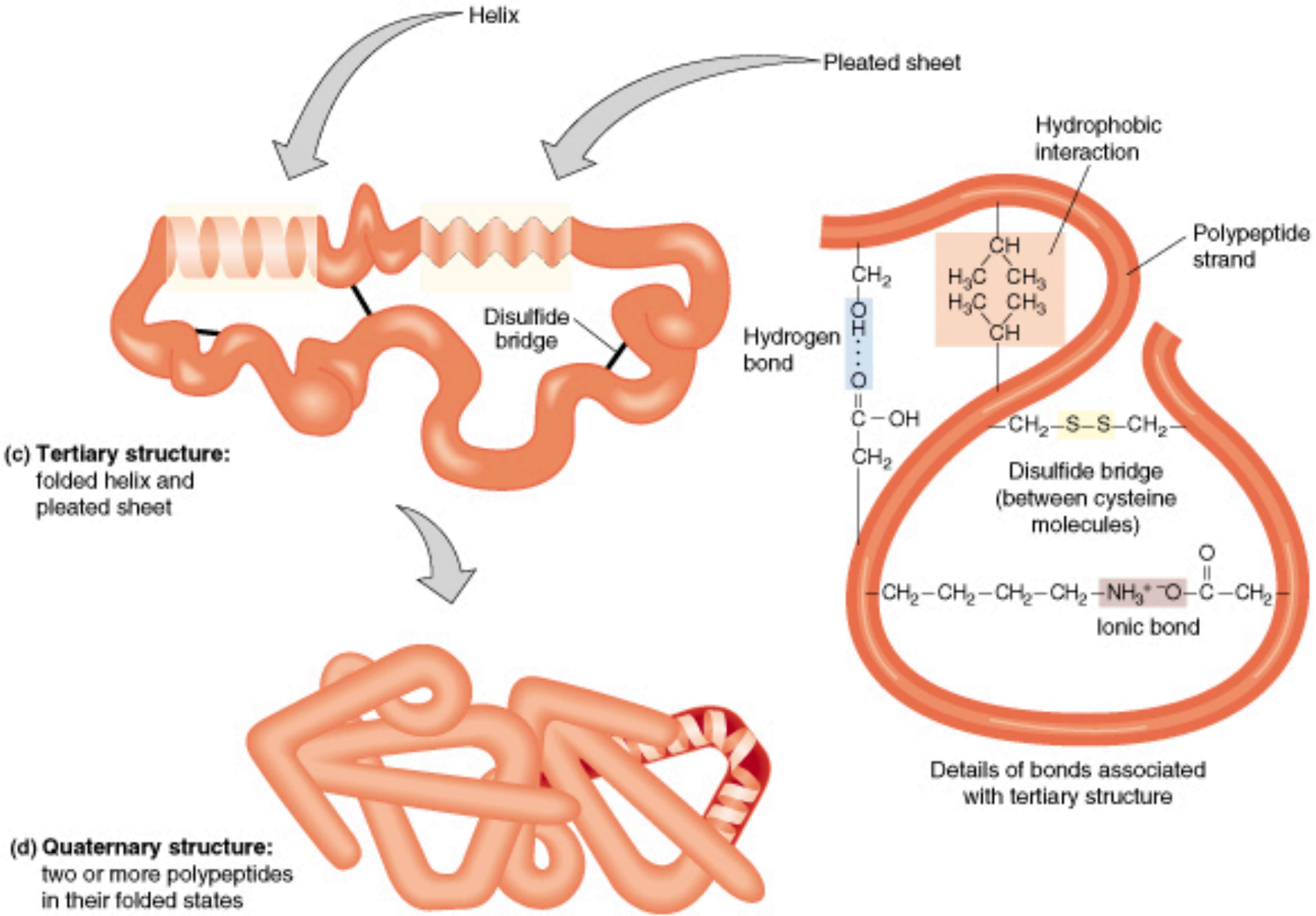
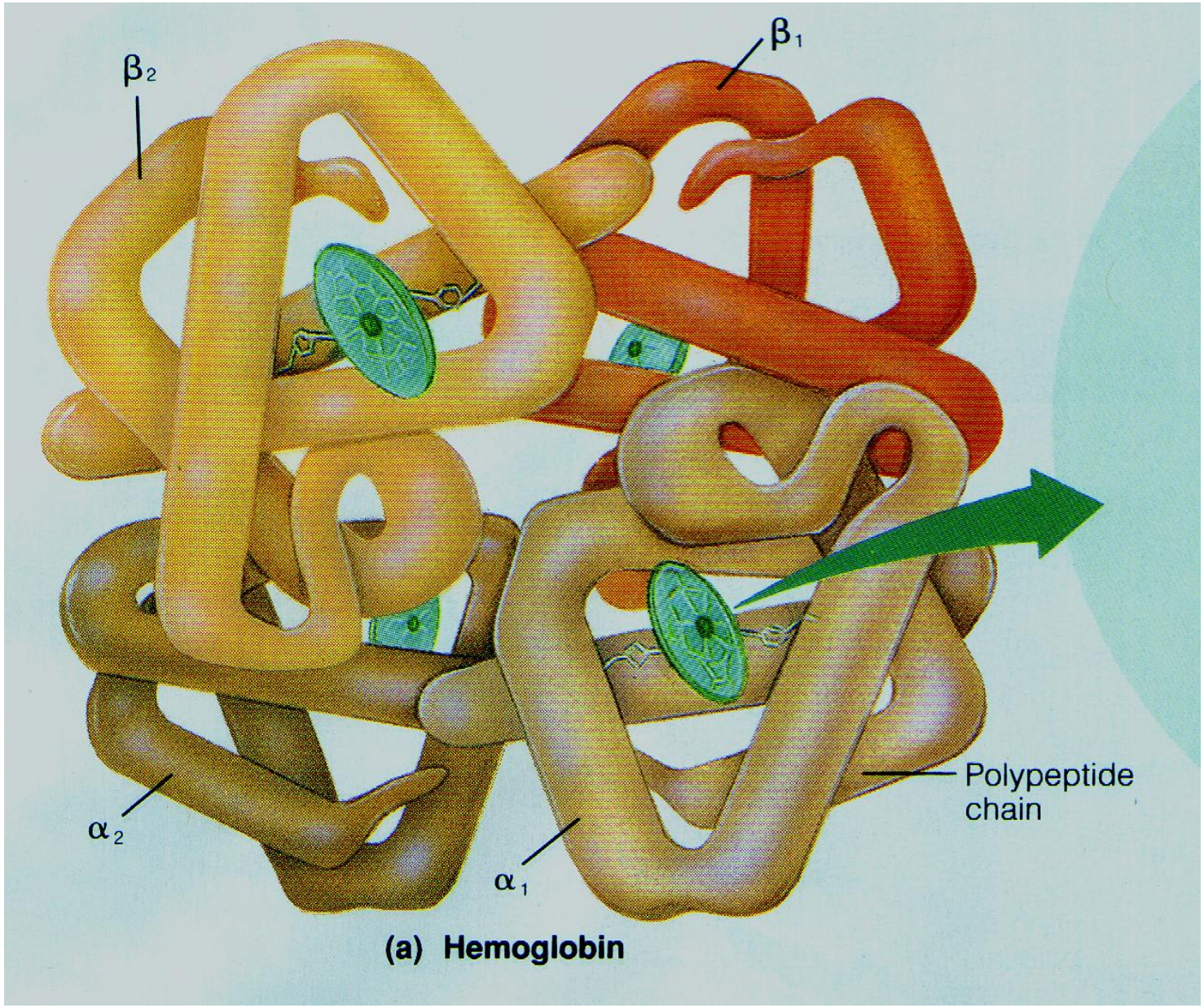
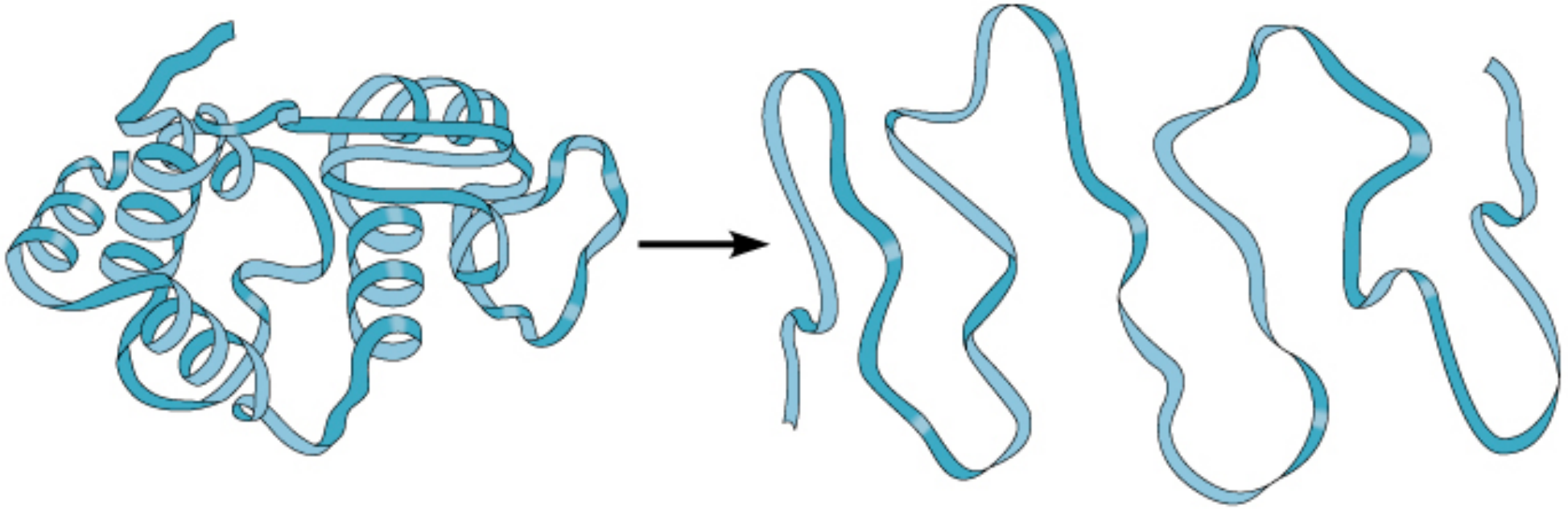


Protein structure: Quaternary (Hemoglobin)



Protein Denaturing



Active (functional) protein

Denatured protein

I. MICROBIAL PHYSIOLOGY

- Metabolism: the sum of all biochemical processes taking place in a living cell. Two phases:
- Anabolism: constructive metabolism; the synthesis reactions; small molecules bonded into larger molecules; energy is "used up"
- Catabolism: destructive metabolism; decomposition reactions; large molecules split into smaller molecules; energy is released

A. Enzymes

- the enzymes present in an organism determine the nature of its physiology
- enzymes are biological catalysts (catalysts are agents that speed up chemical reactions)
- Enzymes “are reusable protein molecules that brings about a chemical change while remaining unchanged itself”

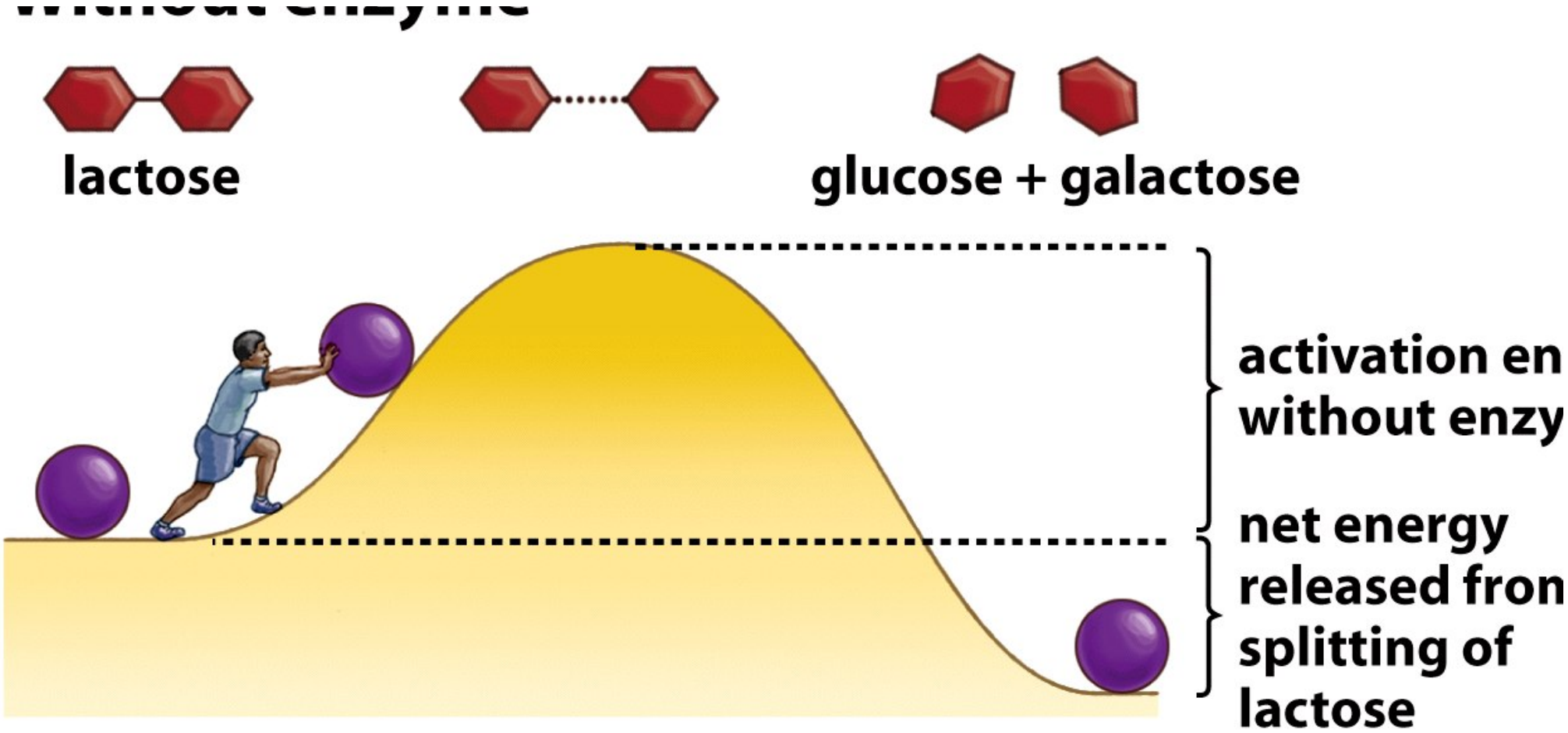
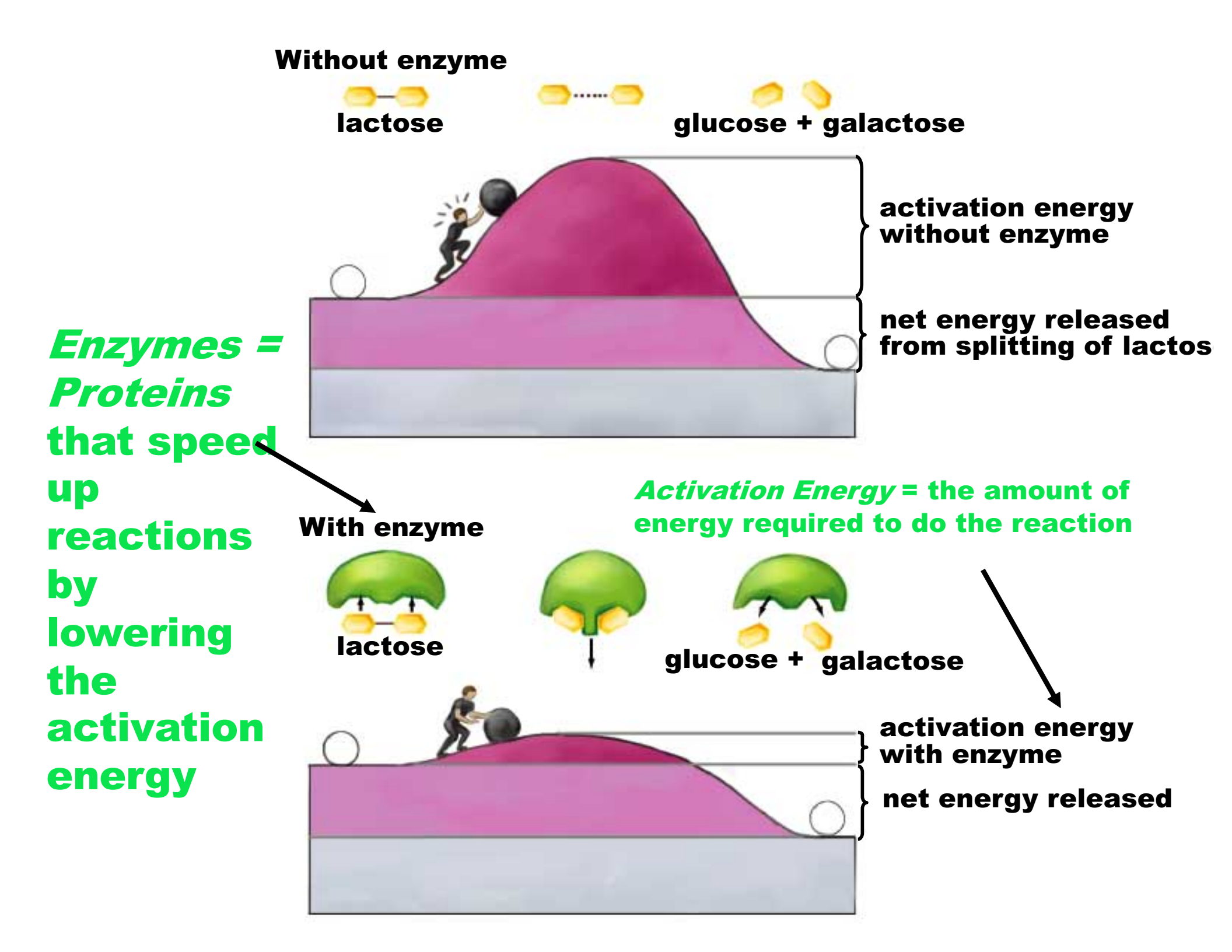


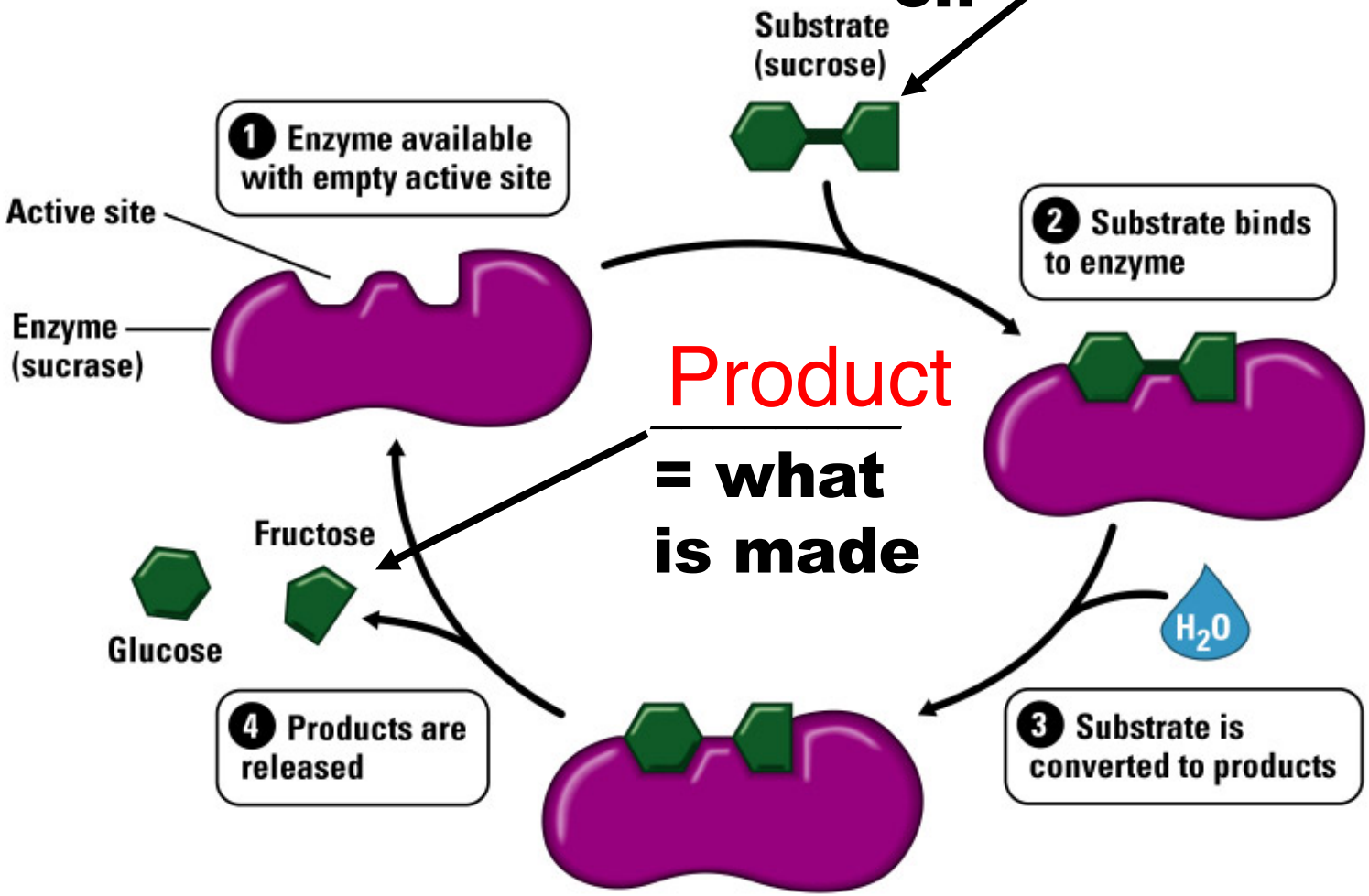
Figure 6-7a A Brief Guide to Biology, 1/e

Activation energy = the amount of energy required to do the reaction


Without enzyme
lactose
glucose + galactose
activation energy without enzyme
net energy released from splitting of lactos
Enzymes = Proteins that speed up reactions by lowering the activation energy
With enzyme
Activation Energy = the amount of energy required to do the reaction
lactose
glucose + galactose
activation energy with enzyme
net energy released

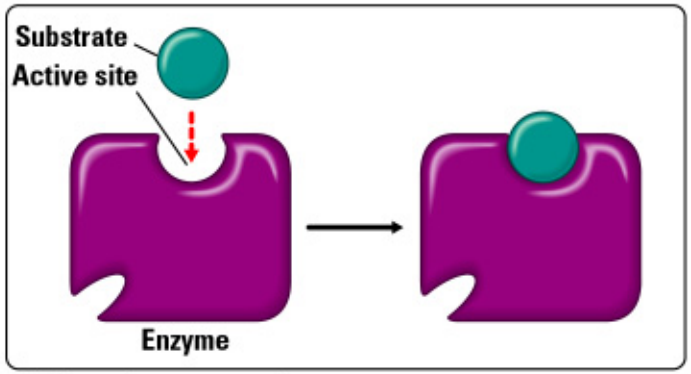
Enzymes

Substrate = what the enzymes works on



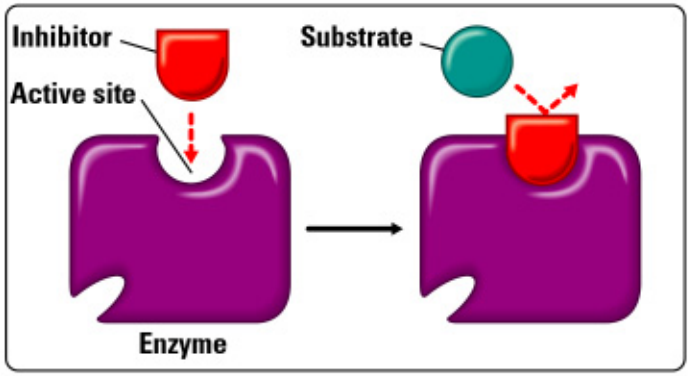
Enzymes

Active Site

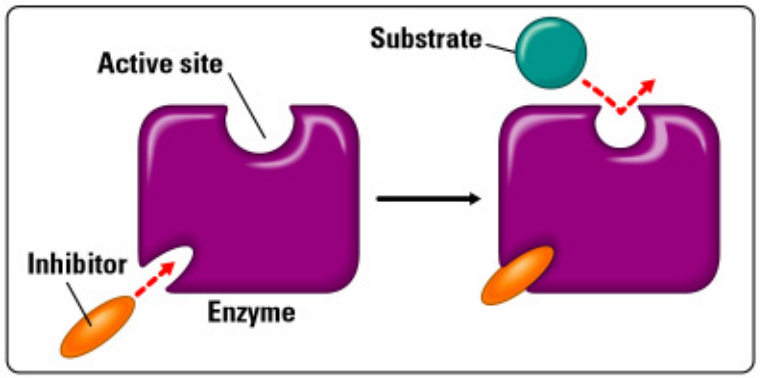


(a) Normal enzyme action

Allosteric Site



(b) Enzyme inhibition by a substrate imposter

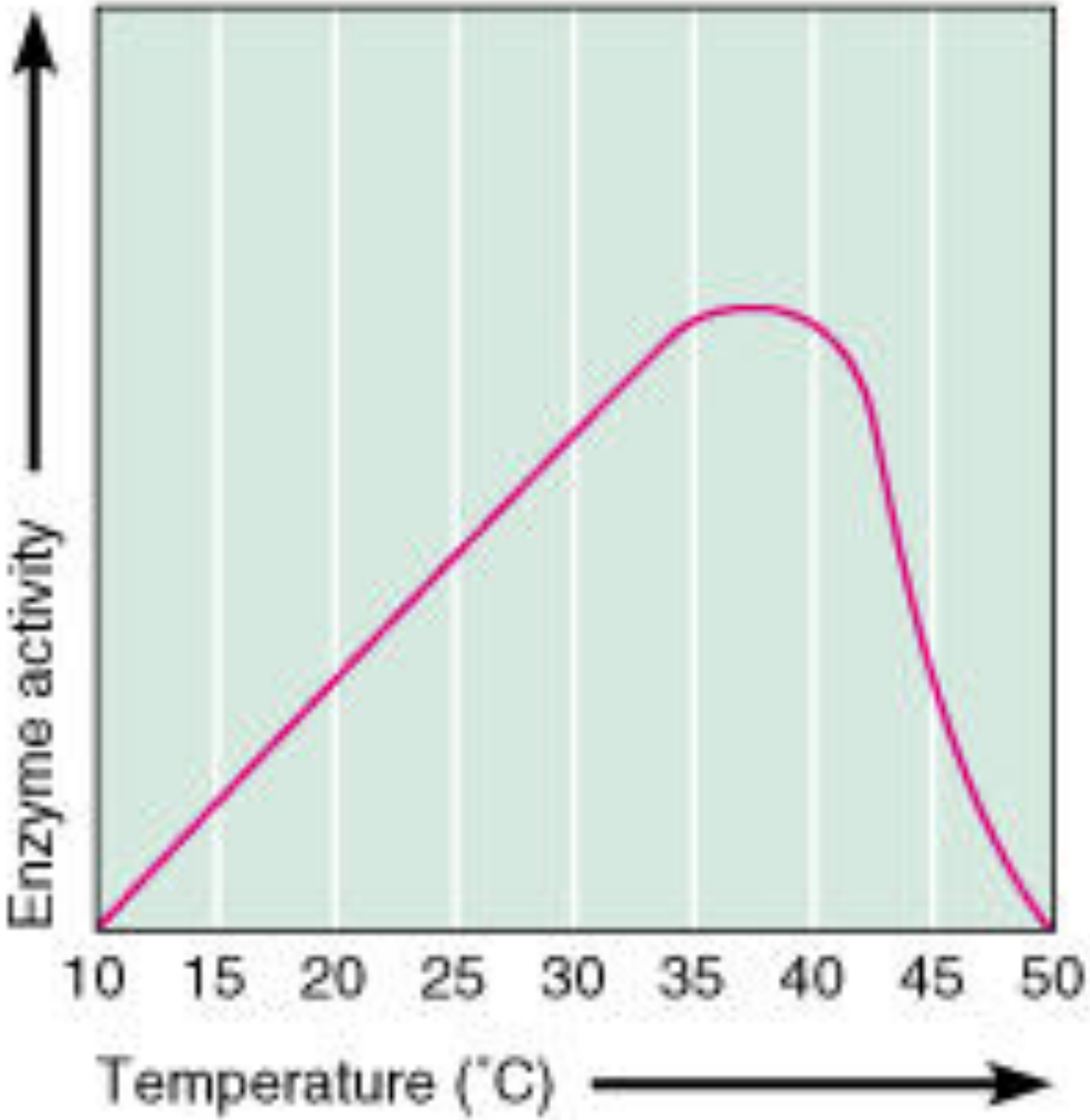


(c) Enzyme inhibition by a molecule that causes the active site to change shape

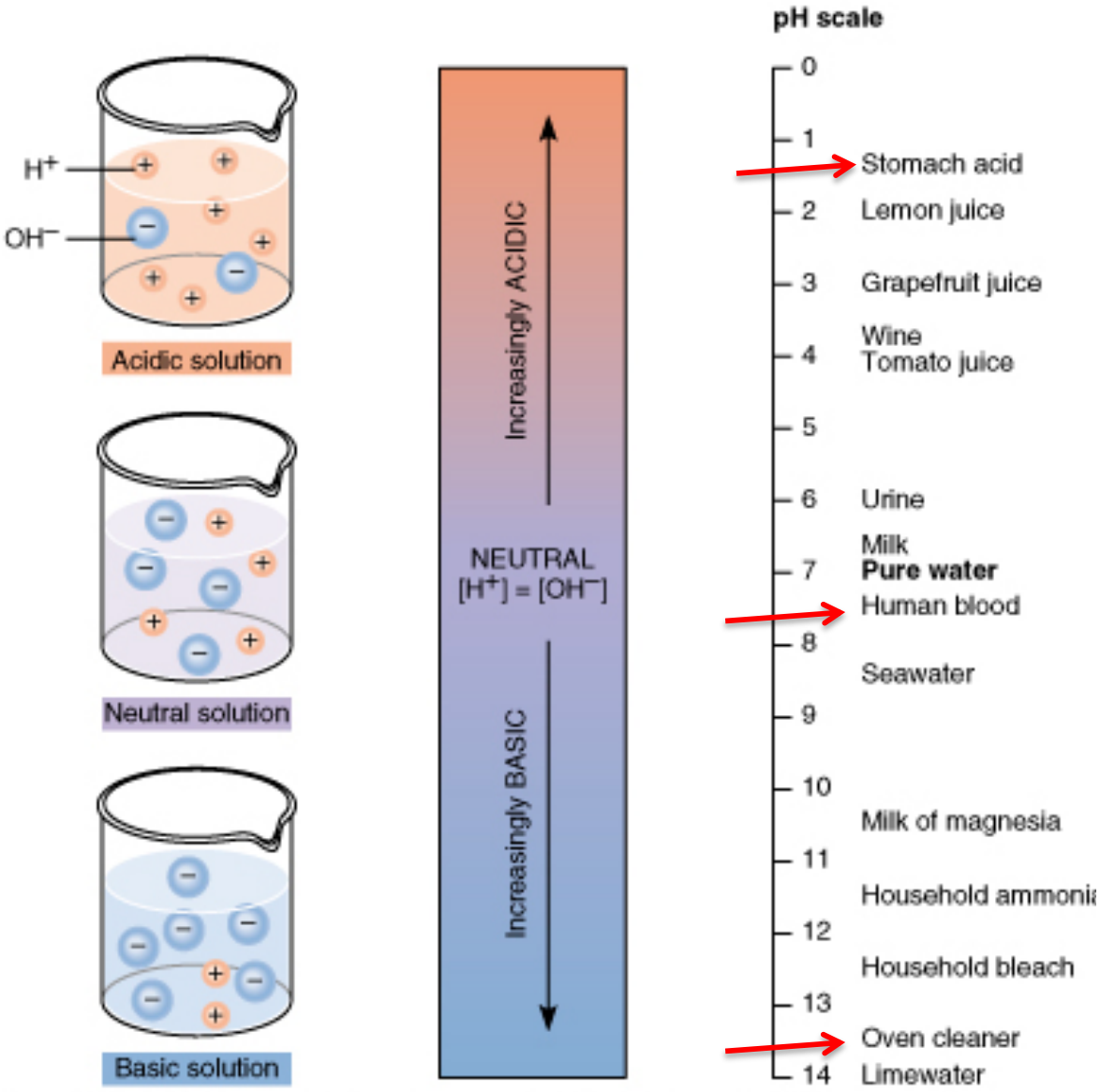
Competitive Inhibitor

Noncompetitive inhibitor

enzyme activity vs temperature



- Measurement of acid/base balance
- Logarithmic scale
- 0-6.9 = acid
- 7.1-14 = basic (alkaline)
- 7 = neutral (like pure water)



Naming of enzymes

- names end with -ase
- name of substrate + ase
  e.g. sucrose is digested by sucrase
- kind of reaction + ase
  e.g. an enzyme that causes oxidation is called oxidase

Types of Enzymes based on location

- endoenzymes: remain inside of the cell (work internally)
  - enzymes of cellular metabolism
  - vulnerable enzymes
- exoenzymes: released to the exterior of the cell (work externally)
  - digestive enzymes and enzymes of virulence

Constitutive vs Induced Enzymes

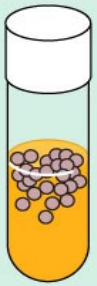
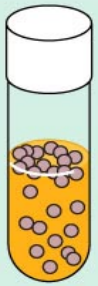
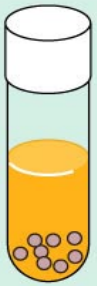
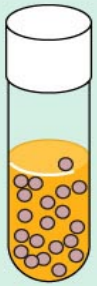
- Constitutive enzymes:
  - always present
  - necessary for life of cell
- Induced enzymes:
  - produced only when substrates are present
  - e.g. digestive enzymes
  - provide efficiency and adaptability

Classification of organisms by oxygen use (study table 6.1)

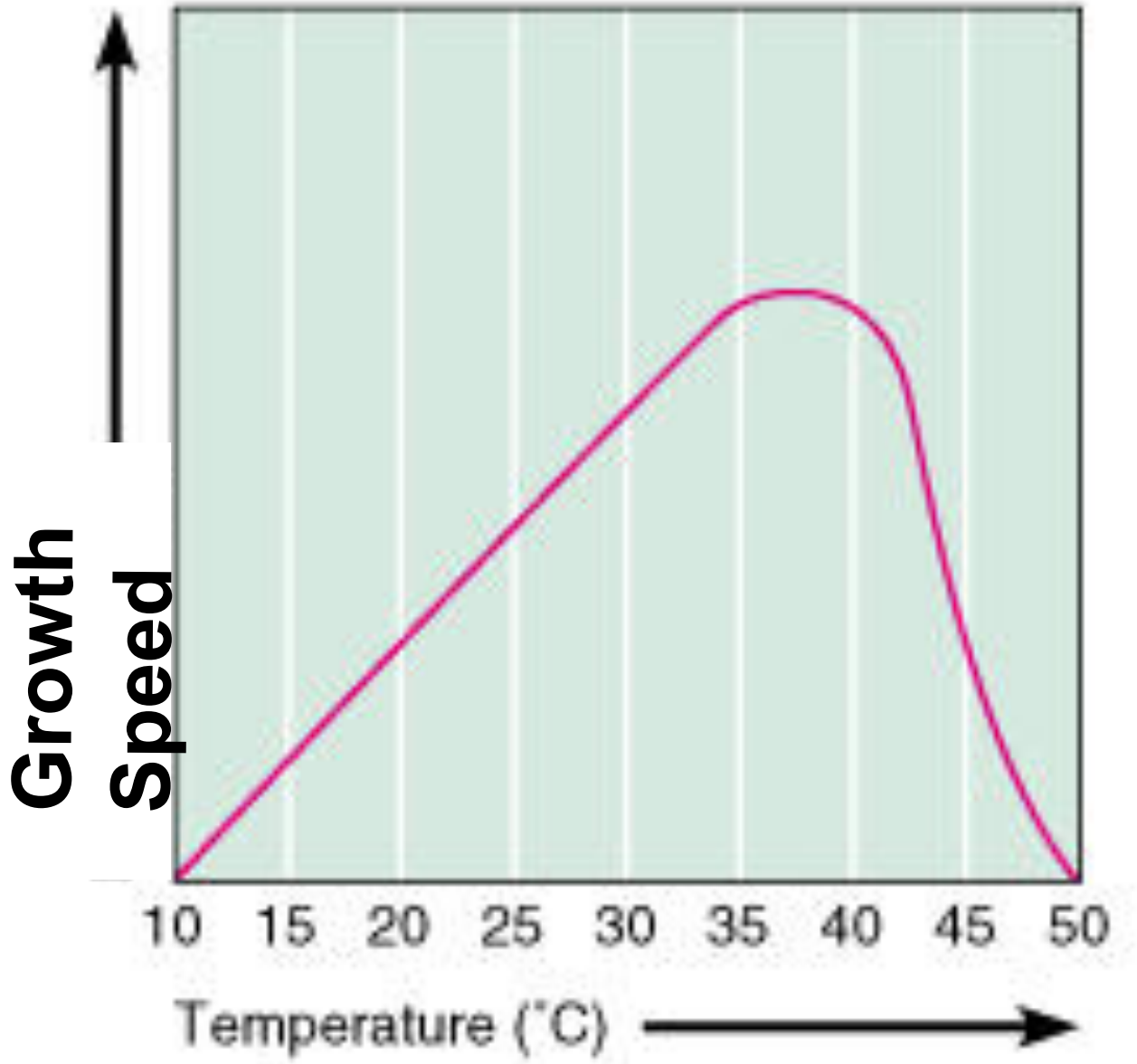
- 1. obligate aerobes: (= strictly aerobic): must have oxygen to grow (go dormant without oxygen)
- 2. microaerophiles: grow best at low oxygen levels (less than atmospheric)
- 3. facultative anaerobes: use oxygen if it's present, but can also grow anaerobically (capable of growing at any oxygen level, but greater growth with oxygen present)
- 4. aerotolerant anaerobes: never use oxygen, but not inhibited by it
- 5. obligate anaerobes: grow only in absence of oxygen (inhibited by oxygen)

Growth at different oxygen levels

TABLE 6.1 The Effect of Oxygen on the Growth of Various Types of Bacteria

	a. Obligate Aerobes	b. Facultative Anaerobes	c. Obligate Anaerobes	d. Aerotolerant Anaerobes	e. Micro-aerophiles
Effect of Oxygen on Growth	Only aerobic growth; oxygen required.	Both aerobic and anaerobic growth; greater growth in presence of oxygen.	Only anaerobic growth; ceases in presence of oxygen.	Only anaerobic growth; but continues in presence of oxygen.	Only aerobic growth; oxygen required in low concentration.
Bacterial Growth in Tube of Solid Growth Medium					
Explanation of Growth Patterns	Growth occurs only where high concentrations of oxygen have diffused into the medium.	Growth is best where most oxygen is present, but occurs throughout tube.	Growth occurs only where there is no oxygen.	Growth occurs evenly; oxygen has no effect.	Growth occurs only where a low concentration of oxygen has diffused into medium.
Explanation of Oxygen's Effects	Presence of enzymes catalase and superoxide dismutase (SOD) allows toxic forms of oxygen to be neutralized; can use oyygen.	Presence of enzymes catalase and SOD allows toxic forms of oxygen to be neutralized; can use oxygen.	Lacks enzymes to neutralize harmful forms of oxygen; cannot tolerate oxygen.	Presence of one enzyme, SOD, allows harmful forms of oxygen to be partially neutralized; tolerates oxygen.	Produce lethal amounts of toxic forms of oxygen if exposed to normal atmospheric oxygen.

Growth speed vs temperature



F. Classification by temperature requirements

- psychrophiles (= cryophiles): cold-loving organisms; have optimum growth temp below 25° C
- mesophiles (meso = middle): have optimum of 25-40° C
- thermophiles: heat-loving organisms; have optimum > 40° C
- hyperthermophiles: growth range = 70-105°C; optimum > 90°C

Growth versus temperature