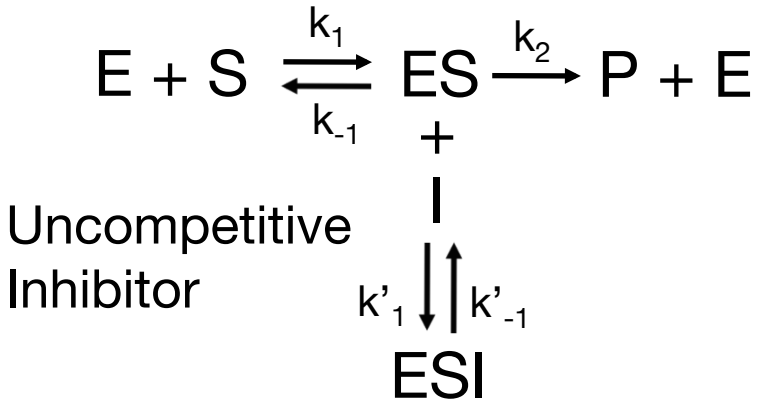
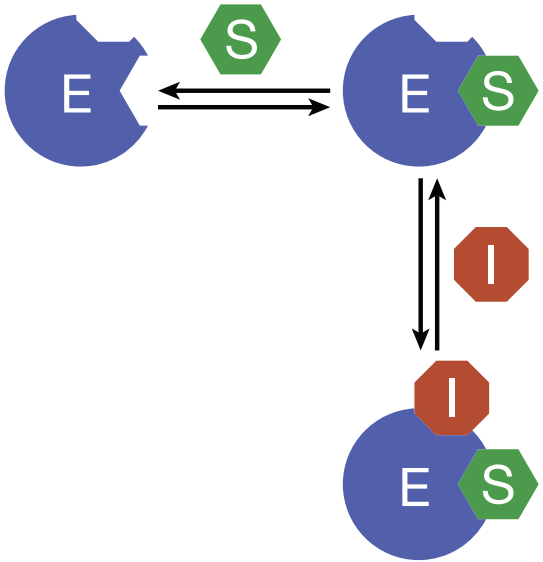

E + S
k1
k-1
ES
k2
P + E
+
I
Uncompetitive
Inhibitor
k'1
k'-1
ESI

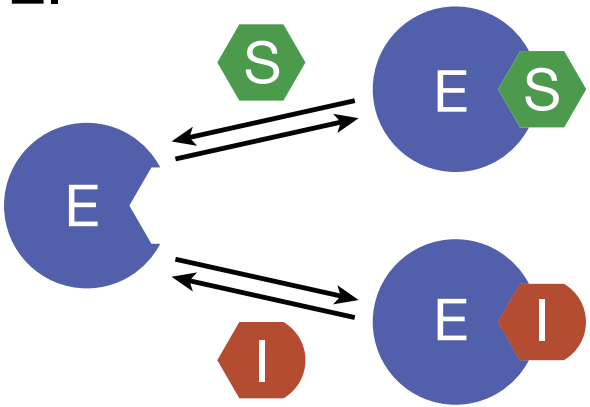

S
E
E
S
I
I
E
S

Competitive Inhibitor

reach V_{max}

$E + S \rightleftharpoons ES \rightarrow P + E$

$+ I \rightleftharpoons EI$

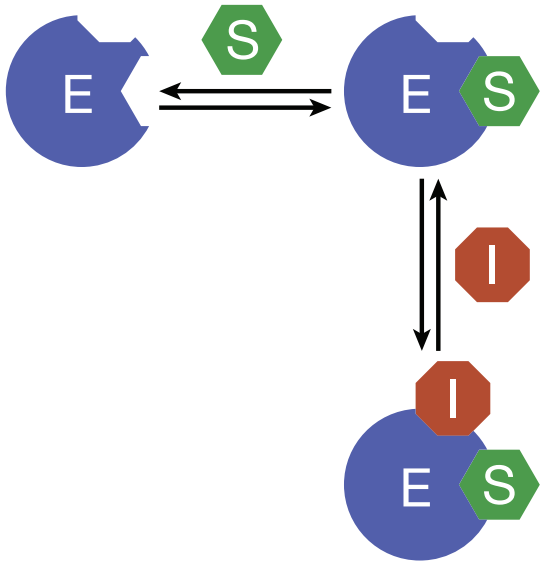


Uncompetitive Inhibitor

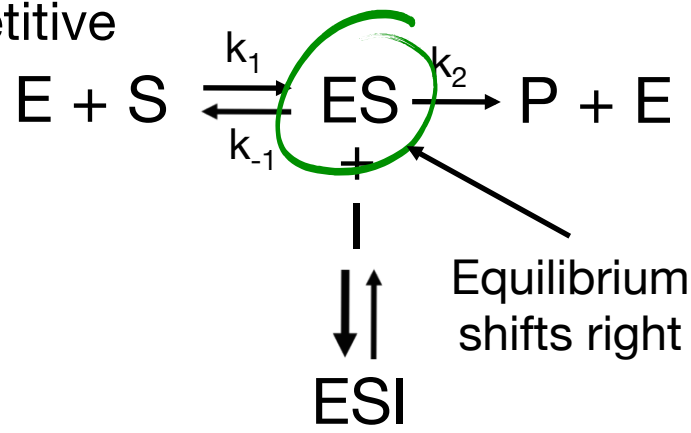
$E + S \rightleftharpoons ES \rightarrow P + E$

$+ I \rightleftharpoons ESI$

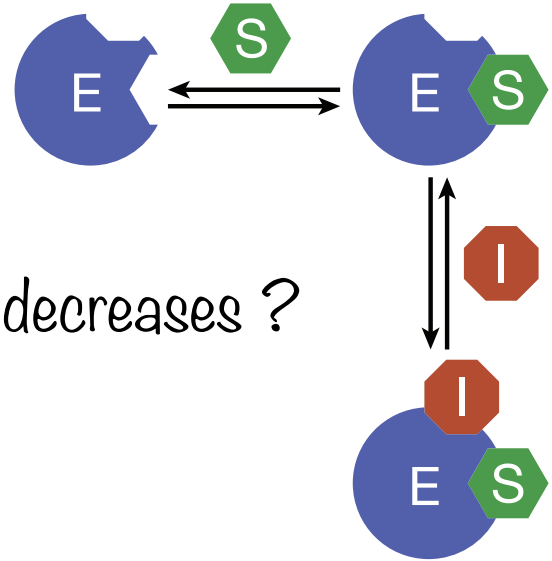
V_{max} decreased



Uncompetitive Inhibitor



Equilibrium shifts right



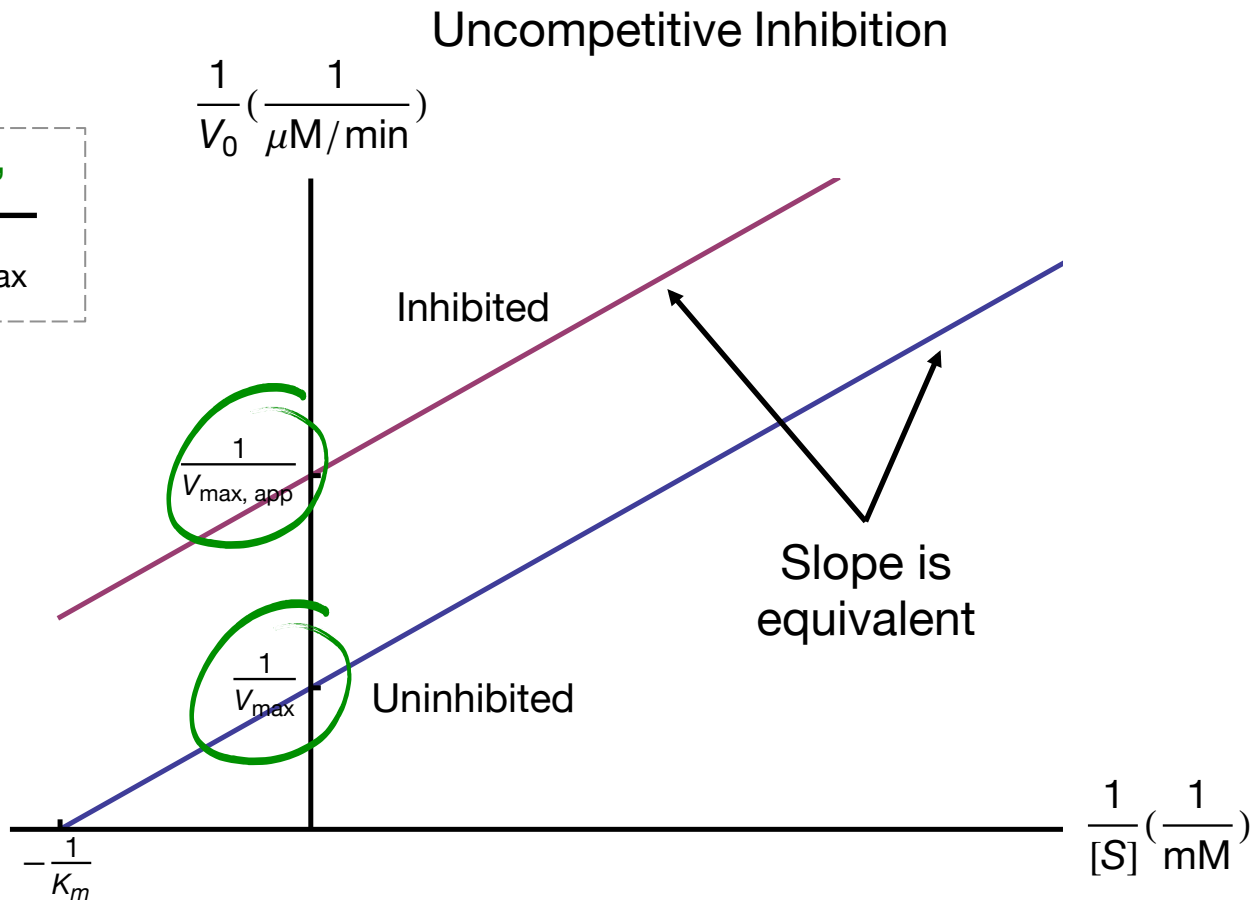
K_m decreases ?

$$\frac{1}{V_o} = \frac{K_m}{V_{max}}\frac{1}{[S]} + \frac{\alpha'}{V_{max}}$$

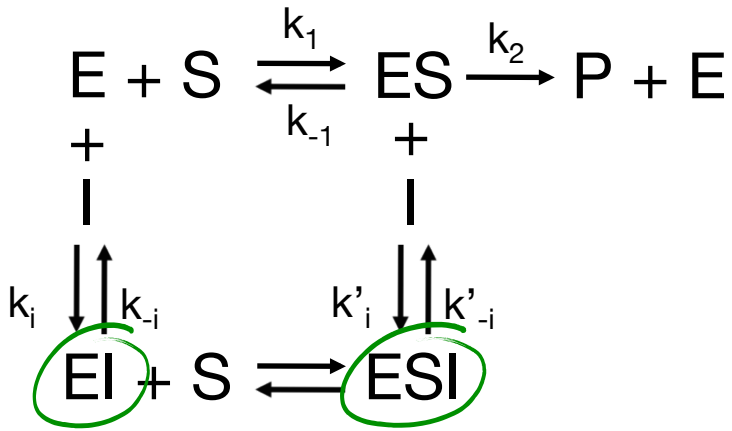
$$\alpha' = 1 + \frac{[I]}{K'_I}$$

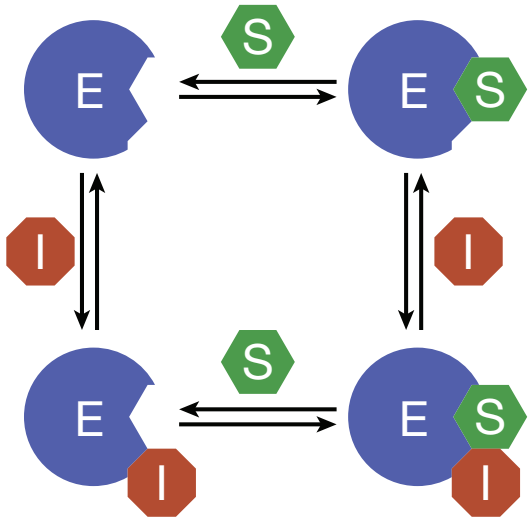
Decreased K_m

Decreased V_{max}

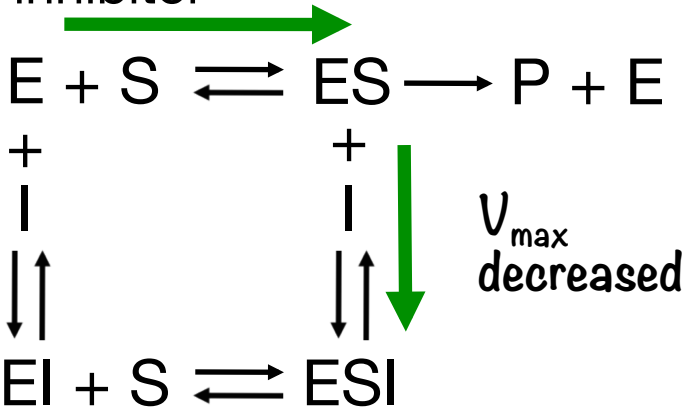


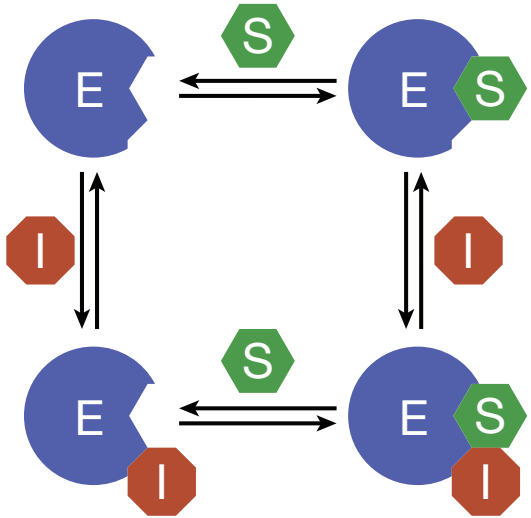
Mixed inhibitor



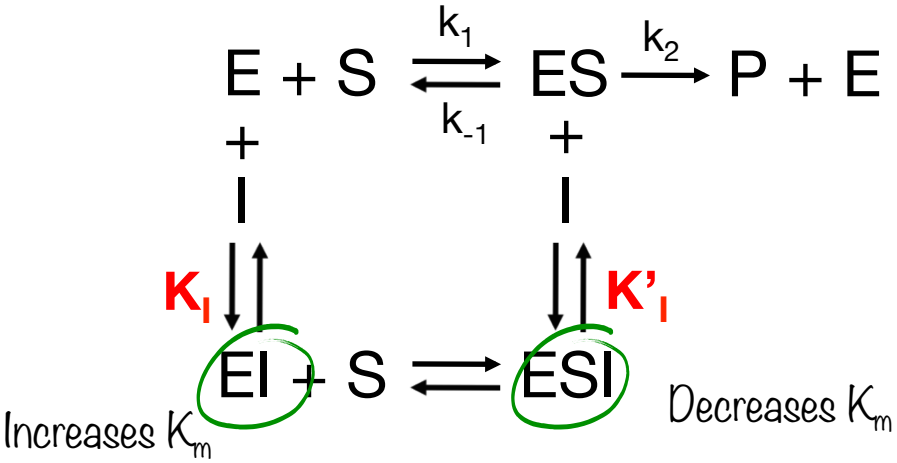


Mixed inhibitor





Mixed inhibitor



K_m can increase, decrease or stay the same

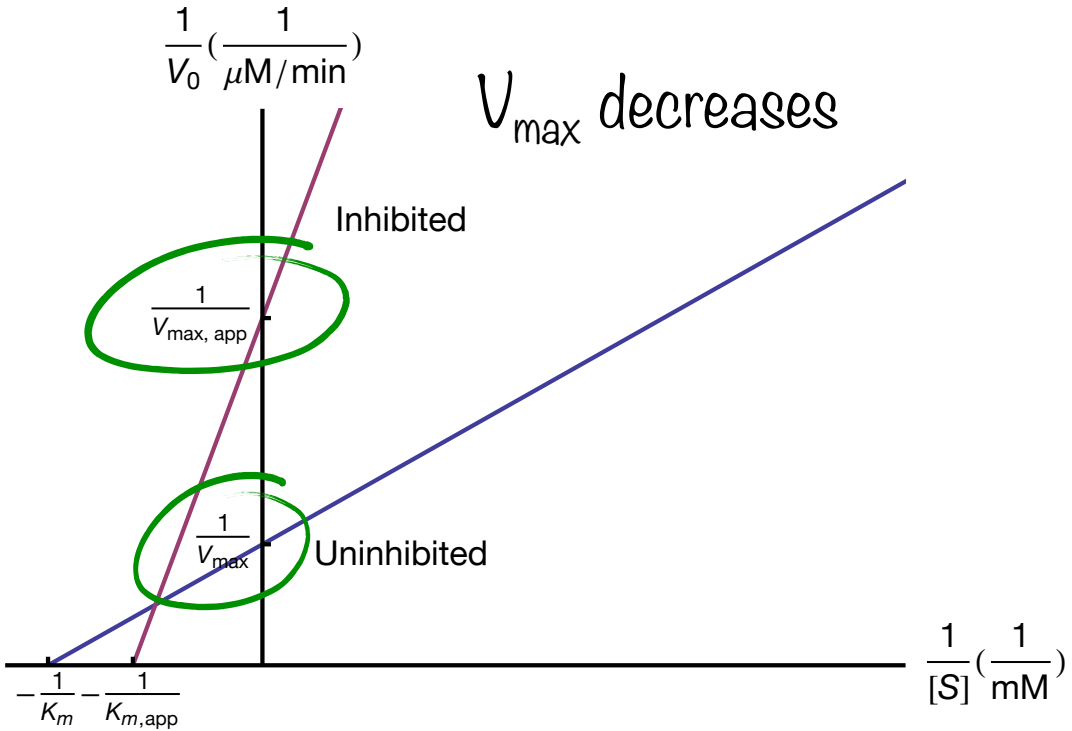
Mixed Inhibitor

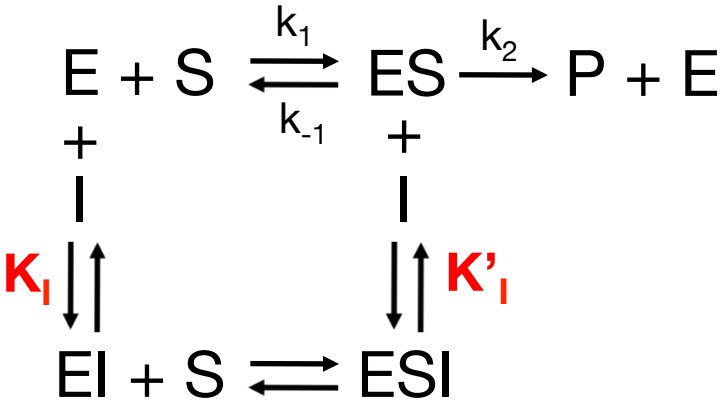
$$\frac{1}{V_o} = \frac{\alpha K_m}{V_{max}} \frac{1}{[S]} + \frac{\alpha'}{V_{max}}$$

$$\alpha = 1 + \frac{[I]}{K_I}$$ Effect of EI formation

$$\alpha' = 1 + \frac{[I]}{K'_I}$$ Effect of ESI formation

Mixed Inhibitor



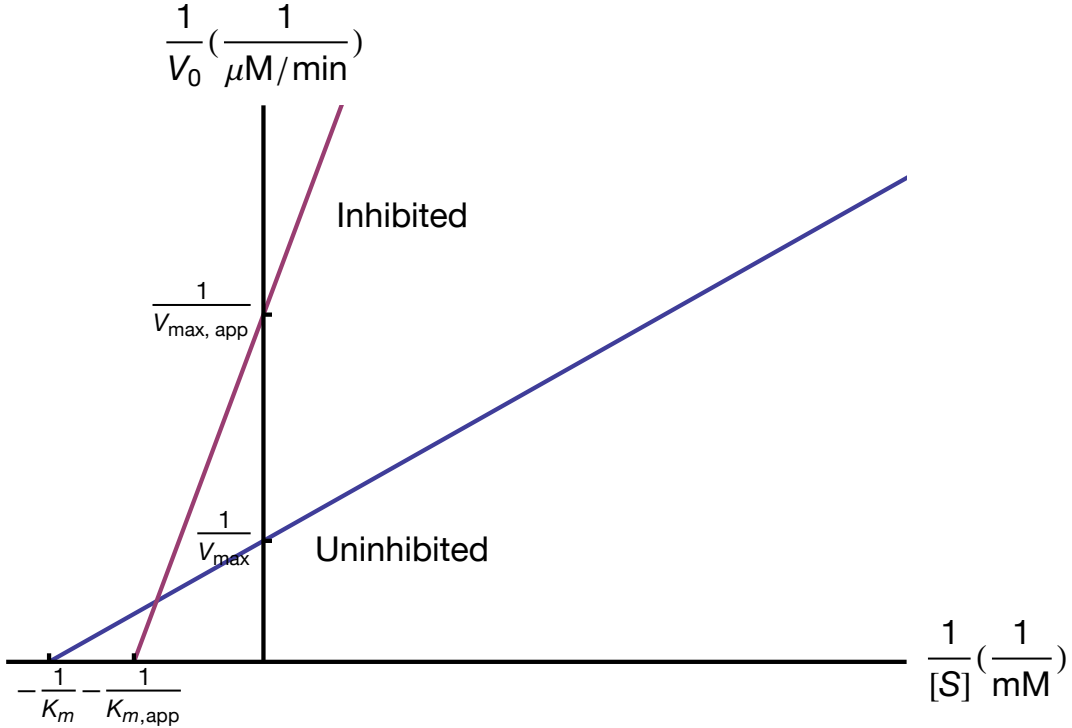


Inhibitor favors E over ES

K_I dominates over K'_I

This example: K_m increases

$$K_{m,app} = \frac{\alpha\, K_m}{\alpha'}$$



Noncompetitive Inhibitor

$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_2} P + E$$

$$+ \; I \qquad\qquad + \; I$$

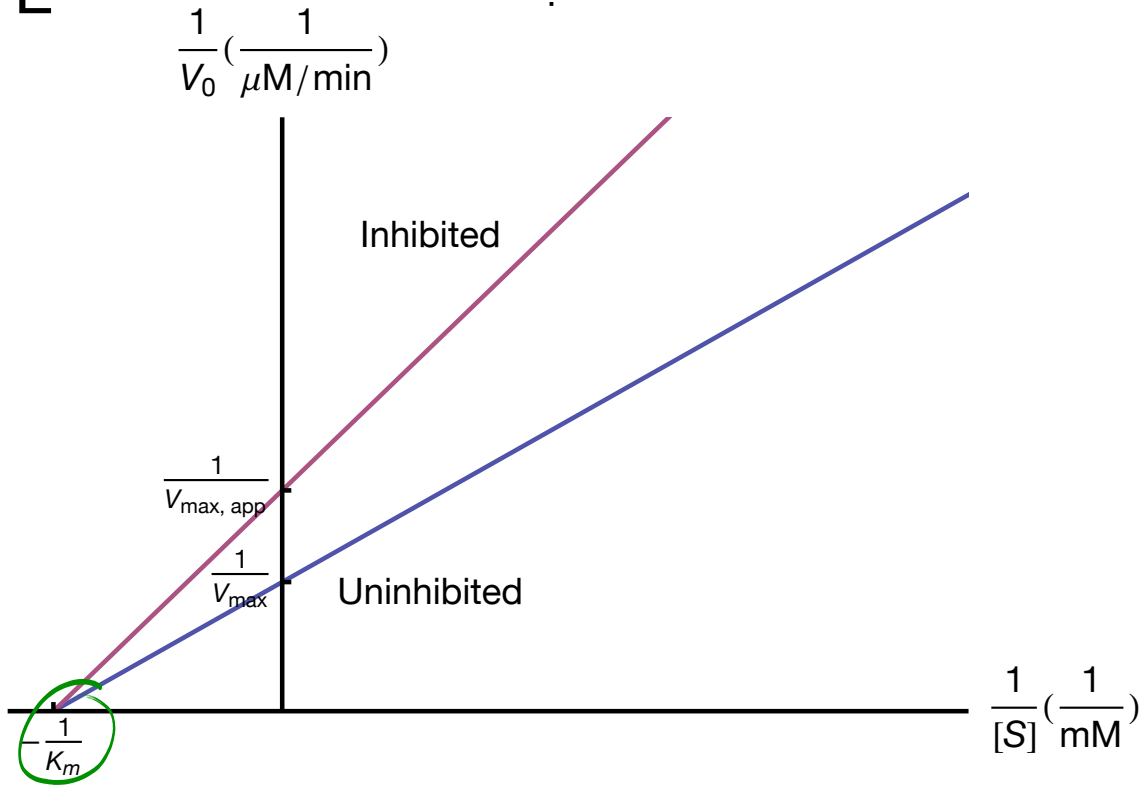
$$K_I \qquad\qquad K'_I$$

$$EI + S \rightleftharpoons ESI$$

$$\alpha = \alpha'$$

$$K_{m,app} = \frac{\alpha \, K_m}{\alpha'}$$

$$K_{m,app} = K_m$$



Conclusion: Effect of reversible inhibitors on $V_{max,app}$ and $K_{m,\ app}$

Inhibitor	$V_{max,app}$	$K_{m,\ app}$
Absent	V_{max}	K_m
Competitive	V_{max}	αK_m
Uncompetitive	V_{max}/α'	K_m/α'
Mixed	V_{max}/α'	$\alpha K_m/\alpha'$