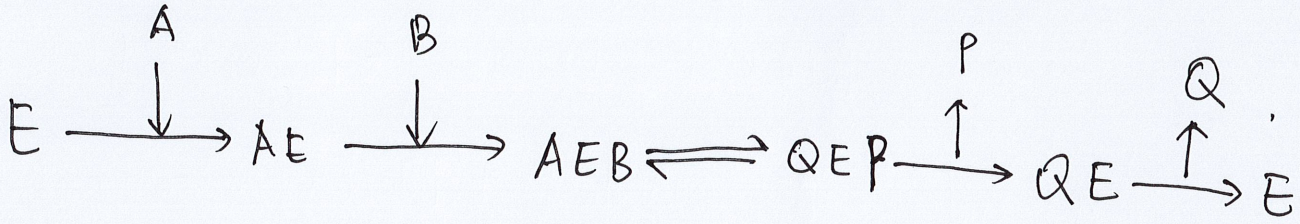
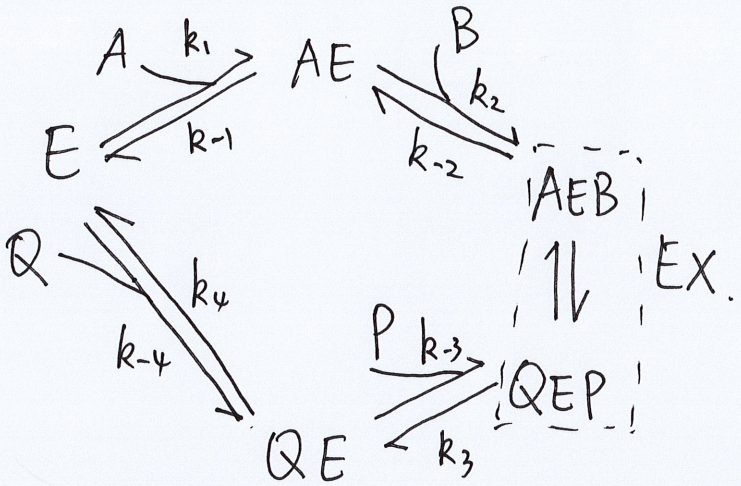
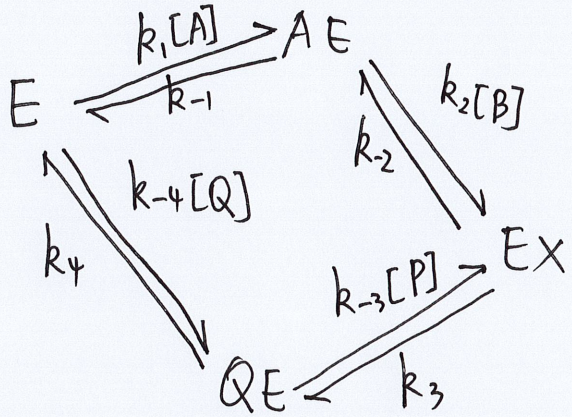
Ordered Bi Bi

2020. 11. 11



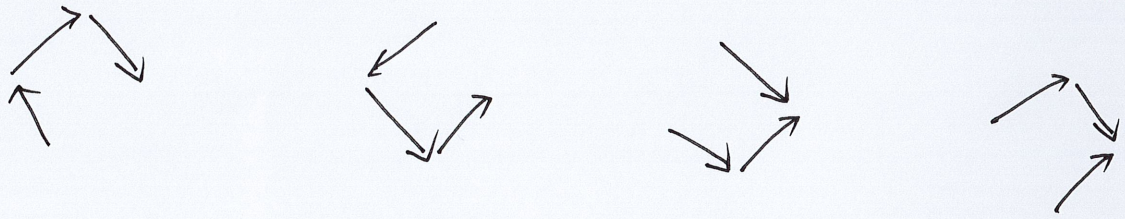




$$\frac{[E]}{[E]_t} = \frac{1}{D}\left(k_3 k_{-2} k_{-1}[P] + k_2[B] k_3 k_4 + k_{-1} k_3 k_4 + k_4 k_{-1} k_{-2}\right)$$

$$\frac{[AE]}{[E]_t} = \frac{1}{D}\left(k_3 k_4 k_1[A] + k_{-4}[Q] k_3[P] k_{-2} + k_1[A] k_{-2} k_3[P] + k_4 k_1[A] k_{-2}\right)$$

$$\frac{[EX]}{[E]_t} = \frac{1}{D}\left(k_4 k_1[A]k_2[B] + k_{-1}k_{-4}[Q]k_{-3}[P] + k_{-4}[Q]k_{-3}[P]k_2[B] + k_1[A]k_2[B]k_{-3}[P]\right)$$



$$\frac{[QE]}{[E]_t} = \frac{1}{D}\left(k_{-2}k_{-1}k_{-4}[Q] + k_1[A]k_2[B]k_3 + k_{-1}k_{-4}[Q]k_3 + k_{-4}[Q]k_2[B]k_3\right)$$

$$D = k_{-1}k_4(k_{-2}+k_3) + k_1k_4(k_{-2}+k_3)[A] + k_2k_3k_4[B]$$
$$+ k_{-1}k_{-2}k_{-3}[P] + k_{-1}k_{-4}(k_{-2}+k_3)[Q]$$
$$+ k_1k_2(k_3+k_4)[A][B] + k_{-3}k_{-4}(k_{-1}+k_{-2})[P][Q] + k_1k_{-2}k_{-3}[A][P]$$
$$+ k_2k_3k_{-4}[B][Q] + k_2k_{-3}k_{-4}[B][P][Q] + k_1k_2k_{-3}[A][B][P]$$

$$V = \frac{d[P]}{dt} = k_3[EX] - k_{-3}[P][QE]$$

$$= \frac{k_3[E]_t}{D}\left(k_4k_1k_2[A][B] + k_{-1}k_{-3}k_{-4}[P][Q] + k_2k_{-3}k_{-4}[B][P][Q] + k_1k_2k_{-3}[A][B][P]\right) - \frac{k_{-3}[P][E]_t}{D}\left(k_{-1}k_{-2}k_{-4}[Q] + k_1k_2k_3[A][B] + k_{-1}k_3k_{-4}[Q] + k_2k_3k_{-4}[B][Q]\right)$$

$$= \frac{[E]_t}{D}\left(k_1k_2k_3k_4[A][B] - k_{-1}k_{-2}k_{-3}k_{-4}[P][Q]\right)$$

当 $[P]=[Q]=0$ 时，

$$V=\frac{k_1k_2k_3k_4[E]_t[A][B]}{k_{-1}k_4(k_{-2}+k_3)+k_1k_4(k_{-2}+k_3)[A]+k_2k_3k_4[B]+k_1k_2(k_3+k_4)[A][B]}$$

$$=\frac{\frac{k_3k_4}{k_3+k_4}[E]_t[A][B]}{\frac{k_{-1}k_4(k_{-2}+k_3)}{k_1k_2(k_3+k_4)}+\frac{k_4(k_{-2}+k_3)}{k_2(k_3+k_4)}[A]+\frac{k_3k_4}{k_1(k_3+k_4)}[B]+[A][B]}$$

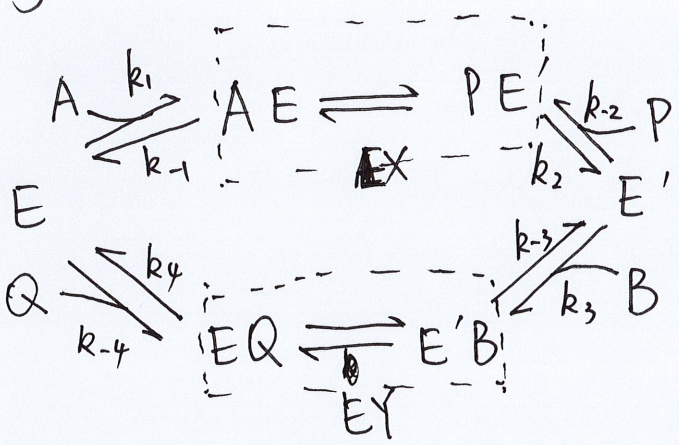
$$=\frac{V_{max}[A][B]}{K_s^AK_m^B+K_m^B[A]+K_m^A[B]+[A][B]}$$

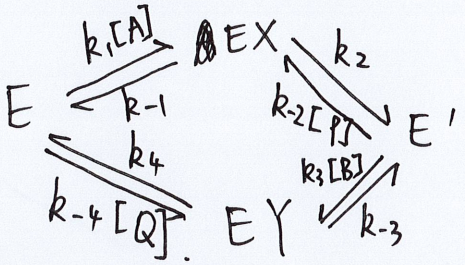
其中 $V_{max}=\frac{k_3k_4}{k_3+k_4}[E]_t$.

$K_s^A=\frac{k_{-1}}{k_1}$，$K_m^A=\frac{k_3k_4}{k_1(k_3+k_4)}$，$K_m^B=\frac{k_4(k_{-2}+k_3)}{k_2(k_3+k_4)}$

Ping-Pong bi-bi Rate equation.

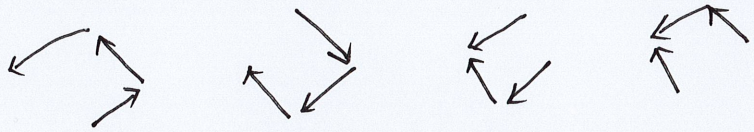
2020.11.11. ①



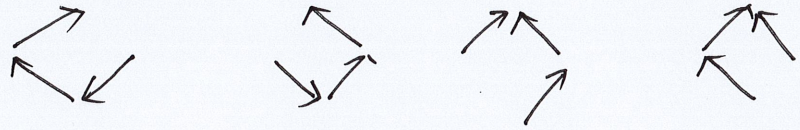


根据 King-Altman Method.

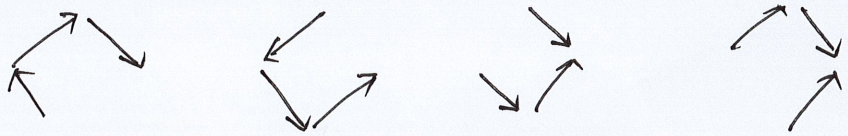
$$\frac{[E]}{[E]_t} = \frac{1}{D}\left(k_{-1}k_{-2}[P]k_{-3} + k_4k_3[B]k_2 + k_{-1}k_4k_3[B] + k_4k_{-1}k_{-2}[P]\right)$$



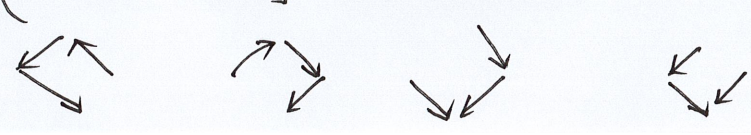
$$\frac{[EX]}{[E]_t} = \frac{1}{D}\left(k_1[A]k_4k_3[B] + k_{-2}[P]k_{-3}k_{-4}[Q] + k_1[A]k_{-2}[P]k_{-3} + k_{-2}[P]k_1[A]k_4\right).$$



$$\frac{[E']}{[E]_t} = \frac{1}{D}\left(k_4k_1[A]k_2 + k_{-1}k_{-4}[Q]k_{-3} + k_2k_{-3}k_{-4}[Q] + k_1[A]k_2k_{-3}\right).$$



$$\frac{[EY]}{[E]_t} = \frac{1}{D}\left(k_{-2}[P]k_{-1}k_{-4}[Q] + k_1[A]k_2k_3[B] + k_{-4}[Q]k_3[B]k_2 + k_{-1}k_{-4}[Q]k_3[B]\right)$$



2020.11.11 ②

$$D = k_{-1}k_{-2}(k_{-3}+k_4)[P] + k_{-3}k_{-4}(k_{-1}+k_2)[Q]$$
$$+ k_1k_2(k_{-3}+k_4)[A] + k_3k_4(k_{-1}+k_2)[B]$$
$$+ k_1k_3(k_2+k_4)[A][B] + k_{-2}k_{-4}(k_{-1}+k_{-3})[P][Q]$$
$$+ k_1k_{-2}(k_{-3}+k_4)[A][P] + k_3k_{-4}(k_{-1}+k_2)[B][Q]$$

$$v = \frac{d[P]}{dt} = k_2[EX] - k_{-2}[E'][P]$$

$$= \frac{k_2[E]_t}{D}\left(k_1k_3k_4[A][B] + k_{-2}k_{-3}k_{-4}[P][Q] + k_1k_{-2}(k_{-3}+k_4)[A][P]\right)$$
$$- \frac{k_{-2}[E]_t[P]}{D}\left(k_1k_2(k_{-3}+k_4)[A] + k_{-3}k_{-4}(k_{-1}+k_2)[Q]\right)$$

$$= \frac{[E]_t}{D}\cdot k_1k_2k_3k_4[A][B]$$

由于是初速度，可以将 $[P]=[Q]=0$ 代入 D 的表达式，即得

$$v = \frac{k_1k_2k_3k_4[E]_t[A][B]}{k_1k_2(k_{-3}+k_4)[A] + k_3k_4(k_{-1}+k_2)[B] + k_1k_3(k_2+k_4)[A][B]}$$

~~$V_{max} = k_2[E]_t$, $K_M^B = \frac{k_2(k_{-3}+k_4)}{k_3}$, $K_M^A = \frac{k_4(k_{-1}+k_2)}{k_1}$~~

$$= \frac{\frac{k_2k_4}{k_2+k_4}[E]_t[A][B]}{\frac{k_2(k_{-3}+k_4)}{k_3(k_2+k_4)}[A] + \frac{k_4(k_{-1}+k_2)}{k_1(k_2+k_4)}[B] + [A][B]}$$