(19) **Today**

6.3 Enzyme Kinetics

6.4 Enzyme Inhibition

6.5 An Enzymatic Mechanism

Next Class (20)

6.5 An Enzymatic Mechanism

Chap 7: Carbohydrates

(21) **Second Class from Today**

Chap 7: Carbohydrates

Third Class from Today (22)

Chap 7: Carbohydrates

Monday office hours rescheduled to 1:10 to 2:10 from now on.

Please hand in reworked test 1.

Test 2 postponed to Wednesday, April 2

$$\text{rate} = k_3[\text{ES}]$$

$$[\text{ES}] = k_1/(k_3 + k_2)[\text{E}][\text{S}]$$

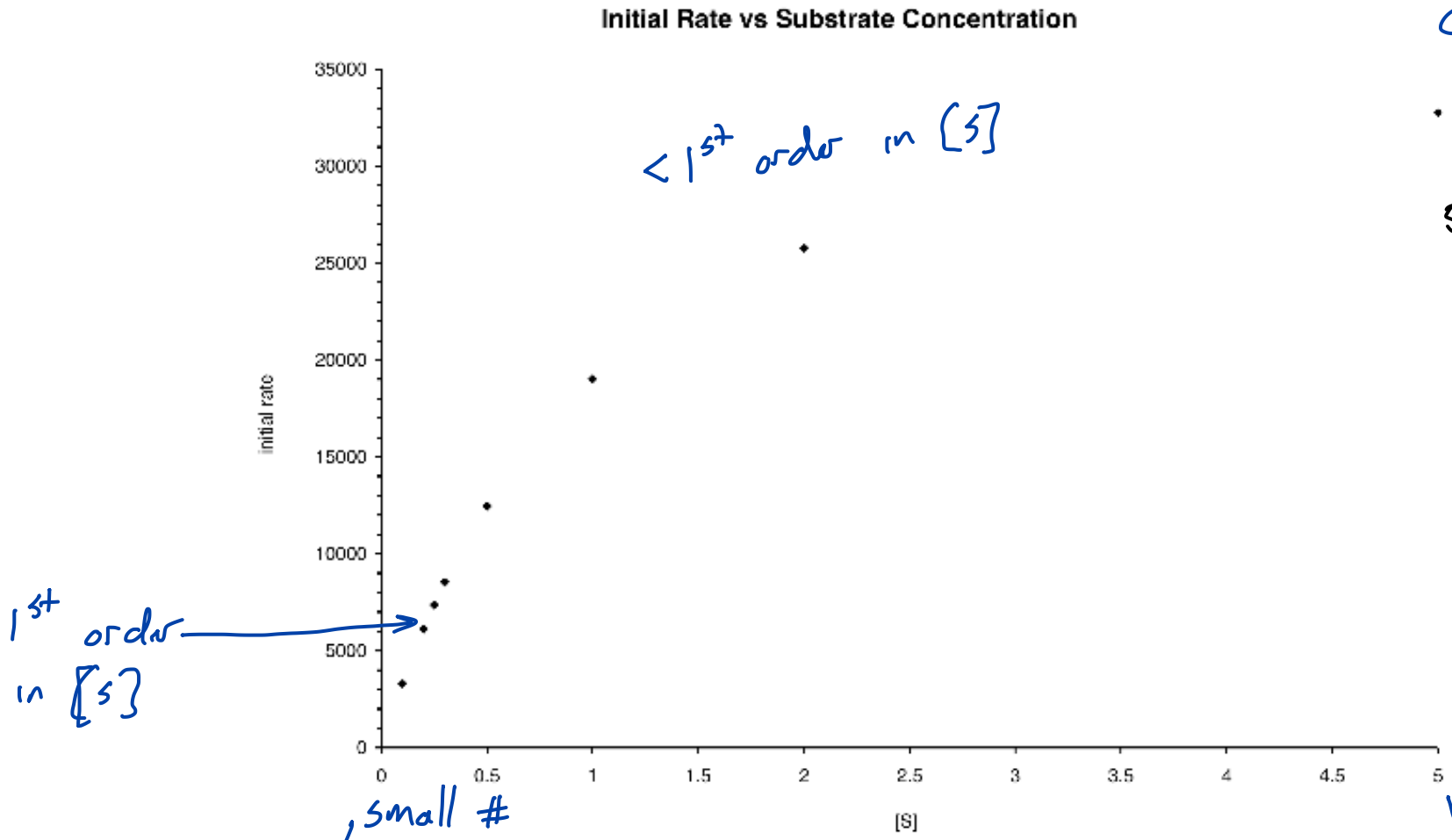
$$\text{K}_\text{m} = (k_3 + k_2)/k_1$$

$$[\text{E}] = [\text{E}]_\text{T} - [\text{ES}]$$

$$[\text{ES}] = [\text{E}]_\text{T}\,[\text{S}]/(\text{K}_\text{m} + [\text{S}])$$

Which finally gets us to the rate law…

$$\textbf{rate} = \frac{k_3[\text{E}]_\text{T}\,[\text{S}]}{(\text{K}_\text{m} + [\text{S}])}$$



0 order in [S]

• V_{max}

5 M = [S]

< 1st order in [S]

1st order in [S]

small #

V_{max}

K_m >> [S]	K_m similar to [S]	K_m << [S]
rate = $\frac{k_3[E]_T\,[S]}{(K_m\ \text{[redacted]})}$	**rate = $\frac{k_3[E]_T\,[S]}{(K_m + [S])}$**	**rate = $\frac{k_3[E]_T\,[S]}{(\text{[redacted]}\ [S])}$**
$K_m + [S] \approx K_m$	less than first order	$K_m + [S] \approx [S]$

at low s bottom s is small so it can be ignored

$$\text{rate} = \frac{k_3[E]_T\,[S]}{(K_m + [S])}$$

$$\frac{1}{\text{rate}} = \frac{K_m + [S]}{k_3[E]_T[S]}$$

$$\frac{1}{\text{rate}} = \frac{K_m}{k_3[E]_T[S]} + \frac{\cancel{[S]}}{k_3[E]_T\cancel{[S]}}$$

$$\frac{1}{\text{rate}} = \left(\frac{K_m}{k_3[E]_T}\right)\frac{1}{[S]} + \frac{1}{k_3[E]_T} \quad \leftarrow \frac{1}{V_{max}}$$

$$y \quad m \quad x \quad + \quad b$$

$V_{max} = k_3[E]_T$

$$\text{rate} = \frac{k_3[E]_T\,[S]}{(K_m + [S])}$$

$$\frac{1}{\text{rate}} = \frac{K_M}{k_3[E]_T\,[S]}\frac{1}{} + \frac{1}{k_3[E]_T}$$

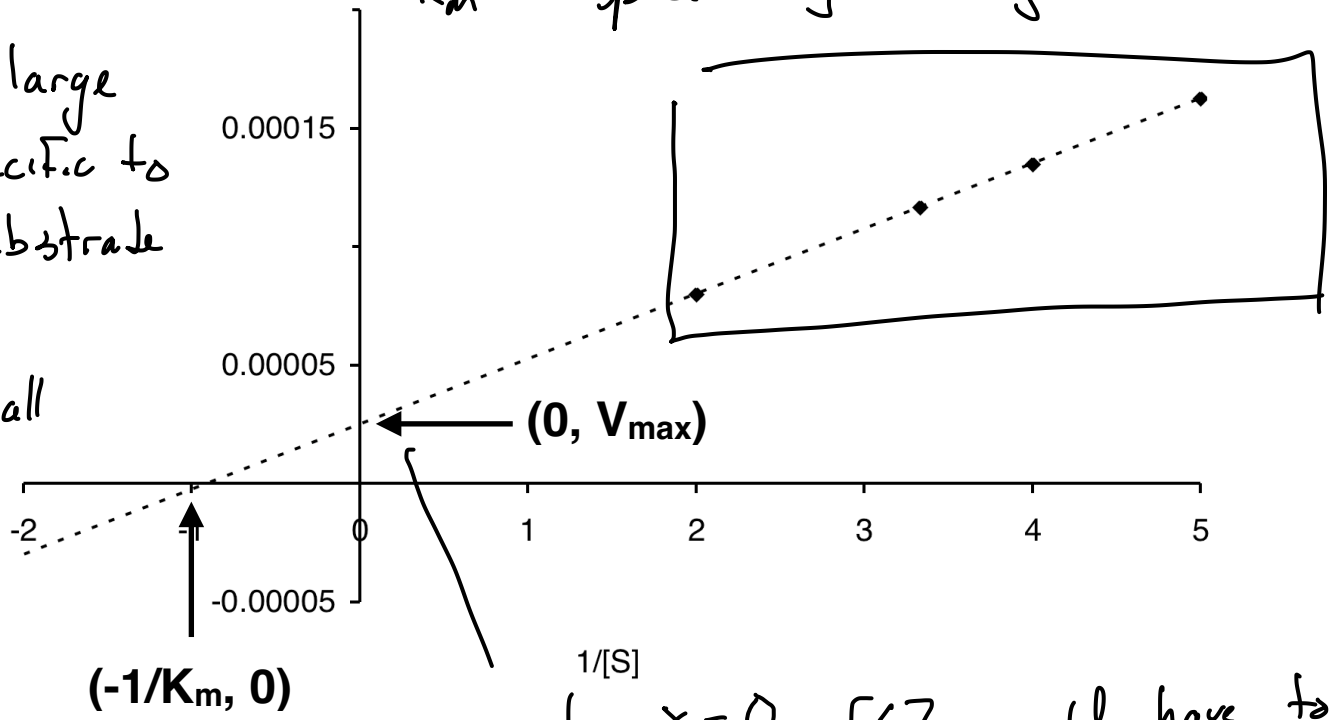
$E + S \underset{k_2}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_3} E + P$

V_{max} intrinsic rate constant (k_3)

K_m specificity for given substrate

K_m small ... k_1 large
enzyme is specific to particular substrate

K_m large, k_1 small
enzyme is less specific

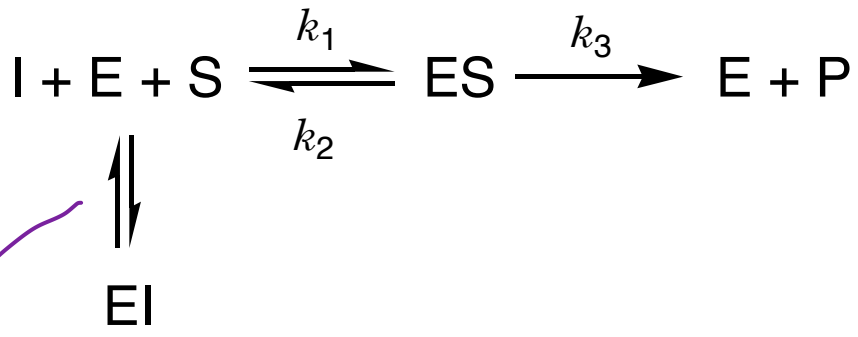


at $x = 0$ $[S]$ would have to be ...

$[S] = \infty$ $\lim_{[S]\to\infty} \frac{1}{[S]} = 0$

if $\frac{k_3 + k_2}{k_1}$ is large k_2 is large and k_1 is small and ES dissociates easily

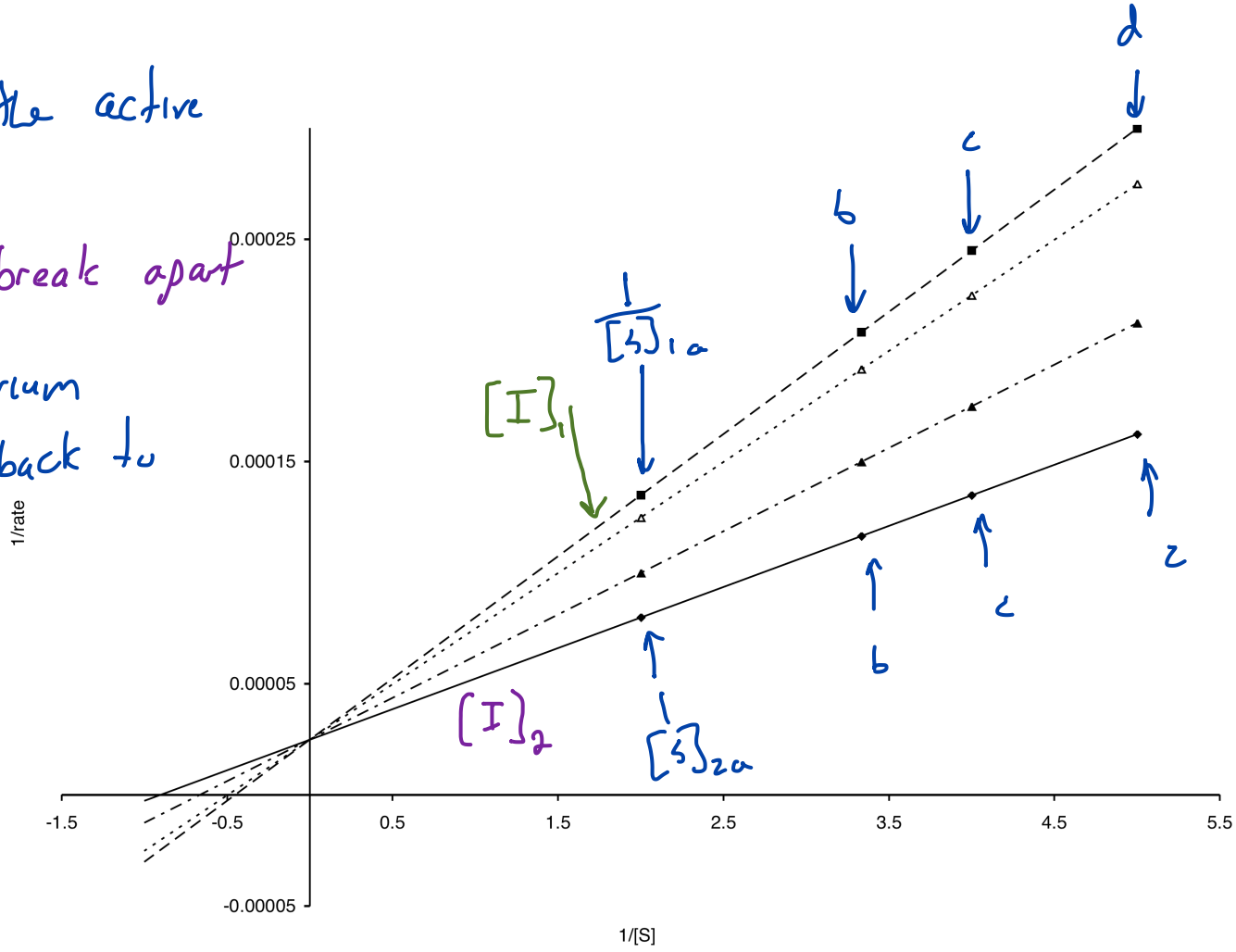
if K_m is small k_1 is large
large k_1 means large binding constant

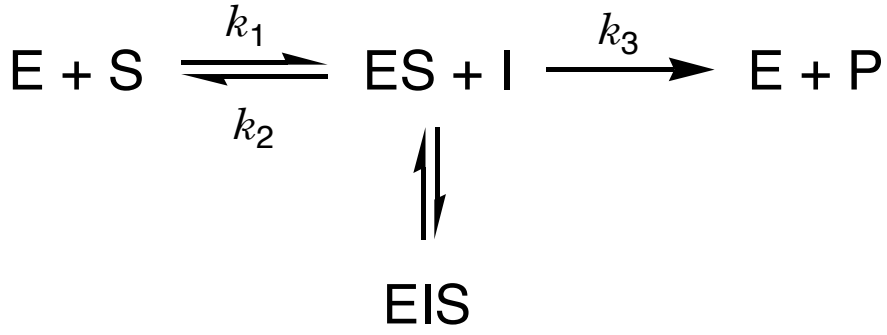


E + I compete for the active site

Equilibrium so EI can break apart

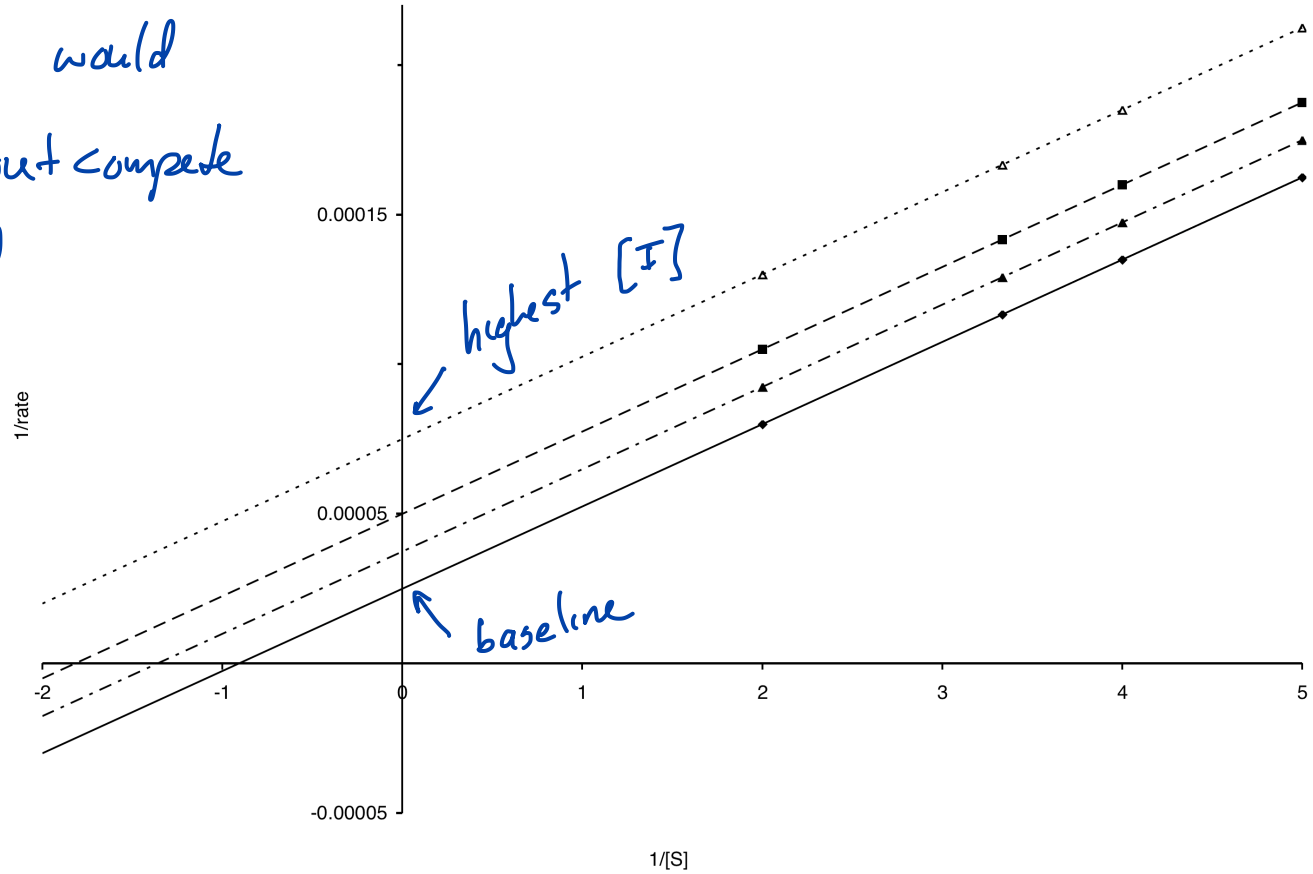
Increase [S] drives equilibrium shifts EI equilibrium back to E + I + S so V_{max} can still be reached





Increase [S] increases [ES]
but if [ES] increases so would
[EIS] so we cannot outcompete
by adding more S and
V_{max} decreases

K_m and V_{max} are
changing by the same



Noncompetitive or Mixed

$k_{is} = k_{ic}$

$$E + S + I \underset{k_2}{\overset{k_1}{\rightleftharpoons}} ES + I \xrightarrow{k_3} E + P$$

$$EI + S \rightleftharpoons EIS$$

V_{max} changes

lines are not parallel

Design a drug to stop/slow a metabolic pathway... which would be better... competitive or uncompetetive