$

de reacciones por unid de tiempo

$$\frac{d}{dt}(V[Te]) = -nK_+ [S_i]^m [Te]^n N_{Ci} + nK_- N_{Pi} - f_{Te}$$



Est estacionario

$$\frac{d}{dt} = 0$$

$$\rightarrow f_{Si} = m f_{Te}, \quad f_{Te} = n f$$

Contrat

$$f = \frac{1}{2} \frac{k}{k_+} \frac{k_-}{k_+} k_+ N_0 \frac{[S_e]^m [T_i]^n - [S_i]^m [T_e]^n}{\left([S_i]^m [T_e]^n + \frac{k_-}{k_+} + \frac{k}{k_+}\right) \cdot \left([S_e]^m [T_i]^n + \frac{k_-}{k_+} + \frac{k}{k_+}\right) \cdots}$$

$$f > 0 \iff \frac{[S_e]^m}{[S_i]^m} > \frac{[T_e]^n}{[T_i]^n}$$

Se na la saturación

Ejemplo de contra transp → intercamb de Na^+ _ Ca^{2+}

$S = Na^+$; $m = 3$, $T = Ca^{2+}$; $n = 1$

mando Na^+ de afuera → Ca^{2+} al ver / adentro

$$\frac{[Na^+]_e^3}{[Na^+]_i^3} > \frac{[Ca^{2+}]_e}{[Ca^{2+}]_i}$$

$$\Leftrightarrow \quad \frac{[Ca^{2+}]_i}{[Ca^{2+}]_e} > \frac{[Na^+]_i^3}{[Na^+]_e^3}$$

$$\frac{[Na^+]_i^3}{[Na^+]_e^3} < 1$$