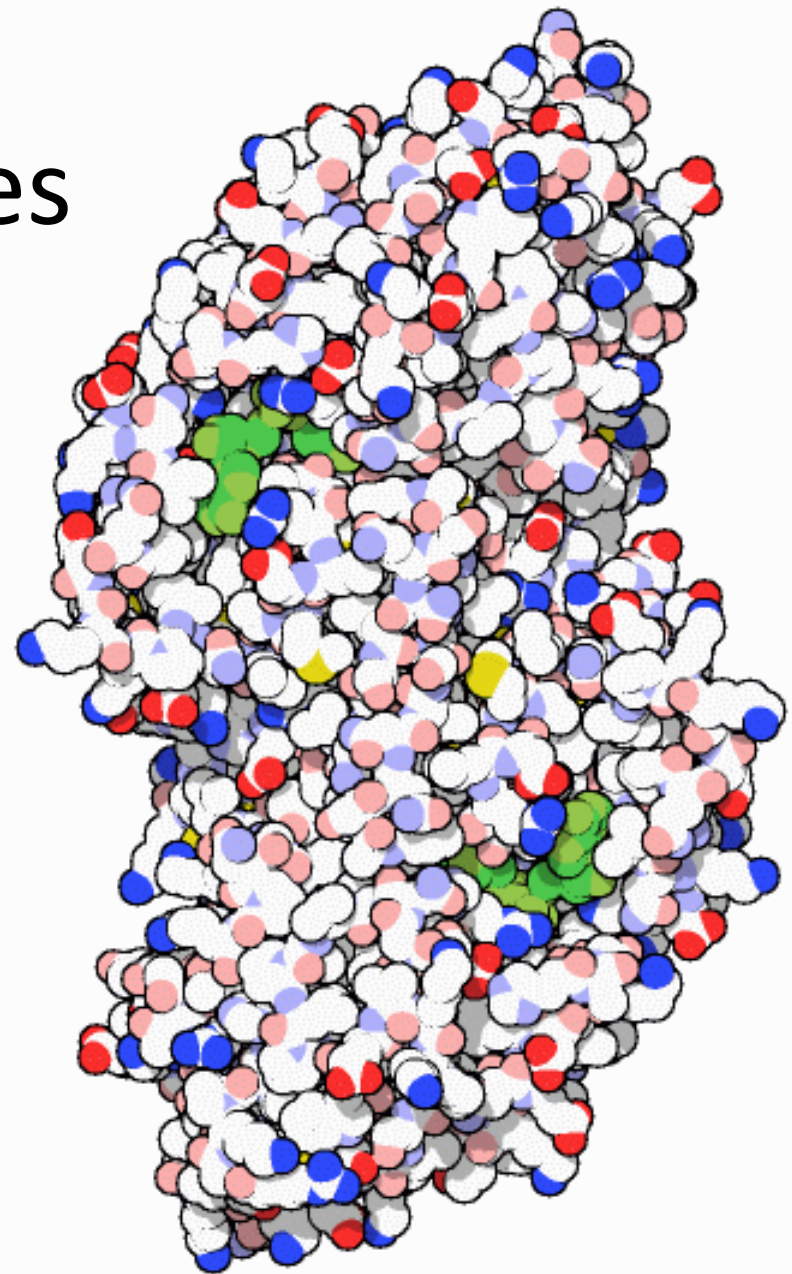


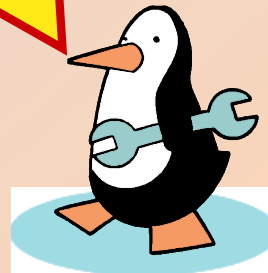
Metabolism & Enzymes



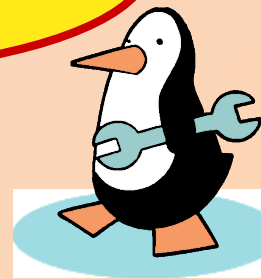
Alcohol Dehydrogenase

- Some chemical reactions release energy
 - exothermic (exergonic)
- Some chemical reactions require input of energy
 - Endothermic (endergonic)

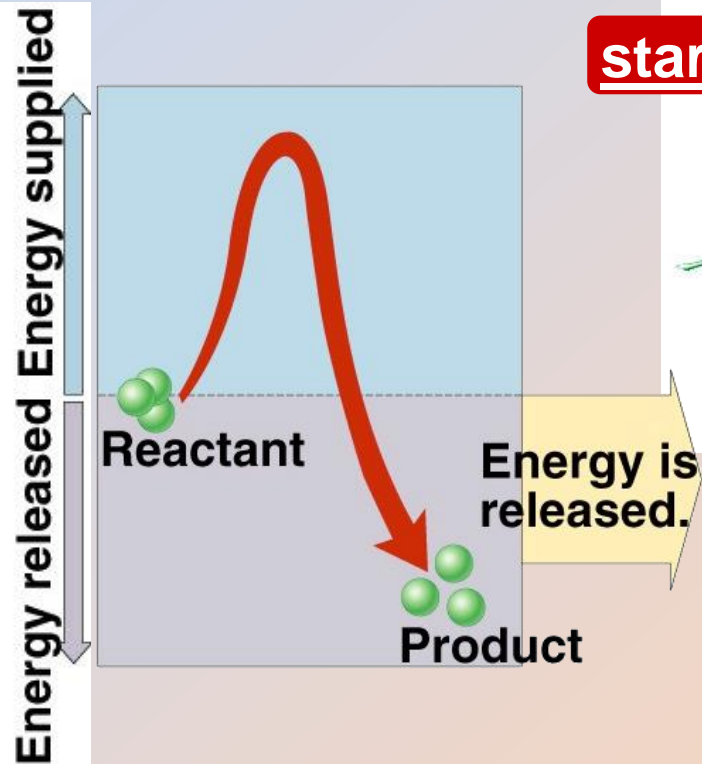
digesting molecules=
LESS organization=
lower energy



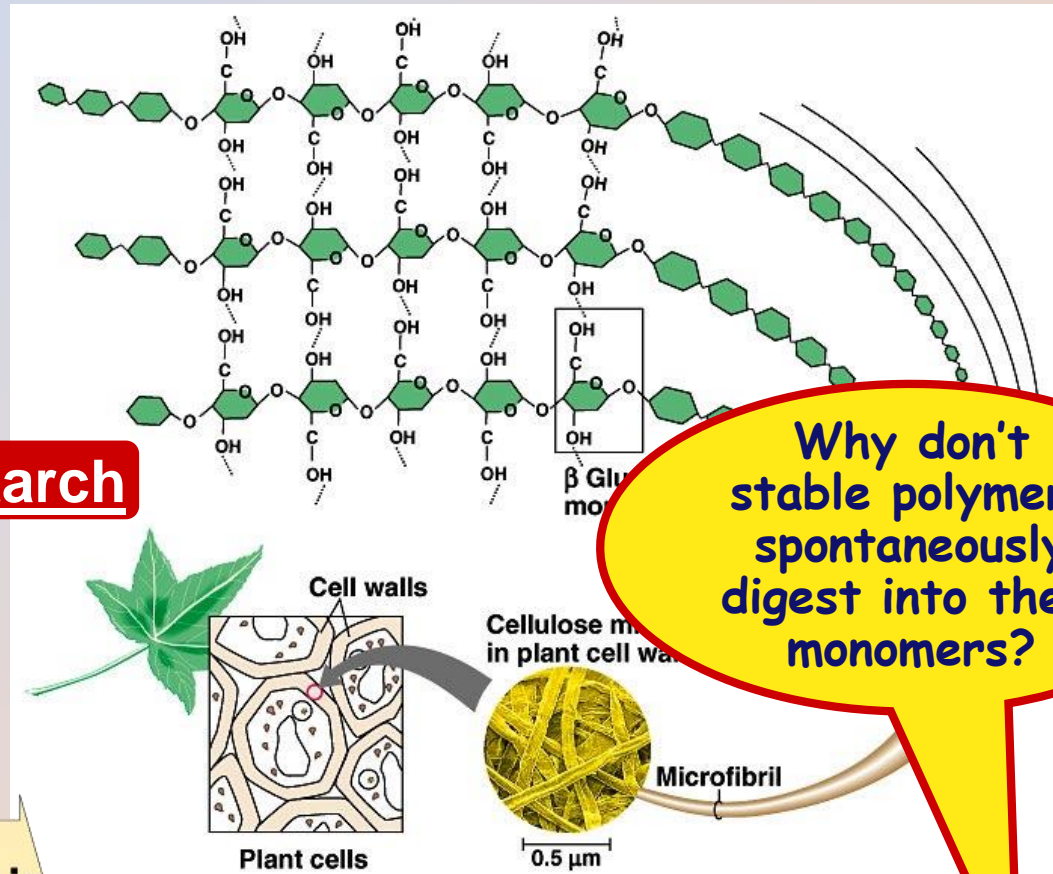
building molecules=
MORE organization=
higher energy



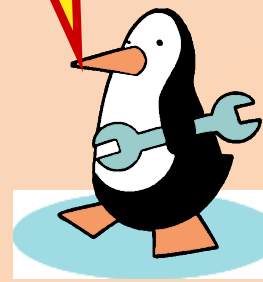
Why don't exergonic reactions just happen spontaneously?



starch

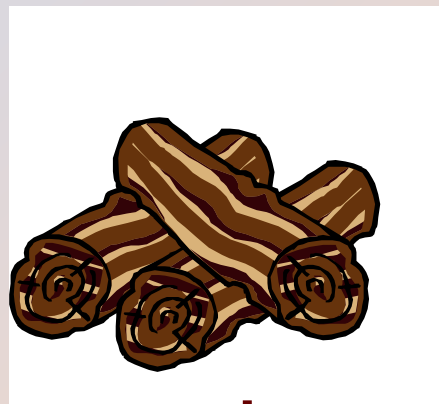


Why don't stable polymers spontaneously digest into their monomers?

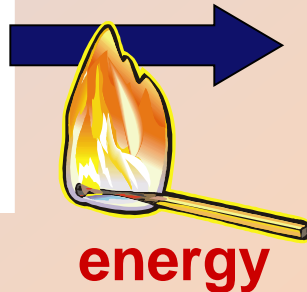


Activation energy

- Breaking down large molecules requires an initial input of energy to break bonds and start the reaction



wood



energy

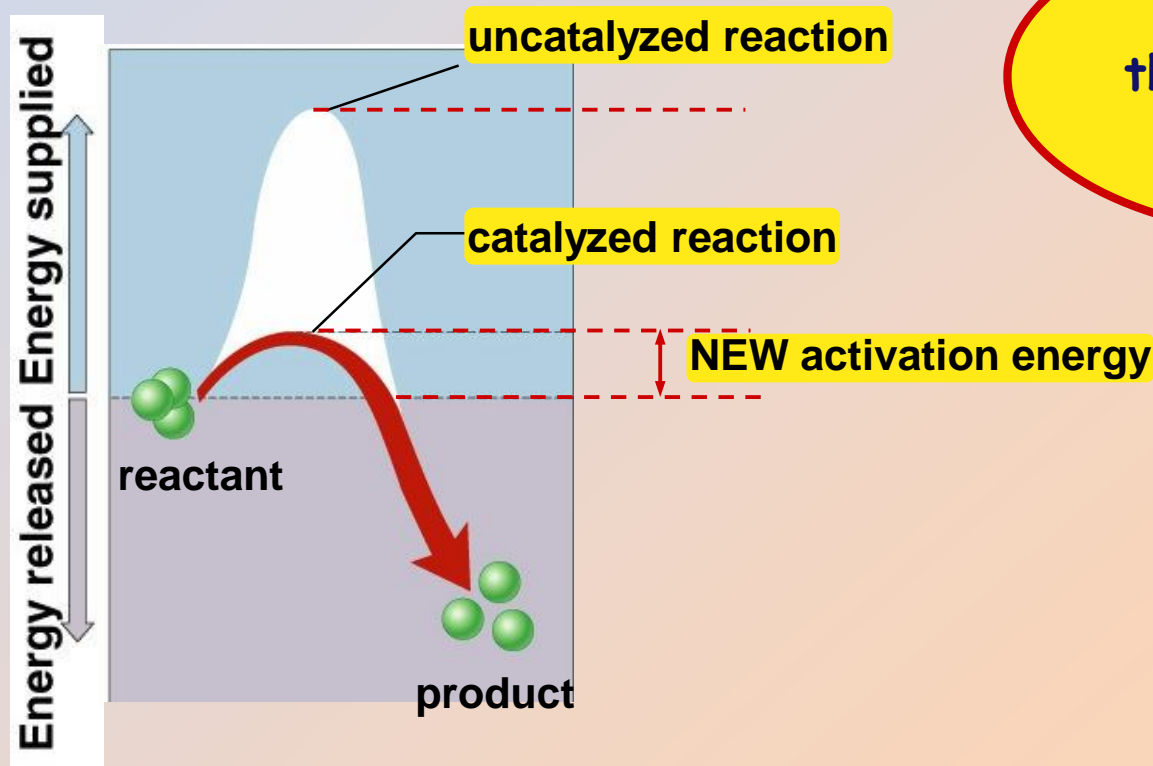


$\text{CO}_2 + \text{H}_2\text{O} + \text{heat}$

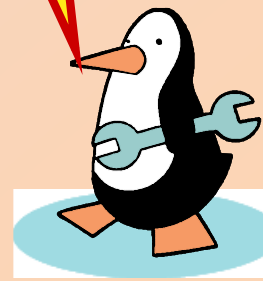
Enzymes Reduce Activation energy

- Catalysts

- reducing the amount of energy to start a reaction

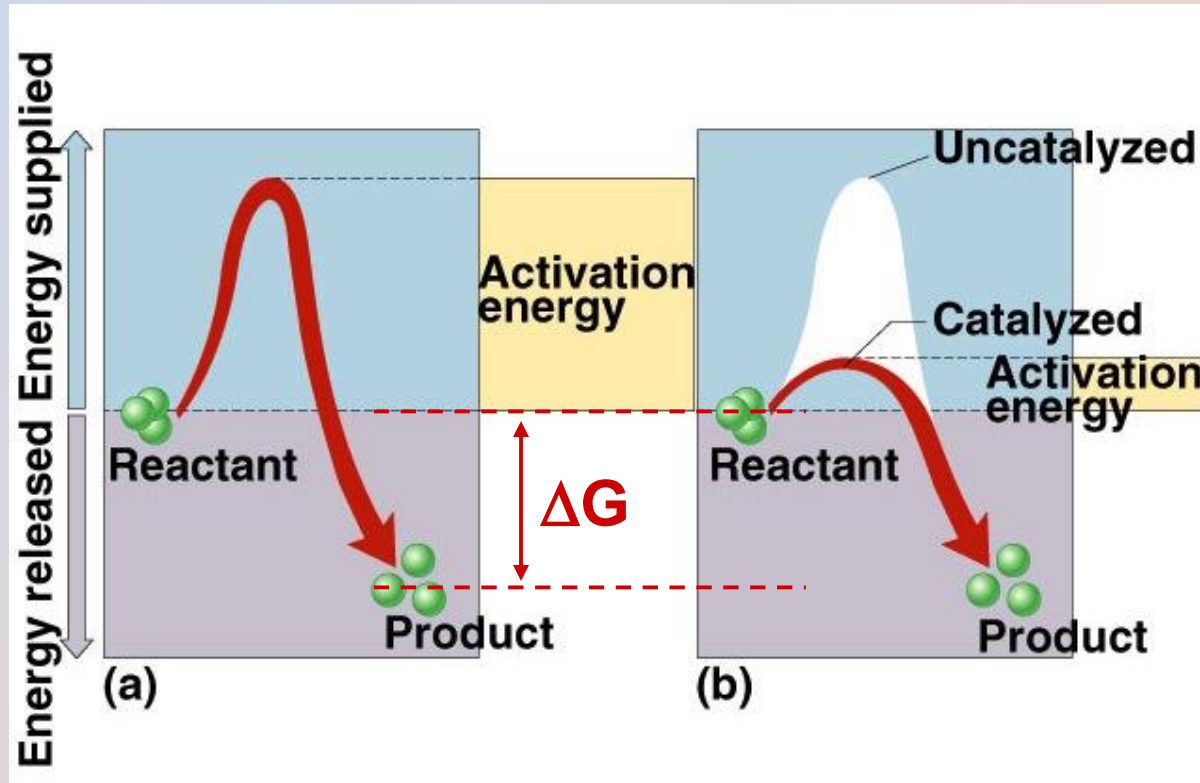


Pheeew...
that takes a lot
less energy!

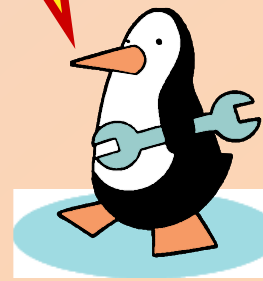


Catalysts = Enzymes

- What a cell has to do to reduce activation energy



Call in the
ENZYMES!



Properties of enzymes

- Reaction specific
 - each enzyme works with a specific substrate
- Not consumed in reaction
 - single enzyme molecule can catalyze thousands or more reactions per second
- Affected by cellular conditions
 - any condition that affects protein structure
 - temperature, pH, salinity
- Made of protein (or sometimes RNA)

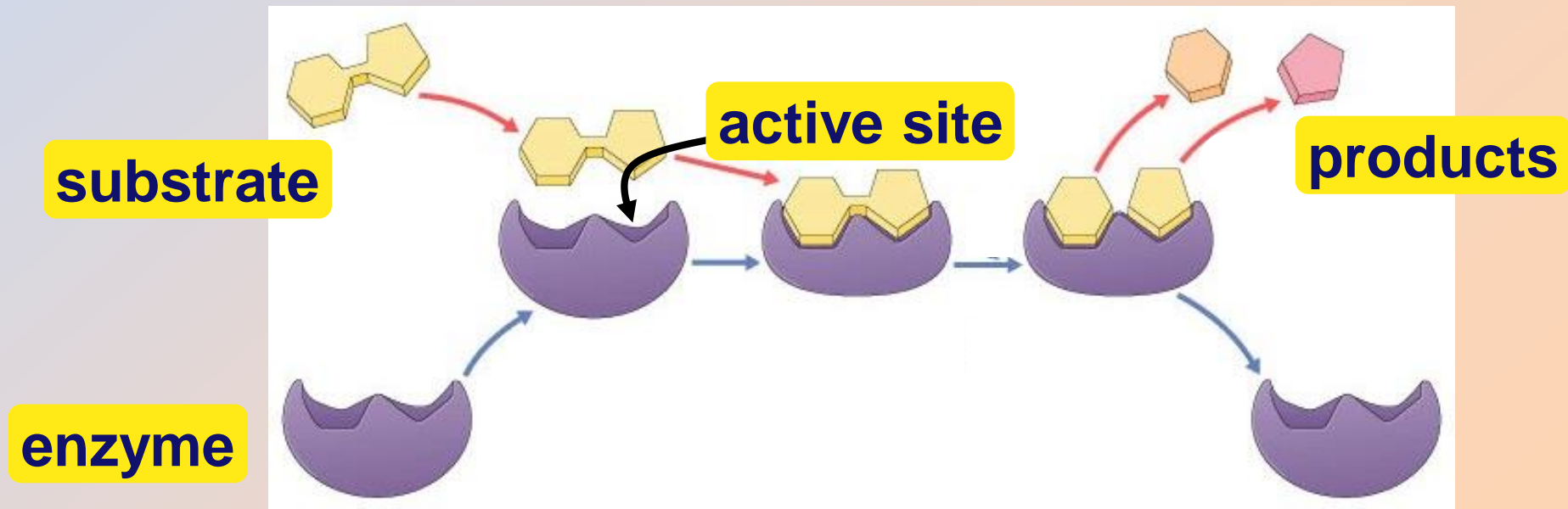
Enzyme vocabulary

substrate

- reactant which binds to enzyme

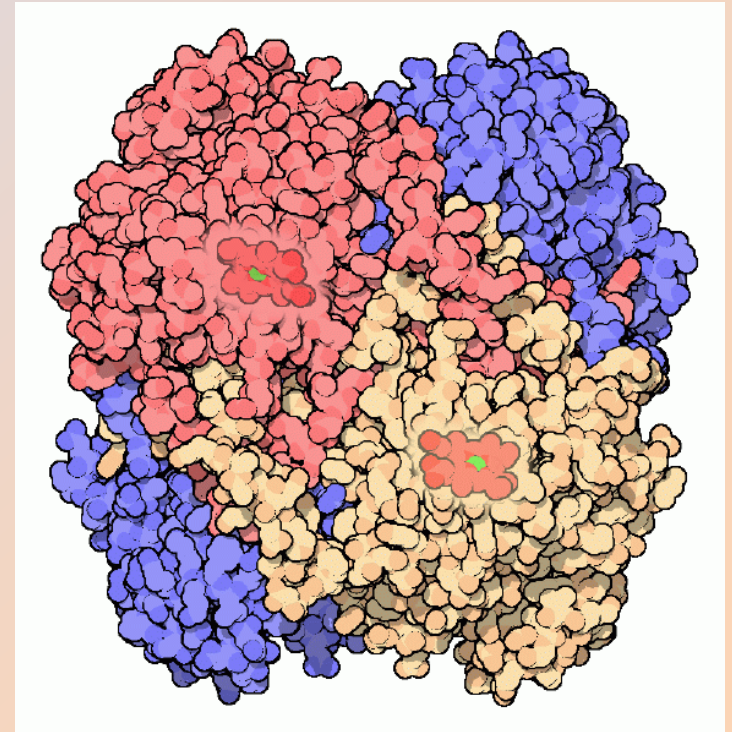
active site

- Where substrate fits into active site



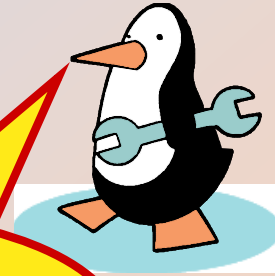
Factors Affecting Enzyme Function

- Enzyme concentration
- Substrate concentration
- Temperature
- pH
- Salinity
- Activators
- Inhibitors

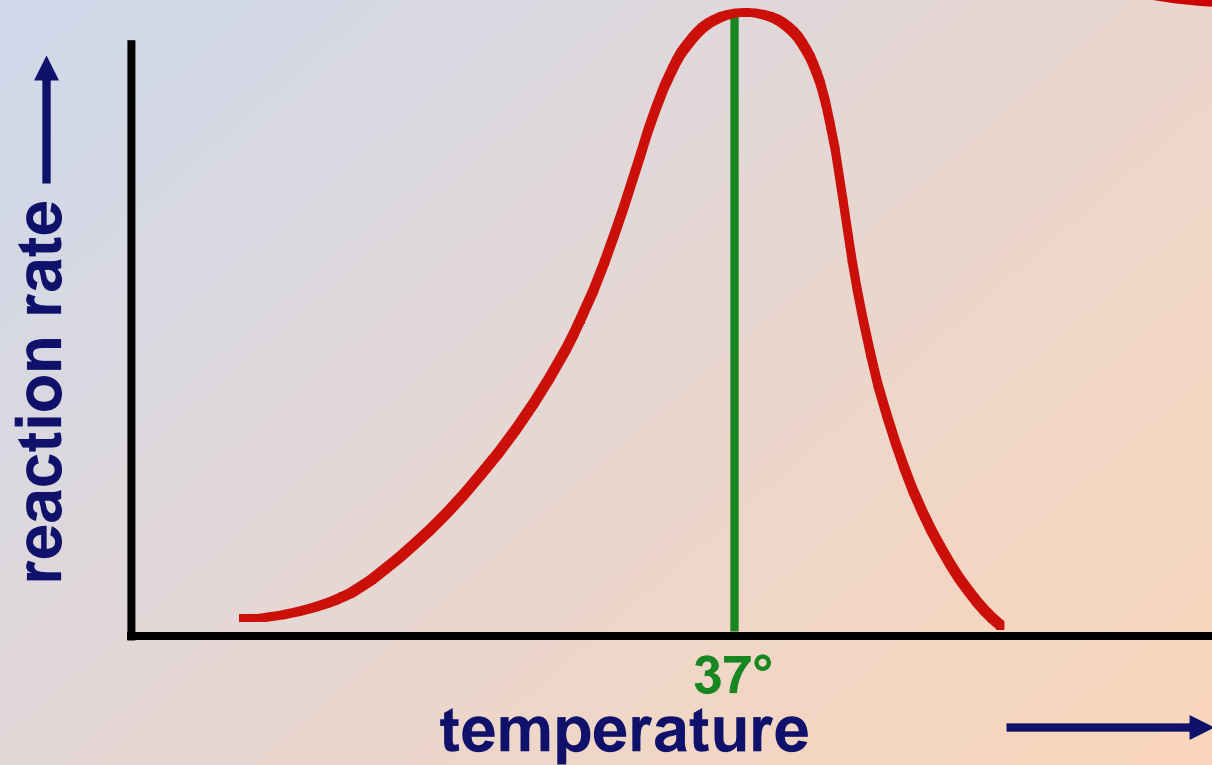


catalase

Temperature



What's
happening here?!



Factors affecting enzyme function

- Temperature

- Optimum T

greatest number of molecular collisions

human enzymes = 35° - 40° C

–body temp = 37° C

- Heat: increase beyond optimum T $^{\circ}$

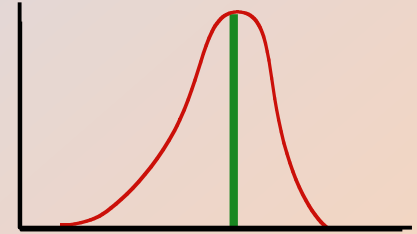
increased energy level of molecules disrupts bonds in enzyme & between enzyme & substrate

denaturation = lose 3D shape (3 $^{\circ}$ structure)

- Cold: decrease T $^{\circ}$

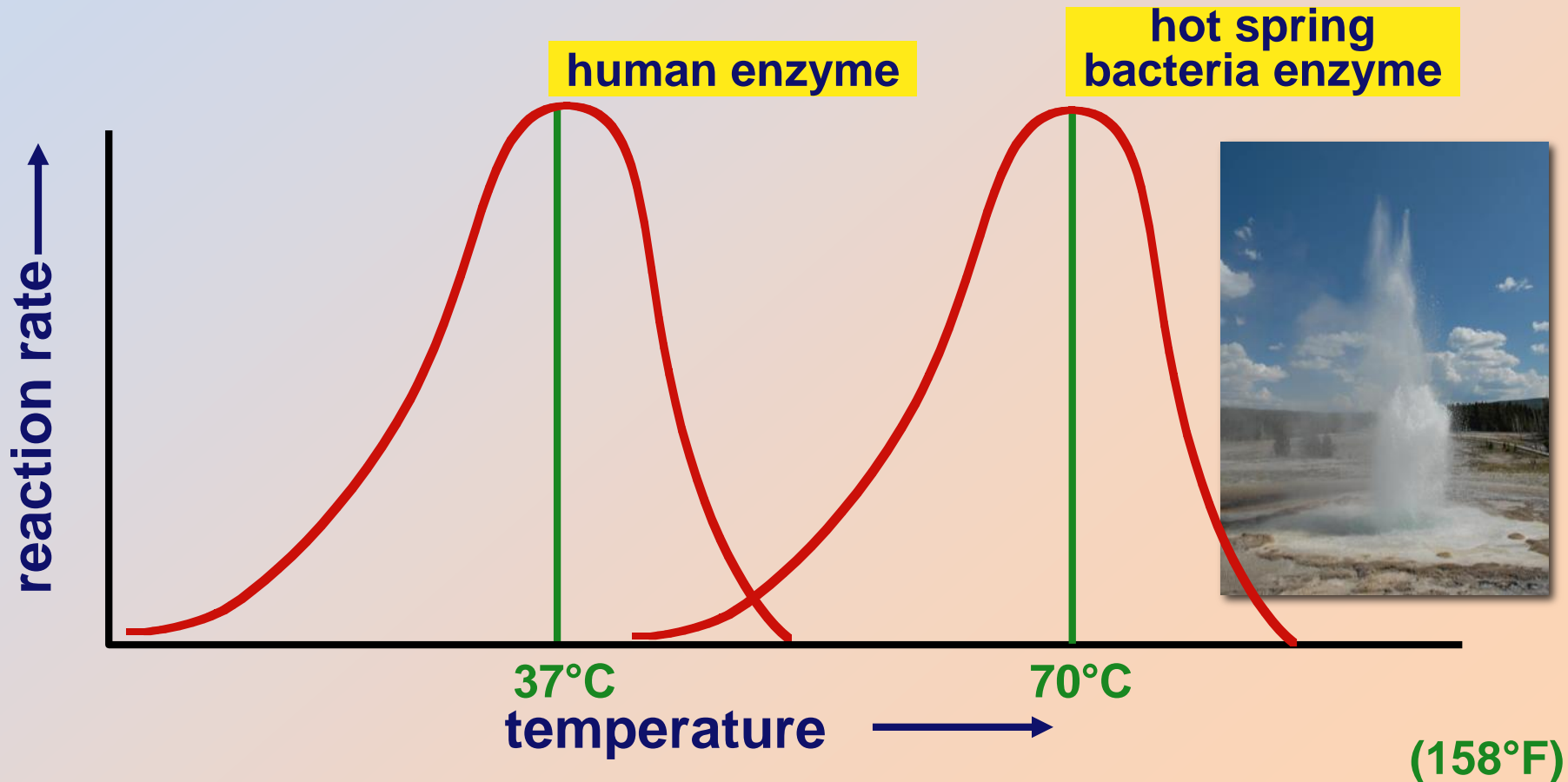
- molecules move slower

- decrease collisions between enzyme & substrate

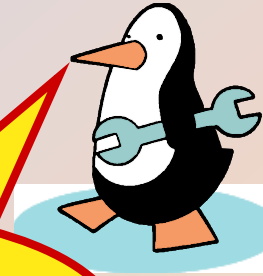


Enzymes and temperature

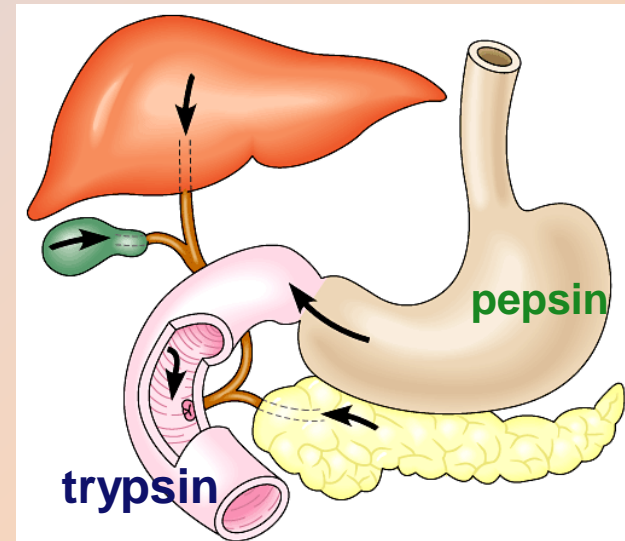
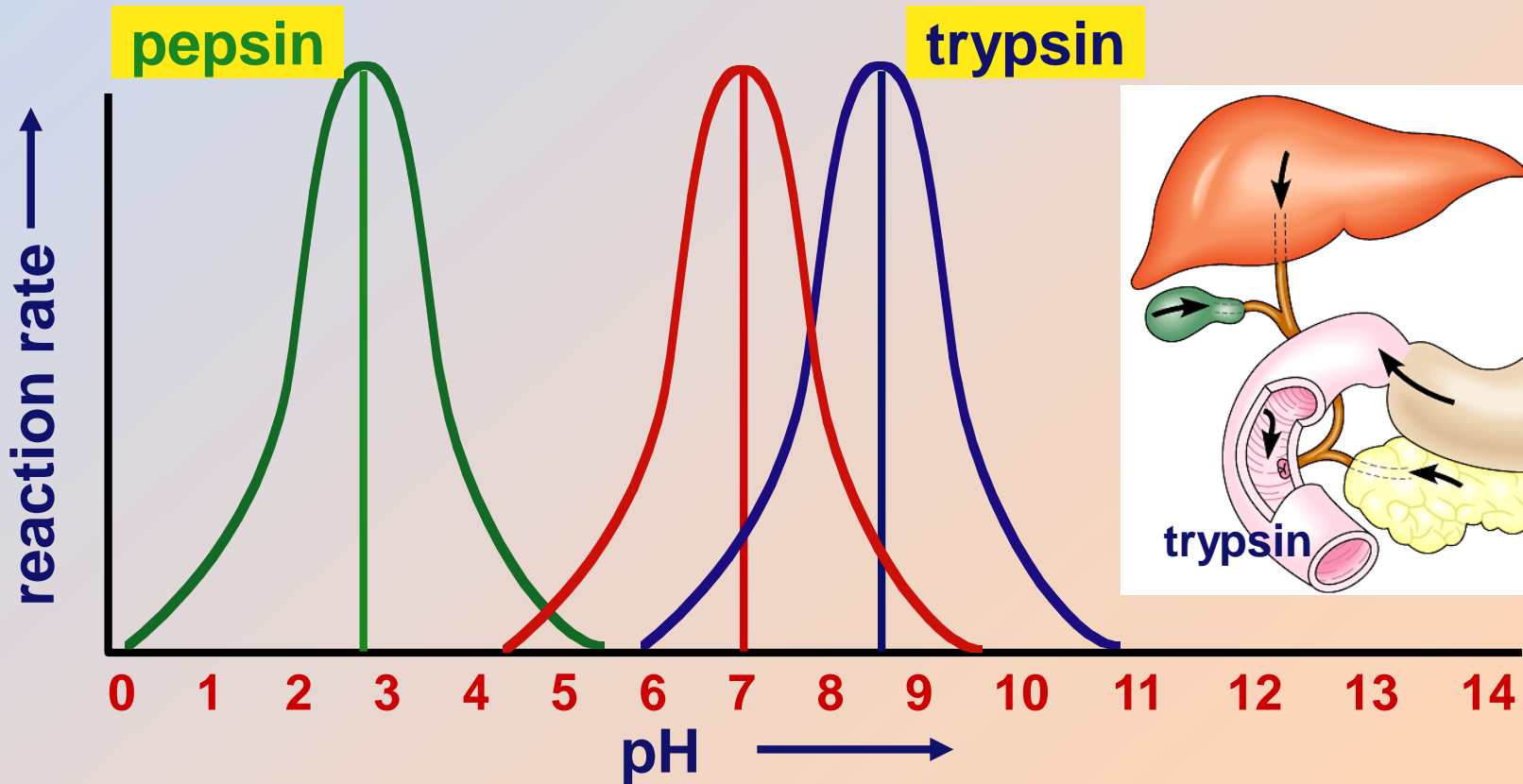
- Different enzymes function in different organisms in different environments



pH

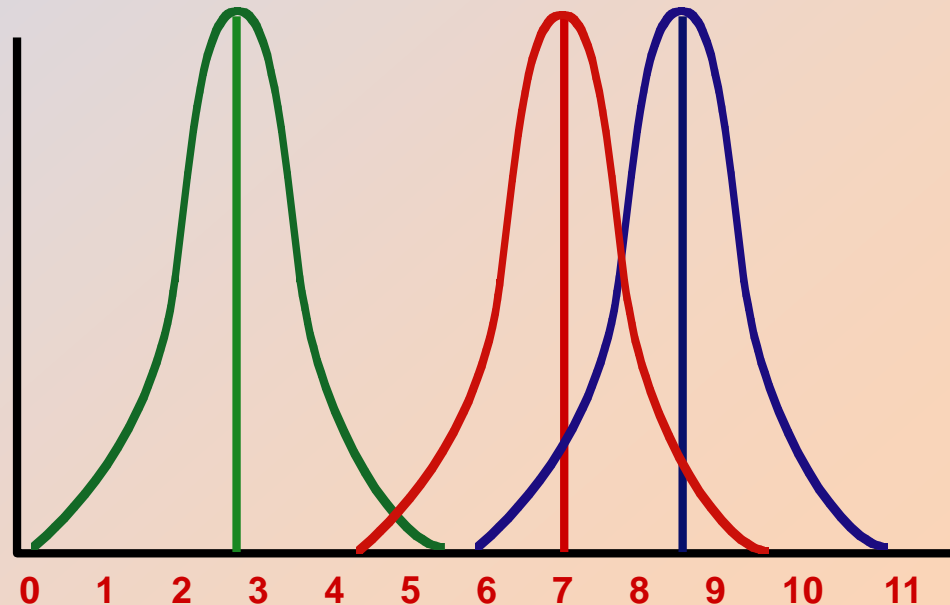


What's happening here?!

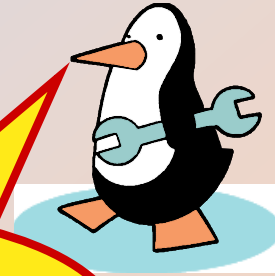


Factors affecting enzyme function

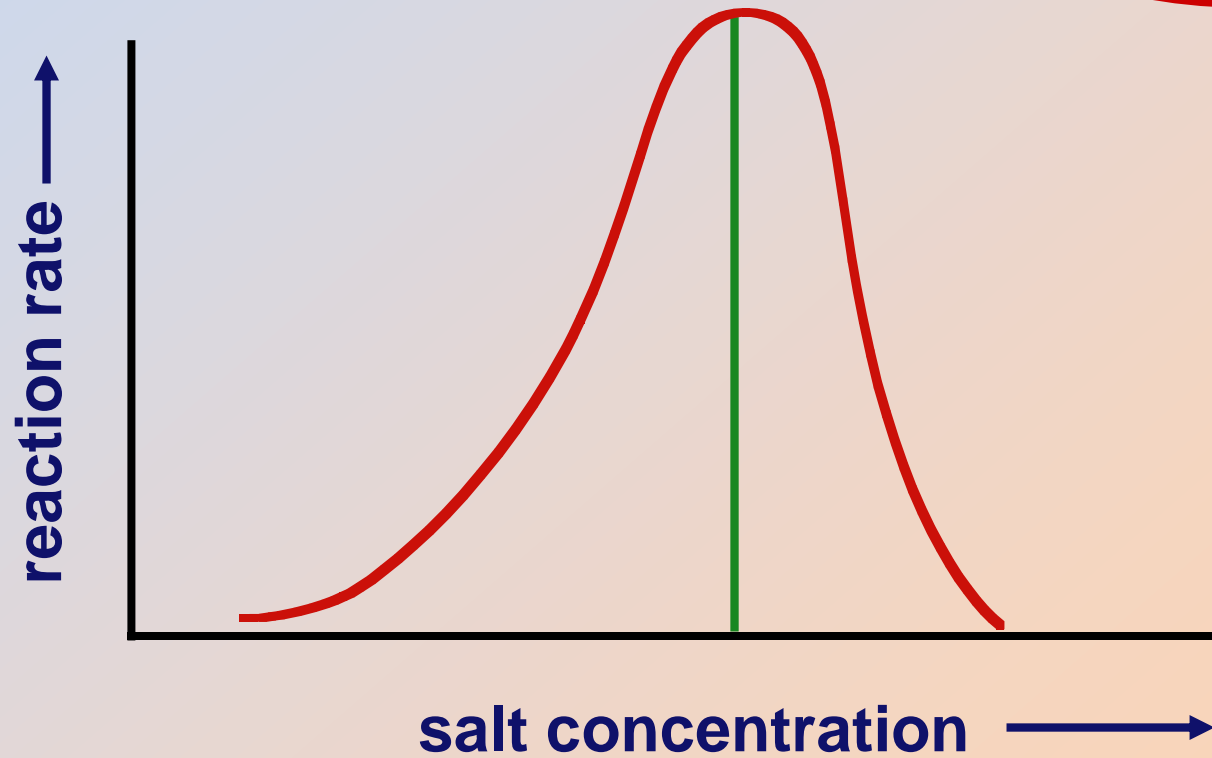
- pH
 - adds or remove H^+ , disrupts 3D shape
denatures protein
- pepsin (stomach) = pH 2-3
- trypsin (small intestines) = pH 8



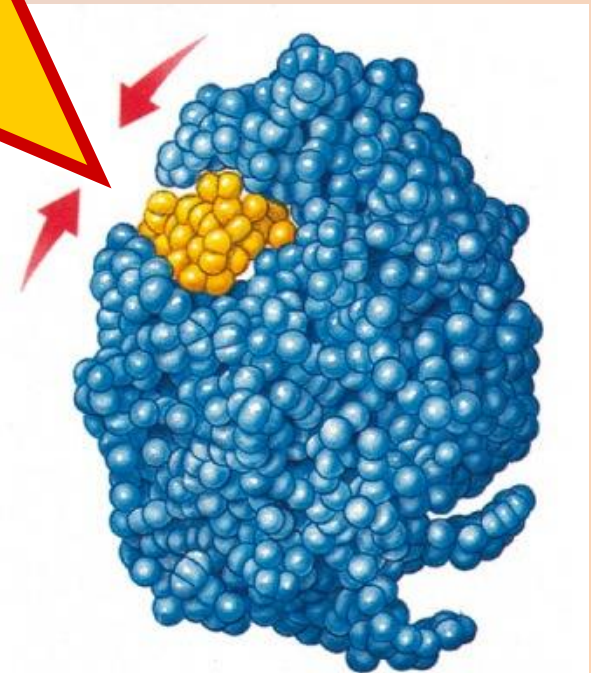
Salinity



What's
happening here?!



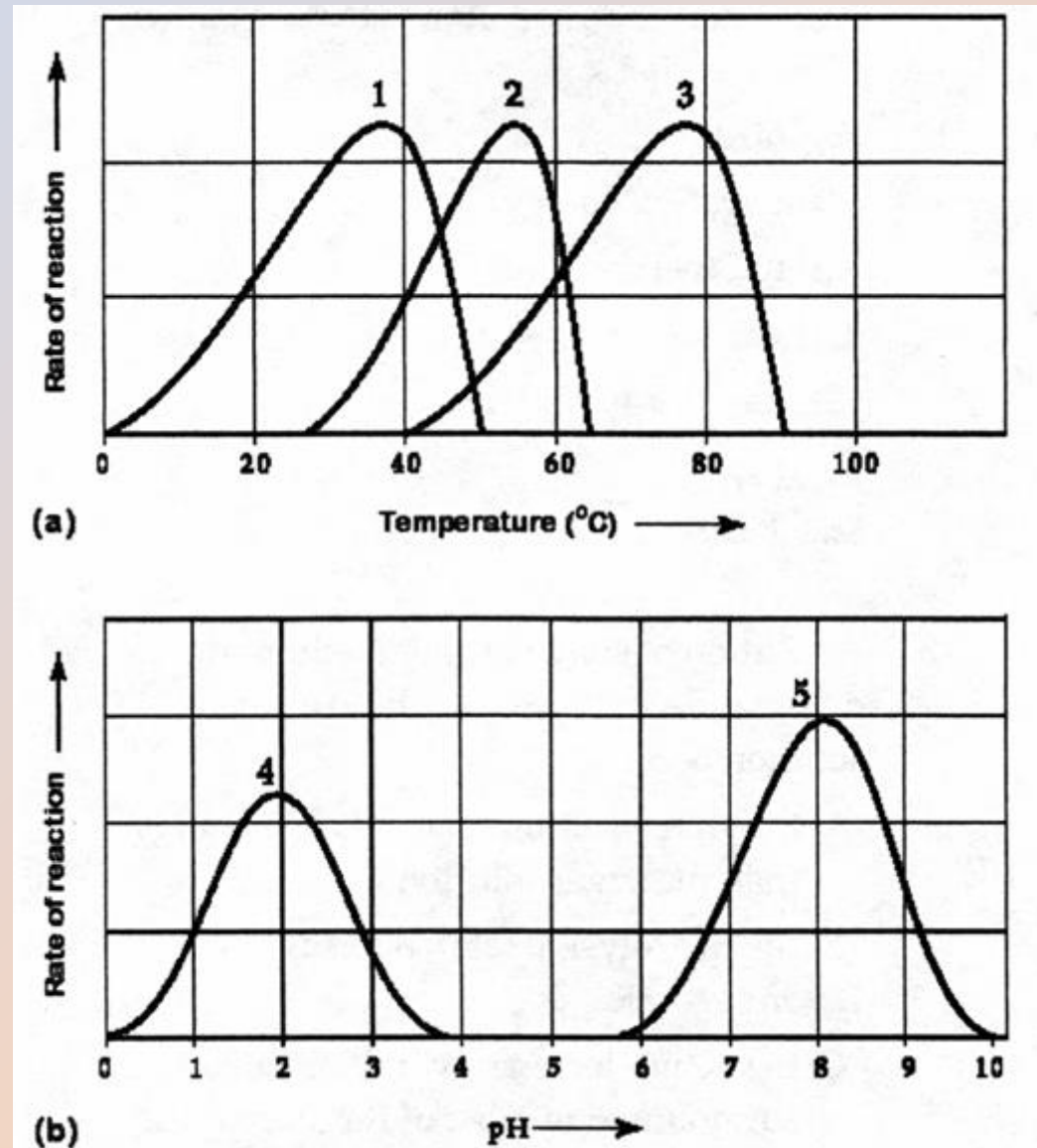
Got any Questions ?!



Review Questions

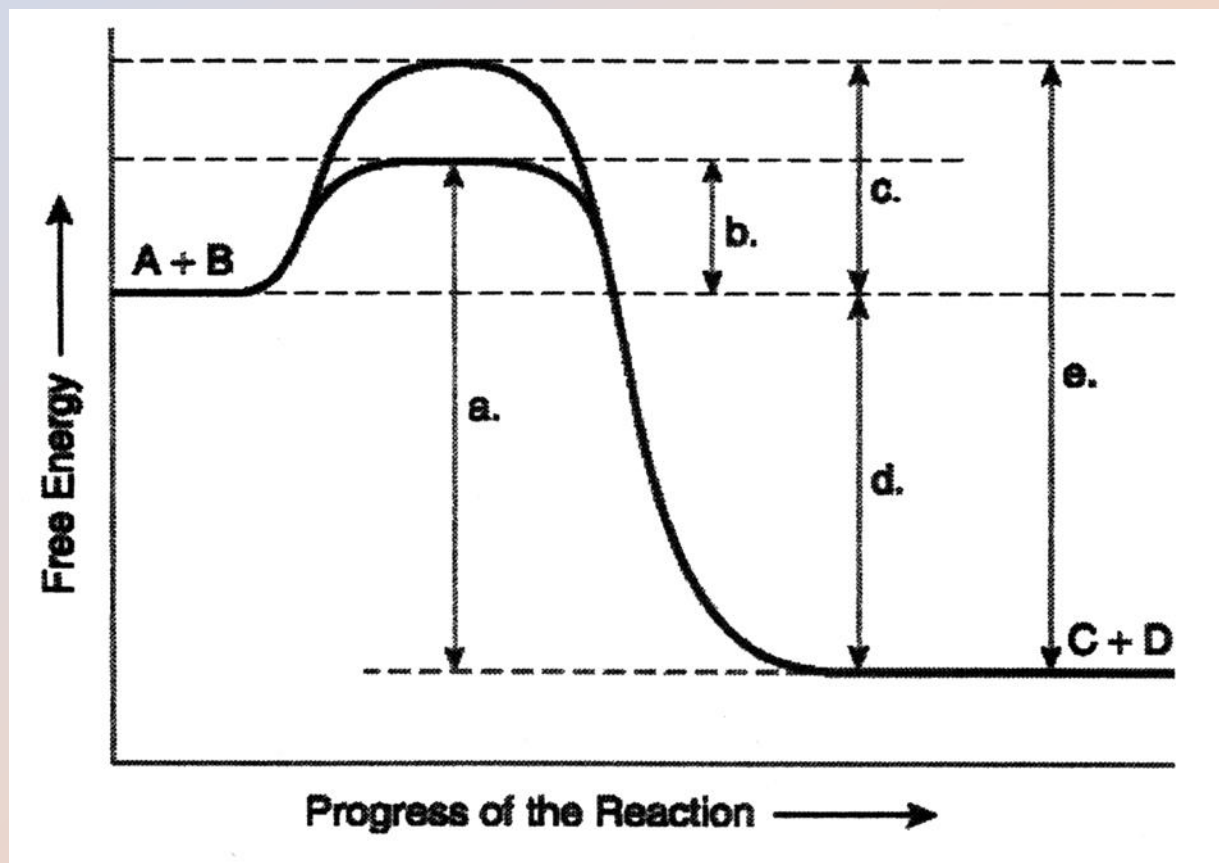
1. Which curve was generated using an enzyme taken from a bacterium that lives in hot springs at temperatures of 70°C or higher?

- A. curve 1
- B. curve 2
- C. curve 3
- D. curve 4
- E. curve 5



3. Which of the following represents the ΔG of the reaction?

- A. a
- B. b
- C. c
- D. d
- E. e



4. Which of the following would be the same in an enzyme-catalyzed or -uncatalyzed reaction?

- A. a
- B. b
- C. c
- D. d
- E. e

