

Enzymes

Learning Target

- 1) Describe the relationship between enzyme, substrate, and active site.
- 2) Predict the effect of factors on enzymatic activity.
- 3) Explain the importance of enzymes to metabolism.

Speed of Reactions



Some reactions occur **slowly**, like the combination of iron and oxygen to form rust.

Other reactions occur very **quickly**, like the combustion of hydrogen gas.



Chemical reactions may either release or absorb energy.



OR





Summarizing Chemical Reactions

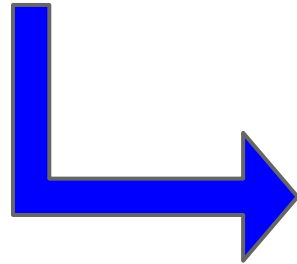


2 Cracker Squares + 1 Marshmallow + 3 Chocolate Squares \longrightarrow 1 S'more

1. What is/are the reactant(s)?
2. What is/are the product(s)?

What is an enzyme?

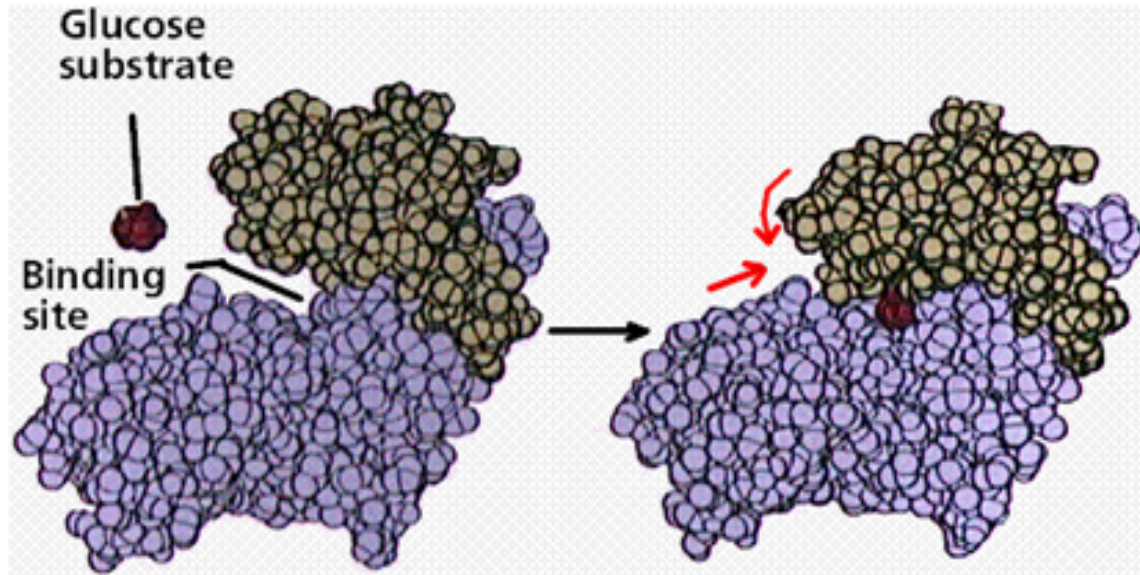
Enzyme: protein that speeds up biochemical reactions by lowering the energy needed for a reaction to happen.



Catalyst: speeds up a chemical reaction.

What is an enzyme?

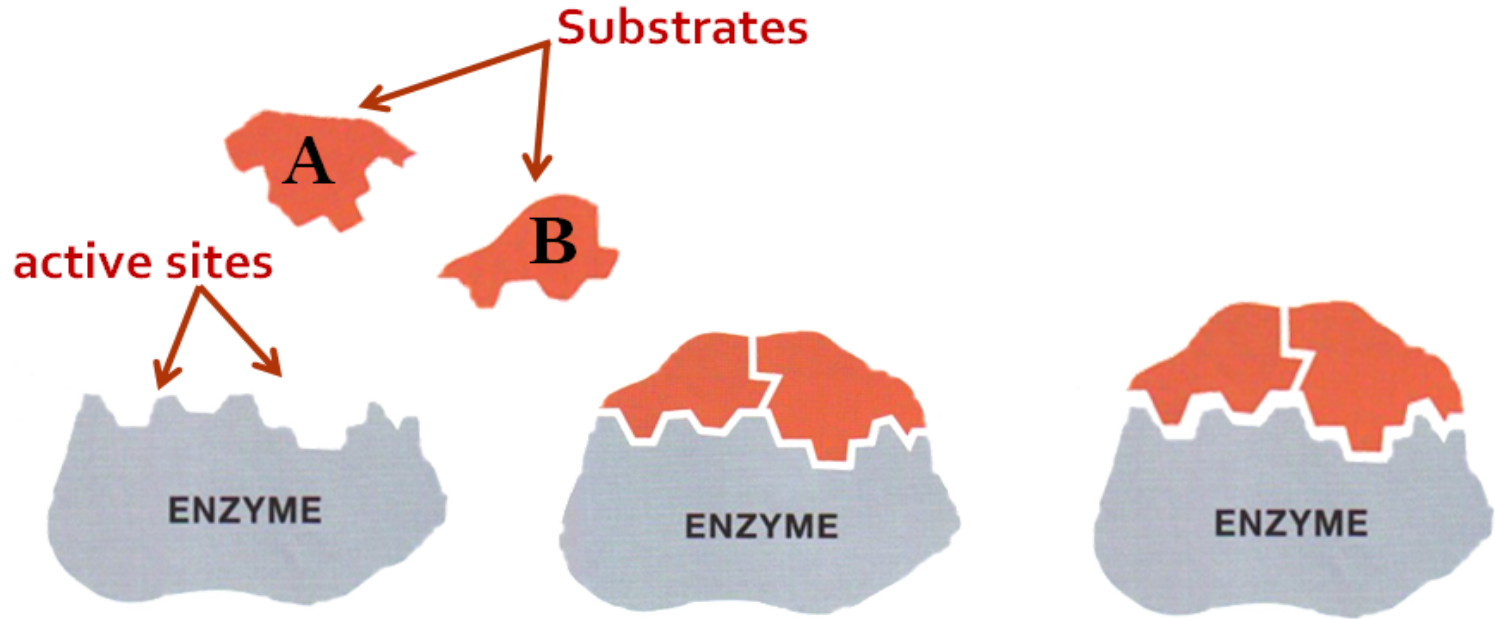
Remember → enzymes are globular proteins!



How do enzymes work?

- Enzymes attract and hold the substrates.
- The substrate fits *perfectly* into the active site.
- Enzymes decrease the amount of activation energy.
- The enzyme does its job (usually combines or changes the substrate) and releases it.
- The enzyme can be used over and over again.
- Every biological process requires an enzyme!

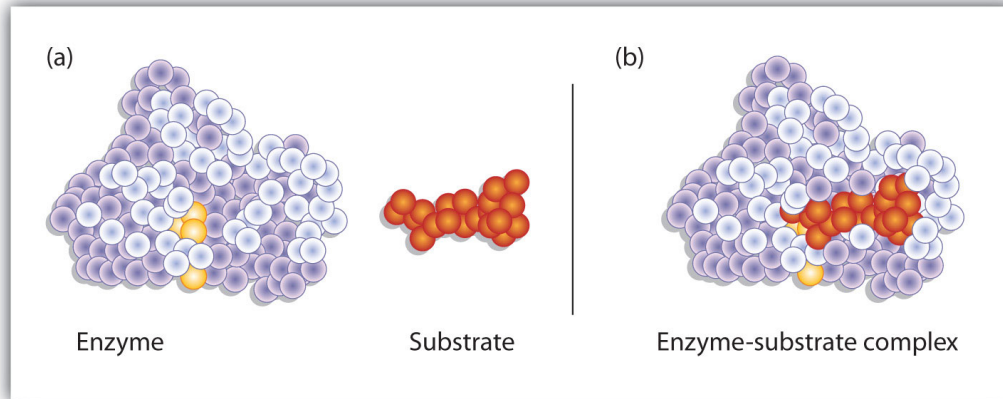
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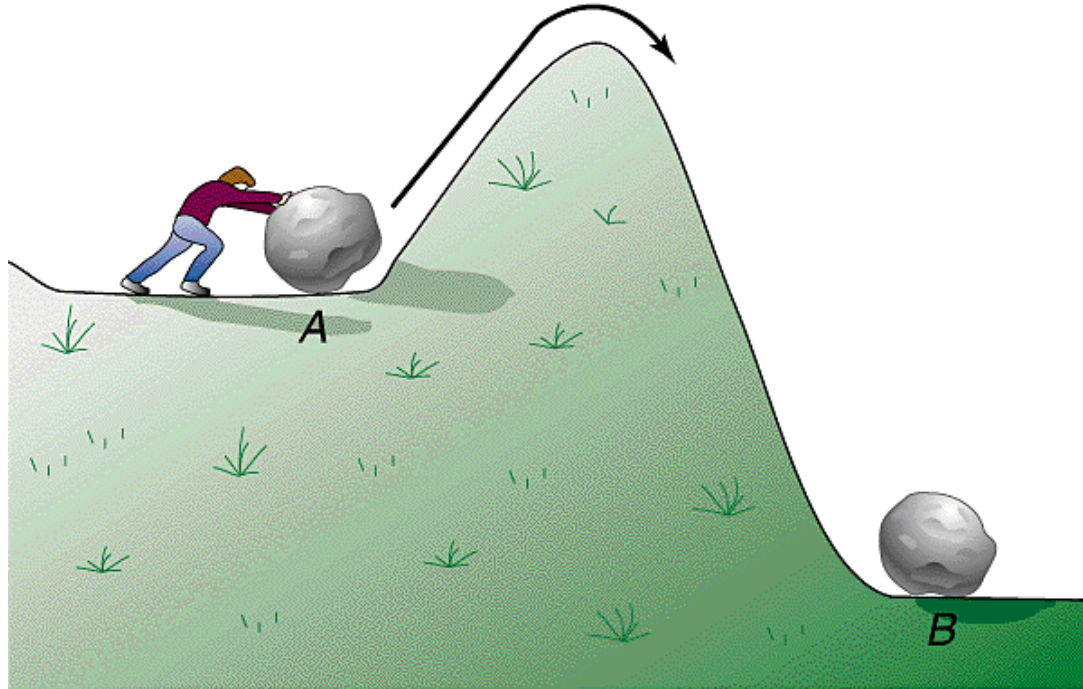
Substrate = Reactant of an enzyme-catalyzed reaction.

Active site = Place on an enzyme where the substrate bind.



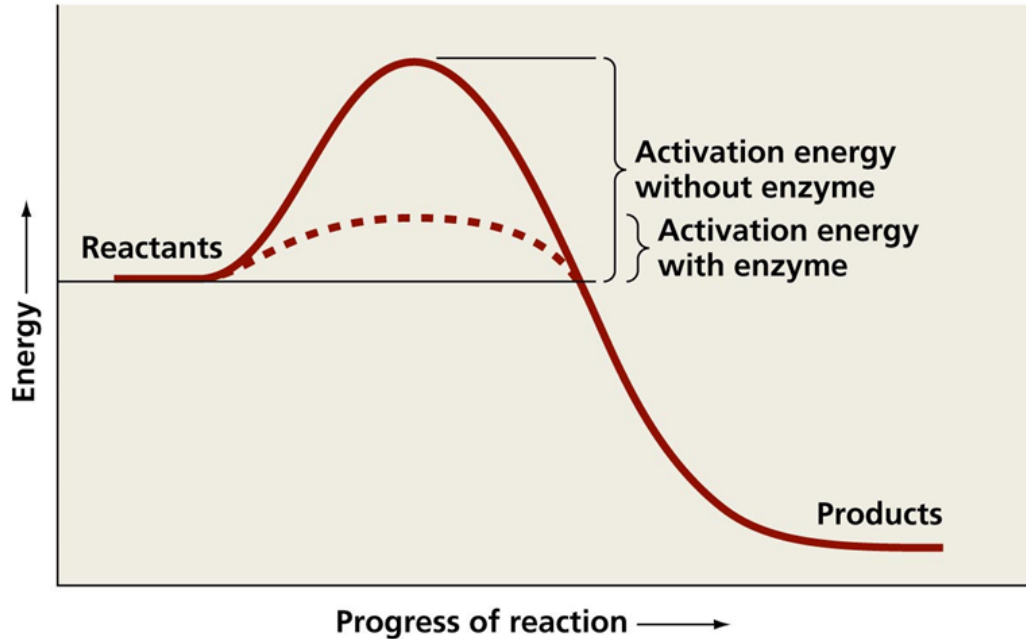
How do enzymes work?

Activation energy = Energy needed to get a reaction started.



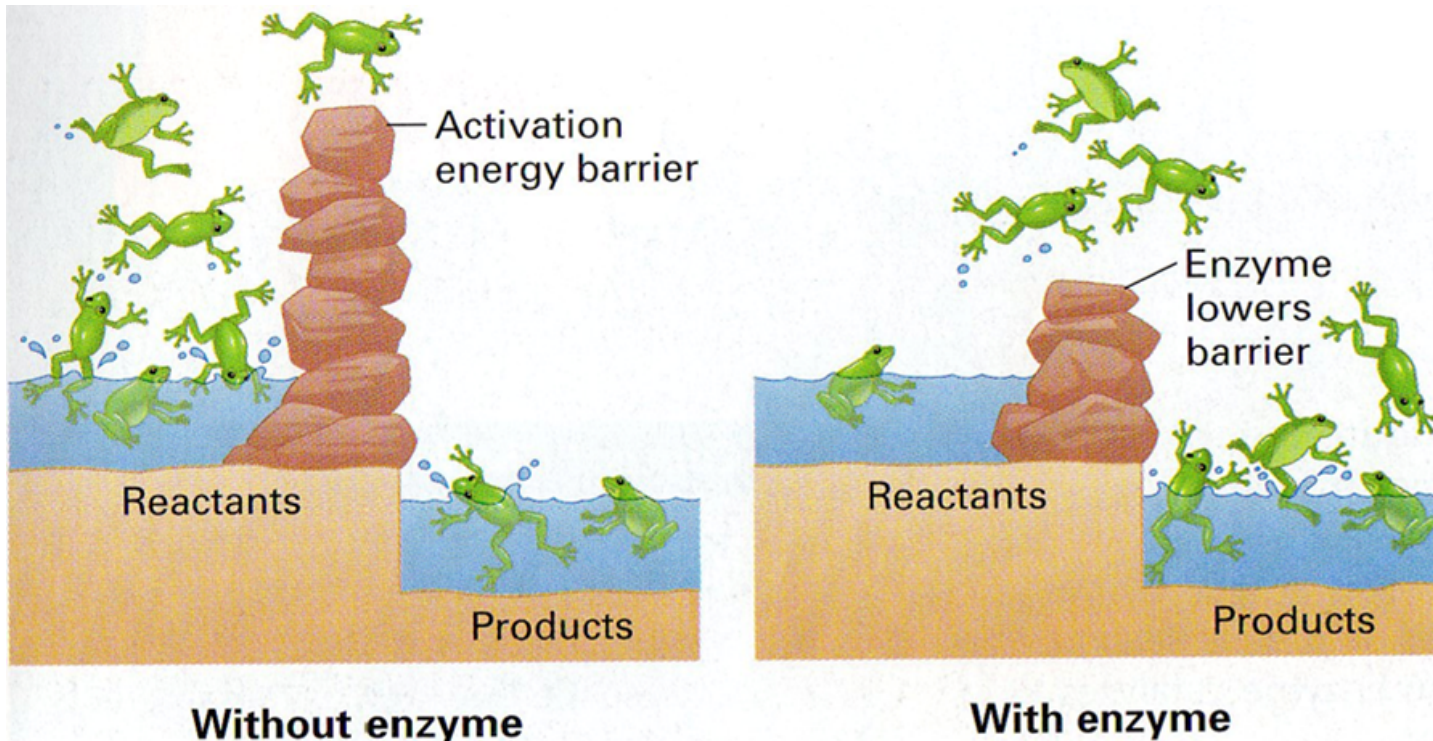
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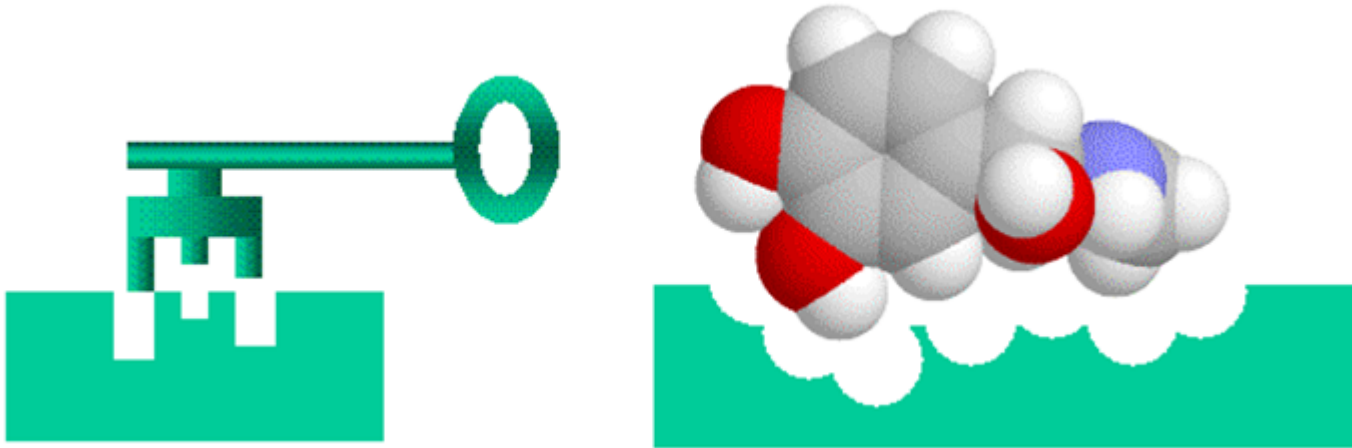


ENZYMES LOWER THE ACTIVATION ENERGY



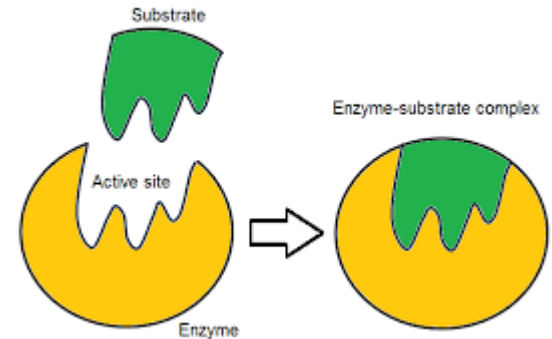
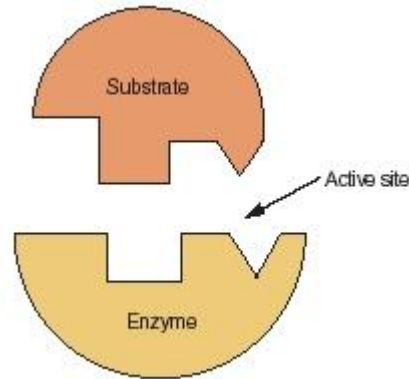
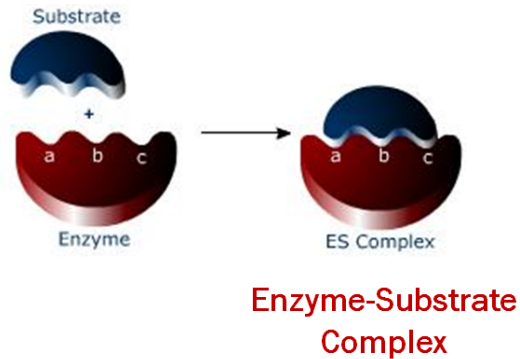
What is the Lock and Key Hypothesis?

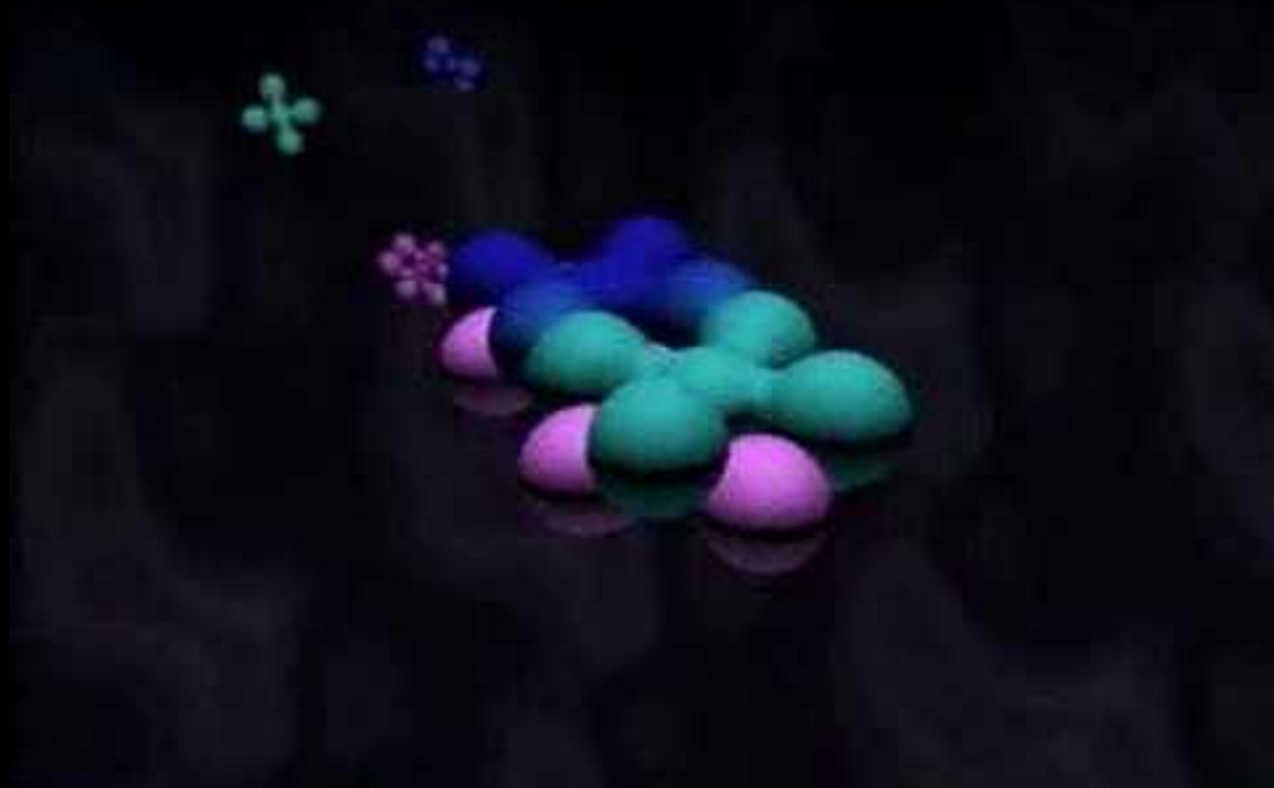
Proteins bind to each other by matching up knobs and depressions on the proteins surfaces, in much the same way that a key fits into a lock.



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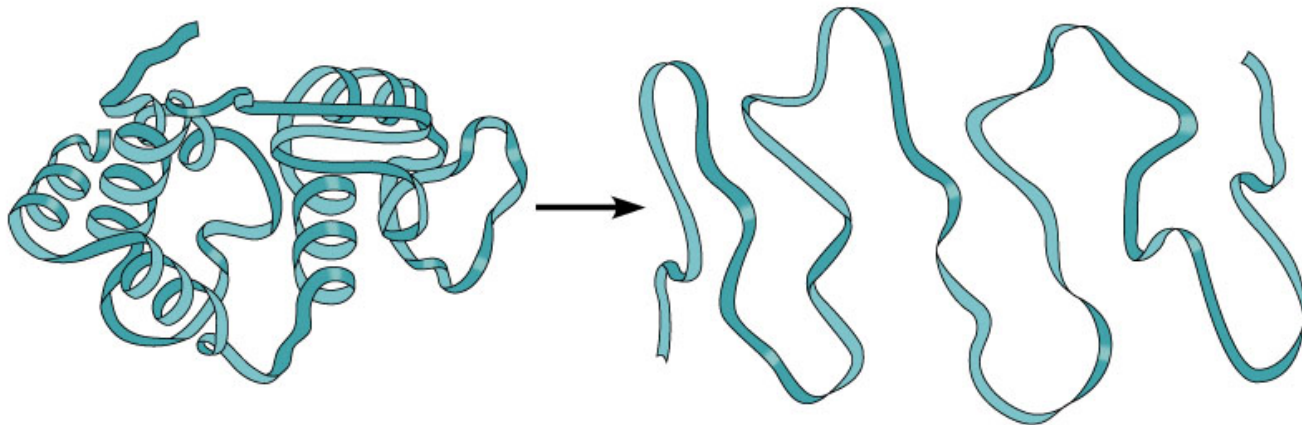
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What can affect the rate at which an enzyme does its job?

Denature: protein changes its shape due to outside stress on the molecule and stops it from working.

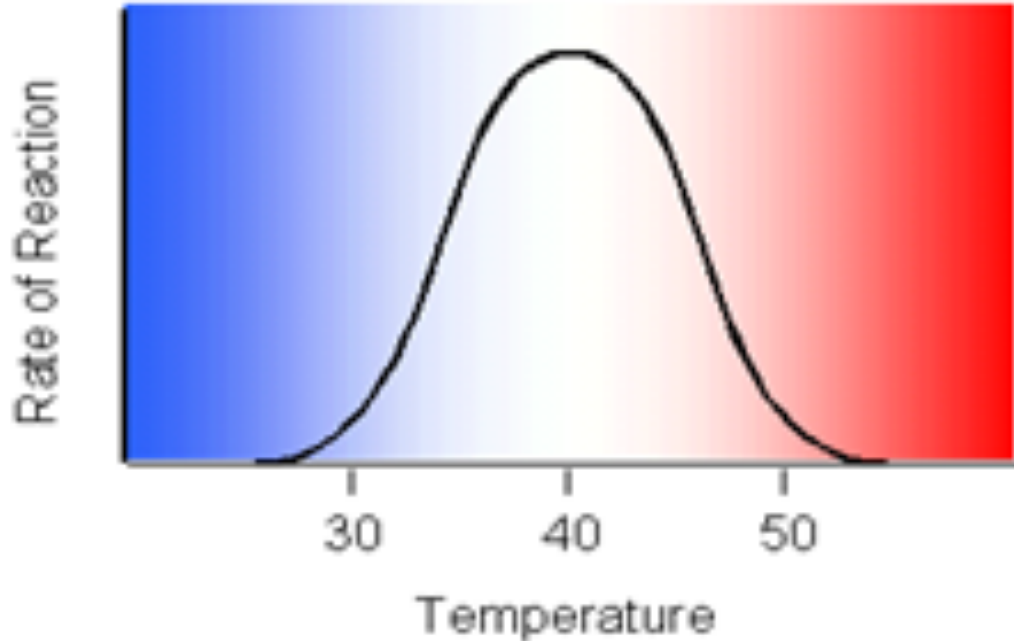


Active (functional) protein

Denatured protein

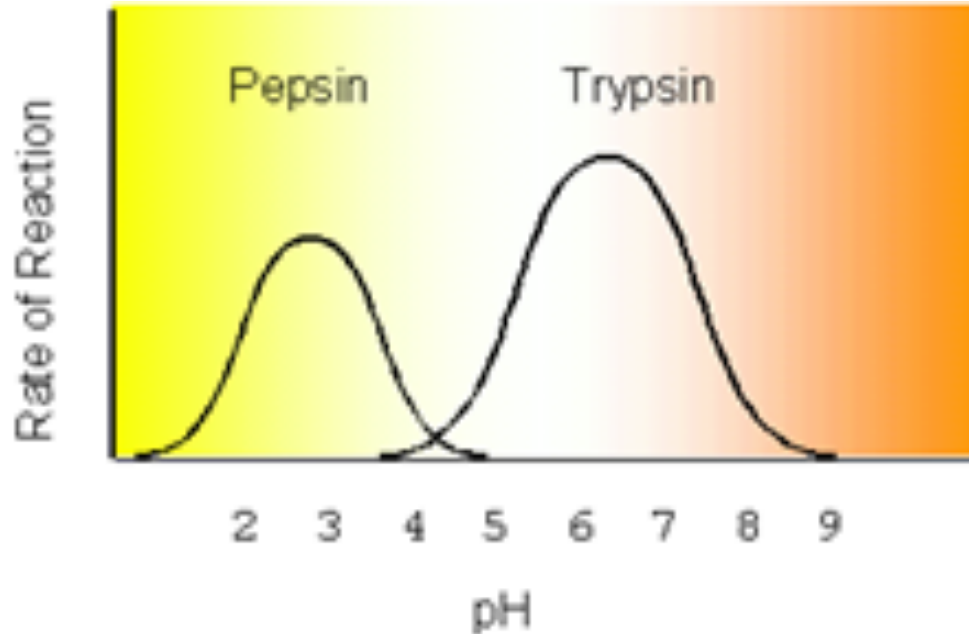
What can affect the rate at which an enzyme does its job?

Temperature: Enzymes will work faster as temperature increases *up until a certain point.*



What can affect the rate at which an enzyme does its job?

pH: Extremely high or low pH will denature enzymes.



What can affect the rate at which an enzyme does its job?

Amount of Enzyme: The more enzymes that are present, the faster the products can be made.

Amount of Substrate: The more substrate that is present, the faster the products can be made *up until a certain point.*

What can affect the rate at which an enzyme does its job?

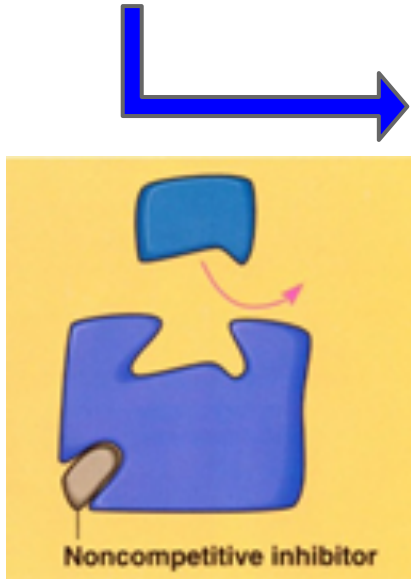
Inhibitor: Substance that blocks or distorts the active site.



Competitive Inhibitor: Closely resembles the shape of the substrate and competes for the same active site.

What can affect the rate at which an enzyme does its job?

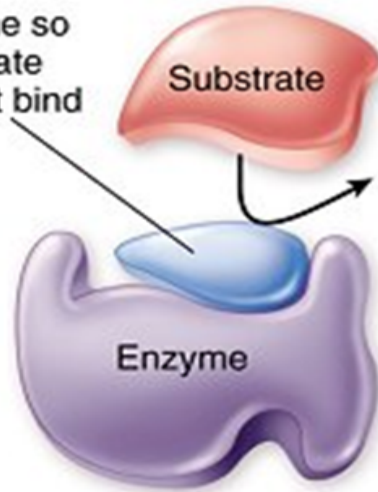
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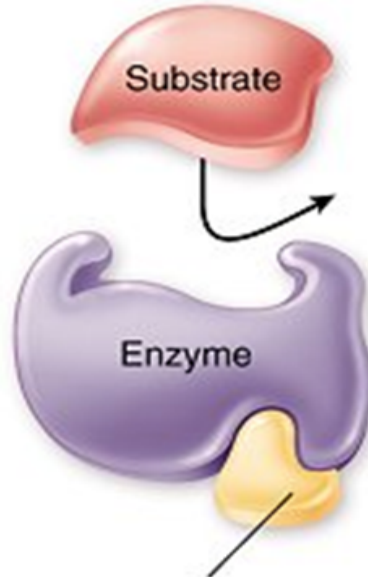
Non-competitive Inhibitor: Bonds to the enzyme in places other than the active site. (Changes the shape of the active site → substrate cannot fit)

What can affect the rate at which an enzyme does its job?

Competitive inhibitor interferes with active site of enzyme so substrate cannot bind



(a) Competitive inhibition



Noncompetitive inhibitor changes shape of enzyme so it cannot bind to substrate

(b) Noncompetitive inhibition

Summarize!