ENZYME EFFICIENCY : $\frac{k_{cat}}{K_M}$

- Mutations in the amino acid sequence of an enzyme will affect its K_M and k_{cat}
- In general :
  - Changes that only affect k_{cat} affect only transition state stabilization
  - Changes that only affect K_M are involved in initial substrate binding
- k_{cat} = speed
- K_M = how little of the substrate that is required in order for the substrate to do its job
- Many mutations affect both K_M and k_{cat} indicating an amino acid side chain involved in both initial substrate binding and its stabilization upon the proteins conformational change.

POST-ACTIVITY

- Enzyme C has Highest Affinity for Substrate
  - It has the lowest K_M value which indicates a high affinity for substrate
- Enzyme B converts the most substrate to product in a given time period
  - It has the highest k_{cat} value
- Enzyme B has the highest catalytic efficiency
  - It has the highest k_{cat} and the lowest K_M
  - $$Enzyme\ A = \frac{\frac{1.4 * 10^{4}\ Moles}{1\ Liter}}{\frac{9.5 * 10^{-5}\ Conversions}{1\ Second}} = \frac{1.47368 * 10^{8}\ Moles \cdot Seconds}{Liters \cdot Conversion}$$
  - $$Enzyme\ B = \frac{\frac{1.0 * 10^{7}\ Moles}{1\ Liter}}{\frac{2.5 * 10^{-2}\ Conversions}{1\ Second}} = \frac{4.0 * 10^{8}\ Moles \cdot Seconds}{Liters \cdot Conversion}$$
  - $$Enzyme\ C = \frac{\frac{8.0 * 10^{2}\ Moles}{1\ Liter}}{\frac{5.0 * 10^{-6}\ Conversions}{1\ Second}} = \frac{1.6 * 10^{8}\ Moles \cdot Seconds}{Liters \cdot Conversion}$$

Enzyme	K_M (M)	k_{cat} (S^{-1})
A	$9.5 * 10^{-5}$	$1.4 * 10^{4}$
B	$2.5 * 10^{-2}$	$1.0 * 10^{7}$
C	$5.0 * 10^{-6}$	$8.0 * 10^{2}$