Semester 1 AP BIOLOGY

Review

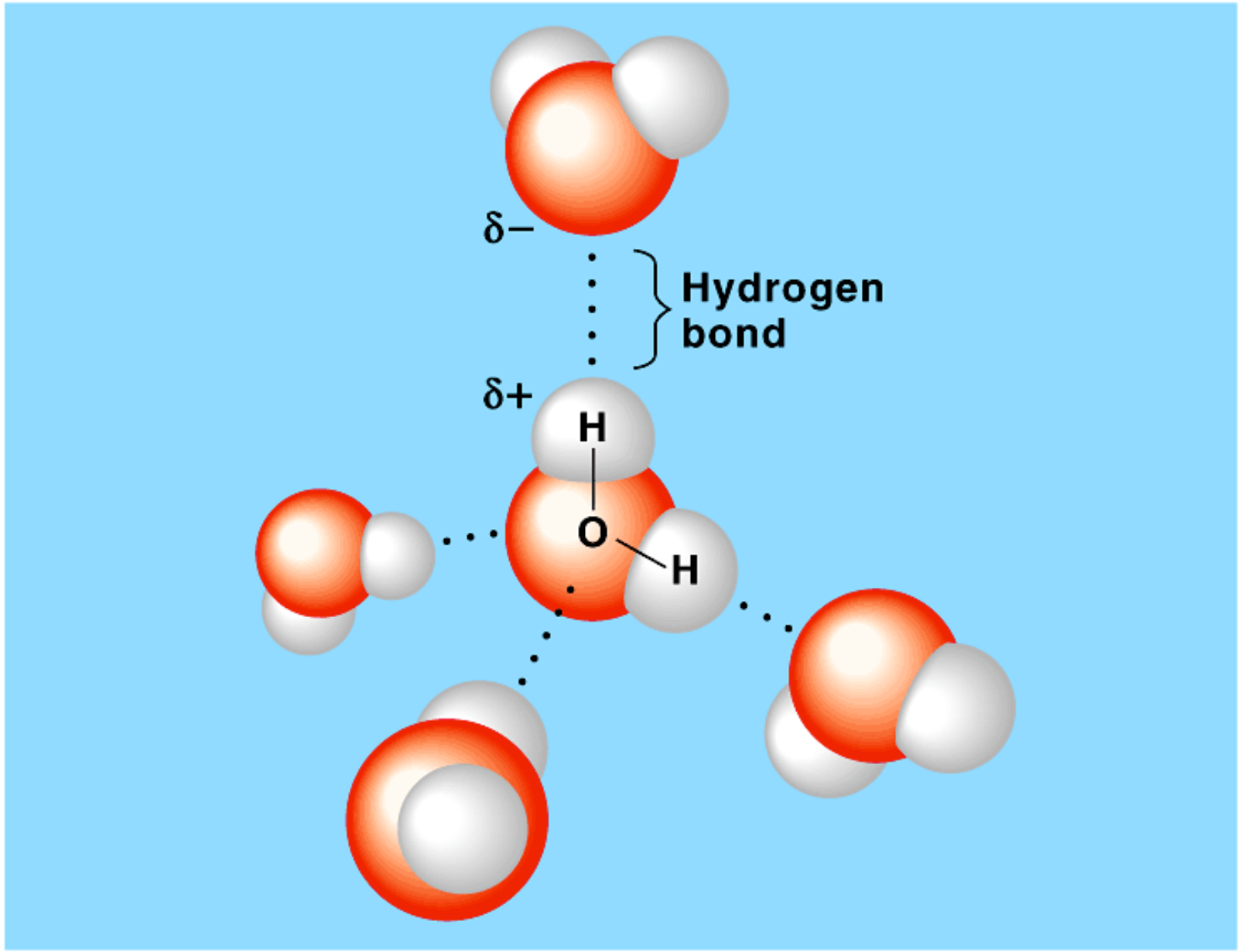
Units #1-5B

Chemical Bonds

- Ionic
- Covalent
- Hydrogen

Water

- High Specific Heat
- High heat of vaporization
- Evaporitive Cooling
- Adhesion/Cohesion
- Polarity



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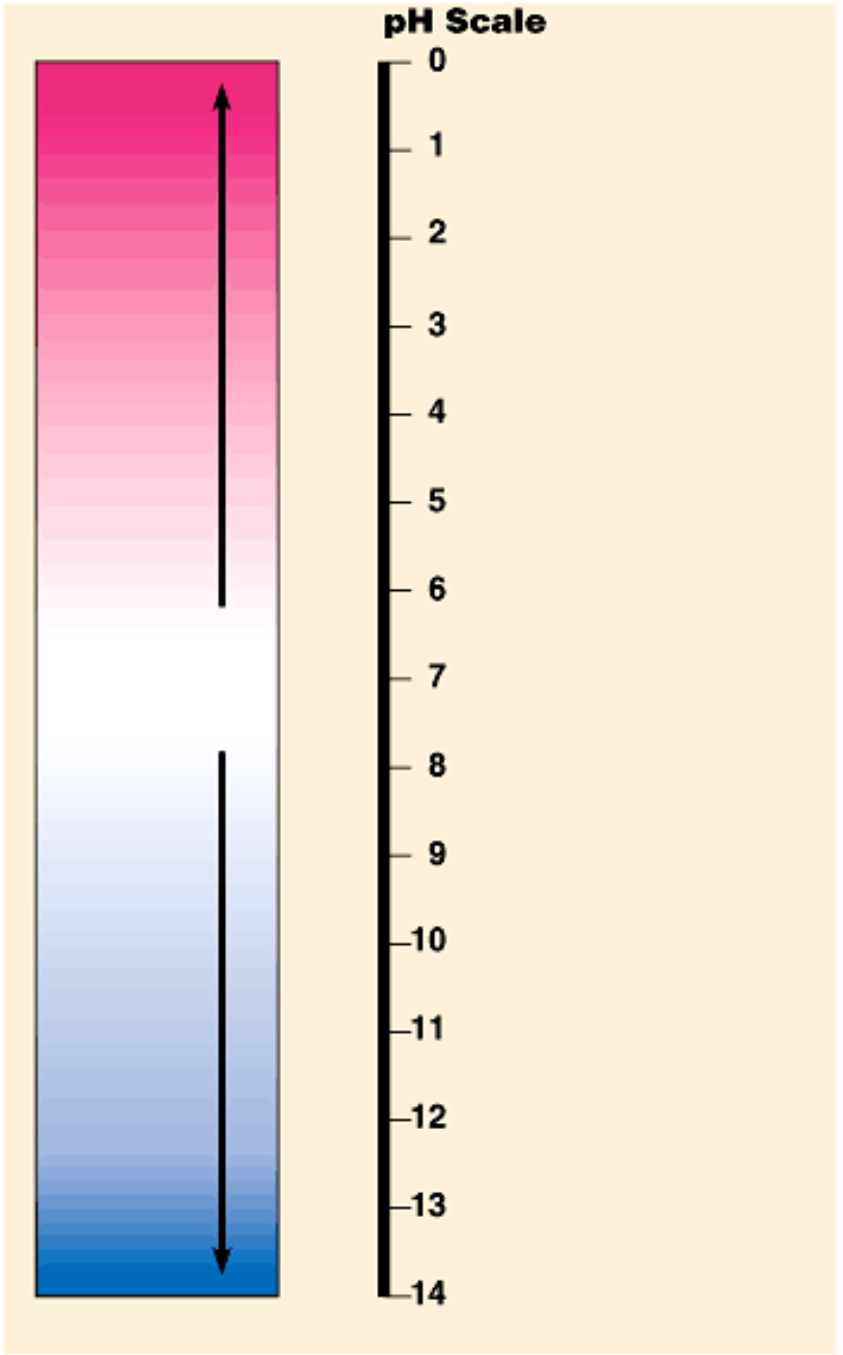
pH Scale

- Acids donate? ions
- Bases donate ? ions



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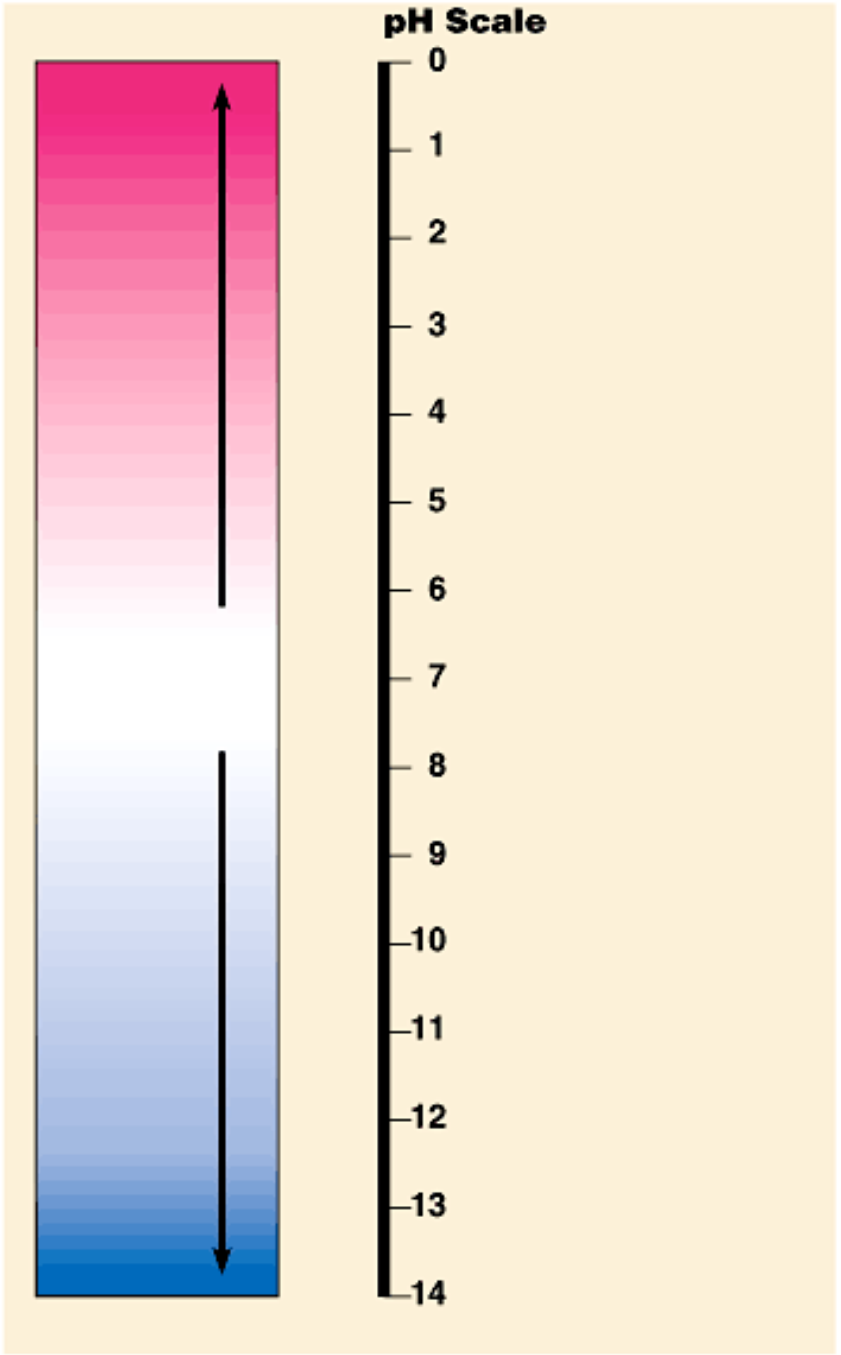
pH Scale

- Acids donate H+ ions
- Bases donate OH- ions



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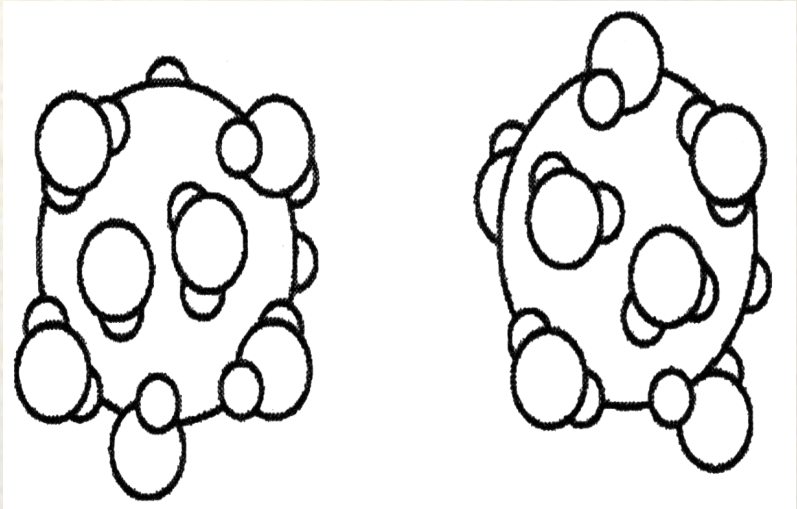
- The following are *pH* values: cola-2; orange juice-3; beer-4; coffee-5; human blood-7.4. Which of these liquids has the highest molar concentration of OH-?

a. cola
b. orange juice
c. beer
d. coffee
e. human blood

- Based on your knowledge of the polarity of water, the solute molecule is most likely *

a. positively charged.
b. negatively charged.
c. neutral in charge.
d. hydrophobic.
e. nonpolar.



- If the pH of a solution is increased from pH 8 to pH 9, it means that the

a. concentration of H+ is 10 times greater than what it was at pH 8.

b. concentration of H+ is 100 times less than what it was at pH 8.

c. concentration of OH- is 10 times greater than what it was at pH 8.

d. concentration of OH- is 100 times less than what it was at pH 8.

e. concentration of H+ is greater and the concentration of OH- is less than at pH 8.

Table 4.1 Functional Groups of Organic Compounds

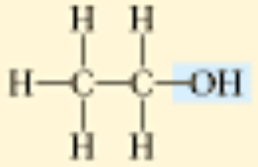
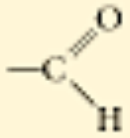
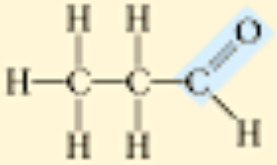
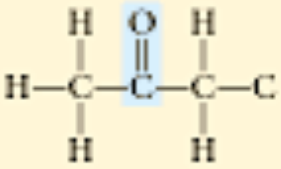
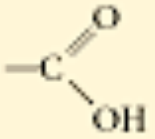
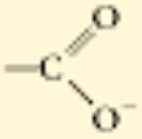
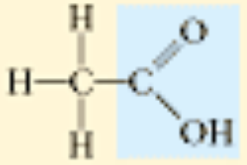
Functional Group	Formula	Name of Compounds	Example
	—OH		 Ethanol (the drug of alcoholic beverages)
			 Propanal
			 Acetone
	 (non-ionized)  (ionized)		 Acetic acid* (the acid of vinegar)

Table 4.1 Functional Groups of Organic Compounds

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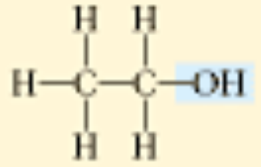
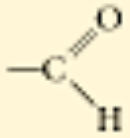
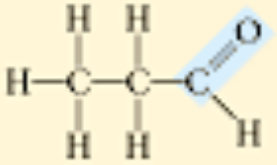
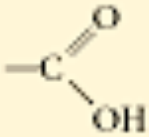
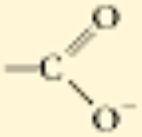
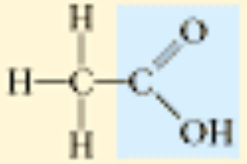
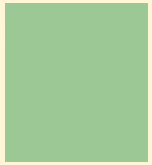
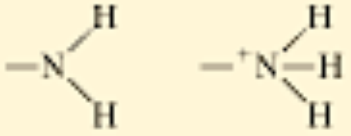
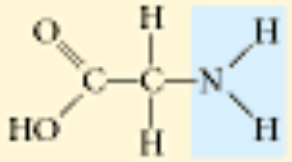
Hydroxyl	—OH	Alcohols	 Ethanol (the drug of alcoholic beverages)
Carbonyl		Aldehydes	 Propanal
		Ketones	 Acetone
Carboxyl	 (non-ionized)  (ionized)	Carboxylic acids	 Acetic acid* (the acid of vinegar)

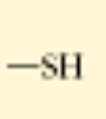


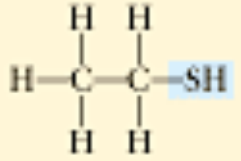


(non-ionized) (ionized)

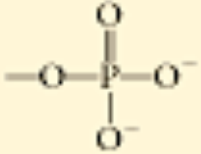


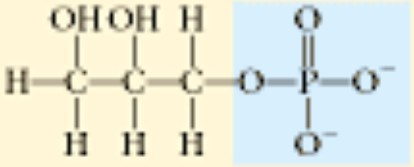
Glycine*
(an amino acid)





Ethanethiol





Glycerol phosphate

*The ionized forms of the carboxyl and amino groups prevail in cells. However, acetic acid and glycine are represented here in their non-ionized forms.

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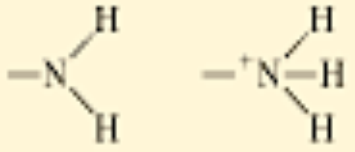
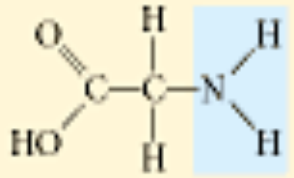
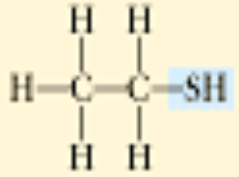
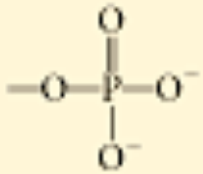
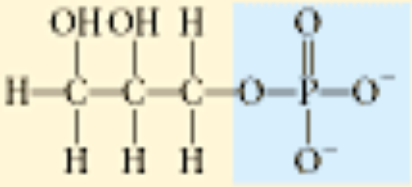
Amino	 (non-ionized) (ionized)	Amines	 Glycine* (an amino acid)
Sulfhydryl	—SH	Thiols	 Ethanethiol
Phosphate		Organic phosphates	 Glycerol phosphate

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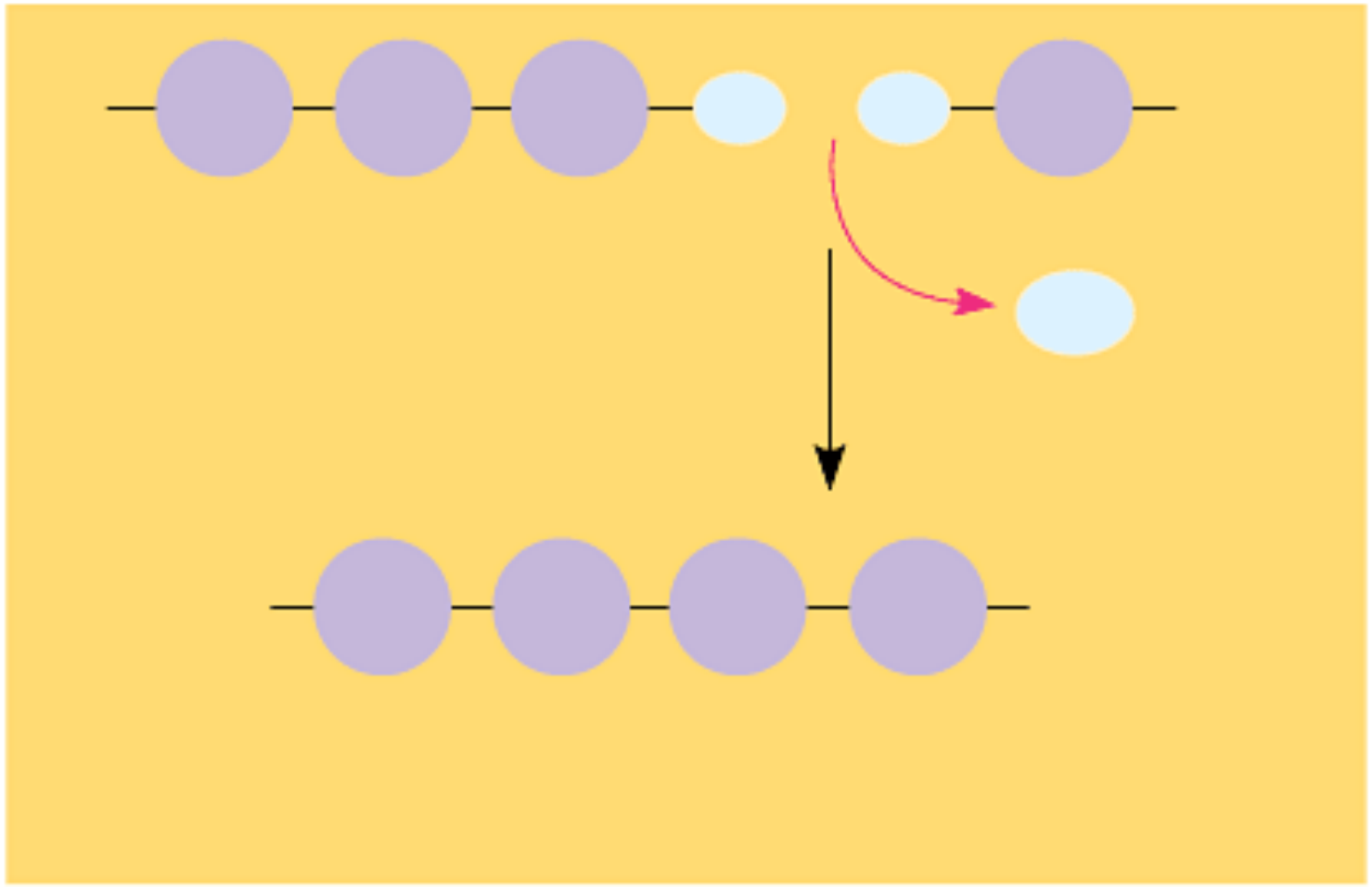
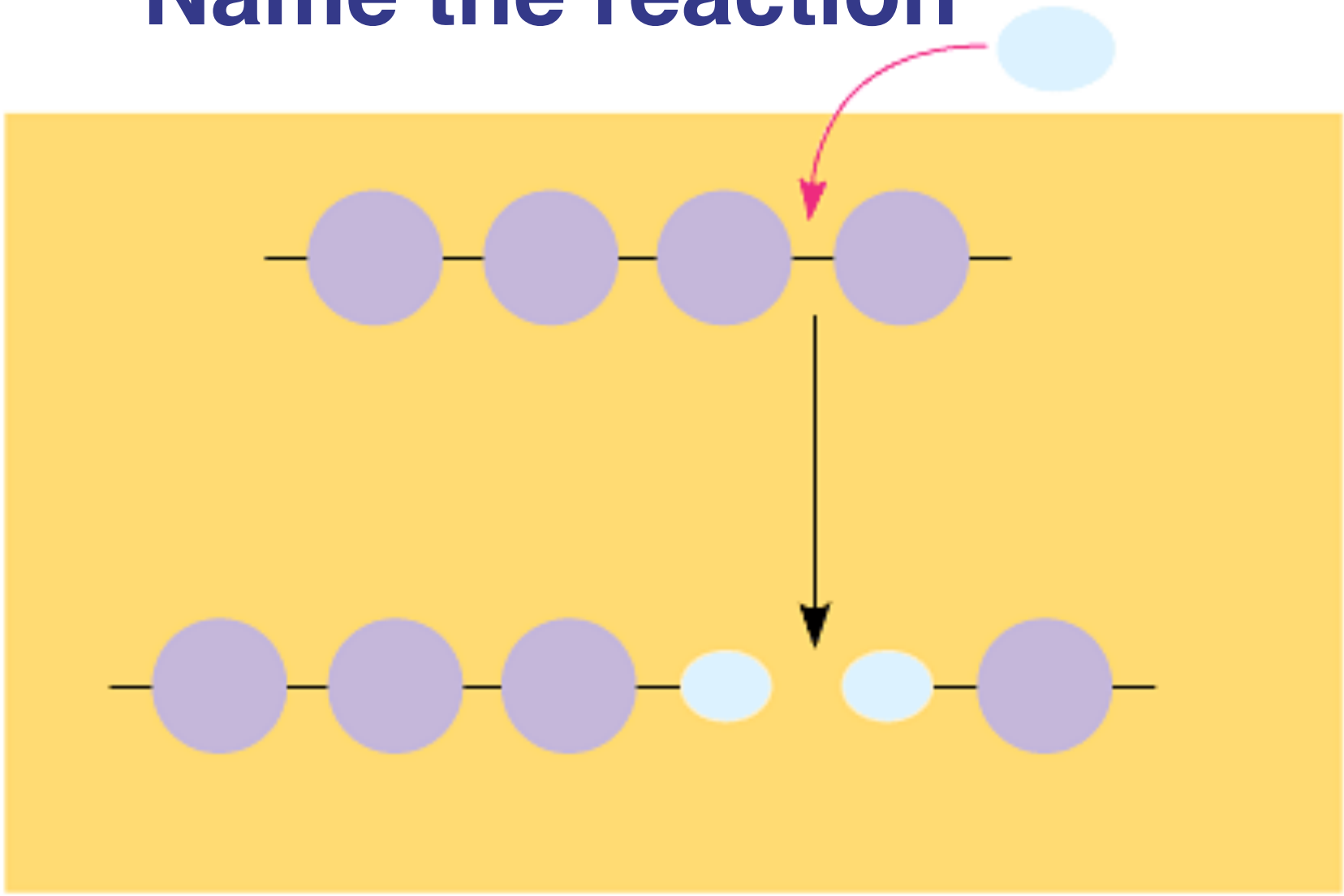
Name the reaction



Name the reaction



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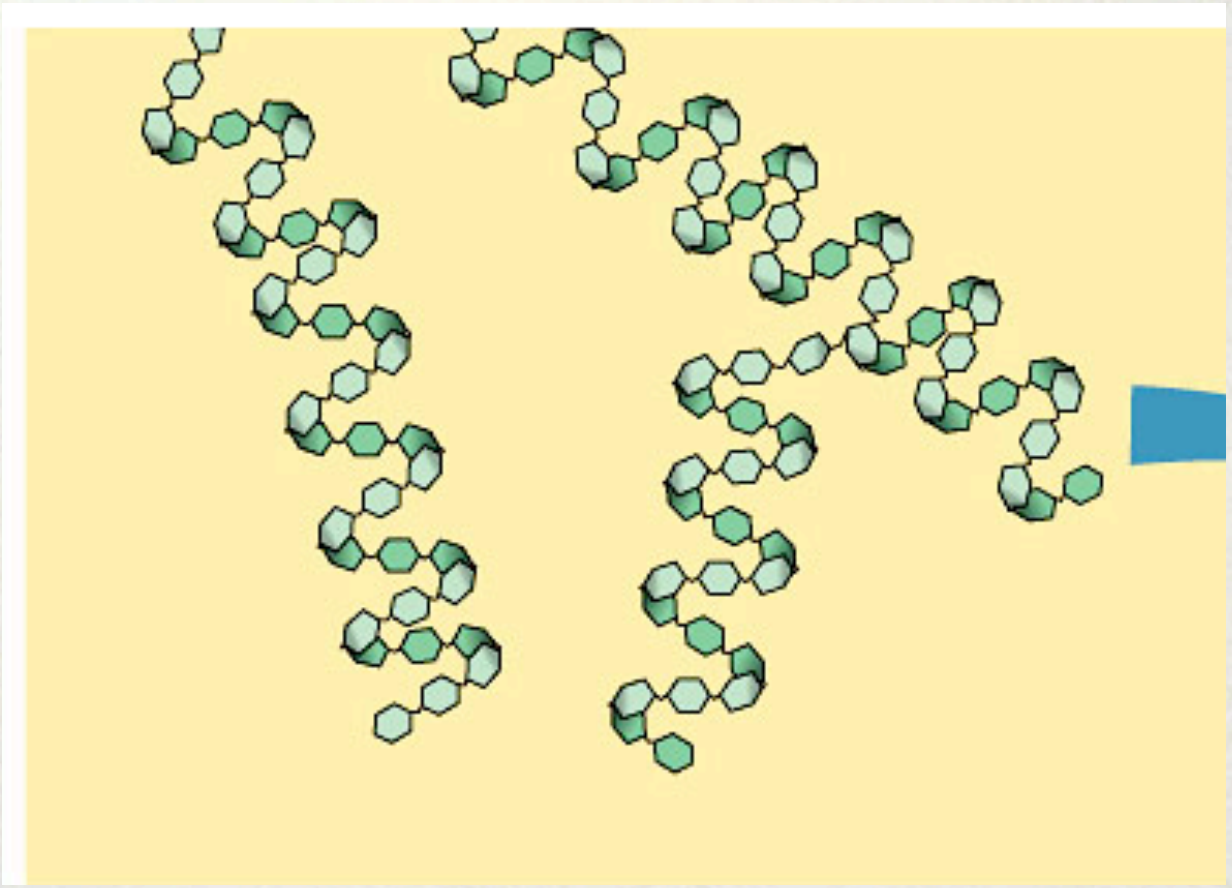
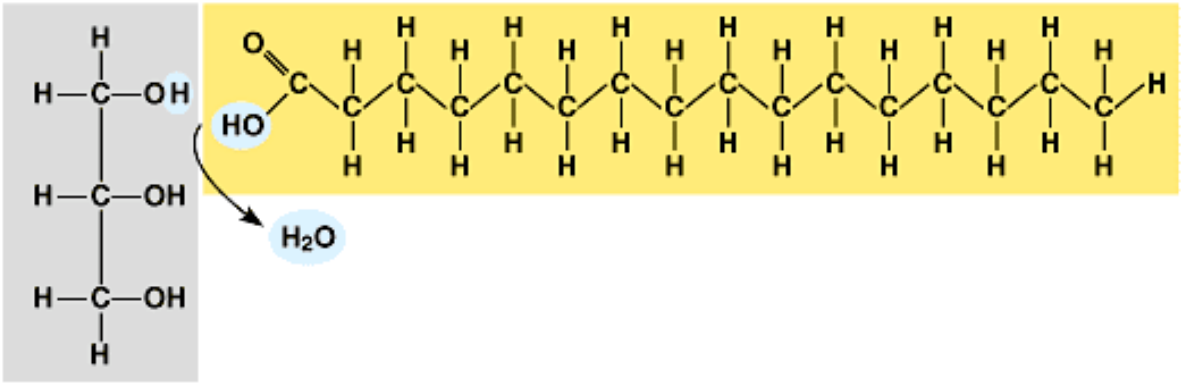
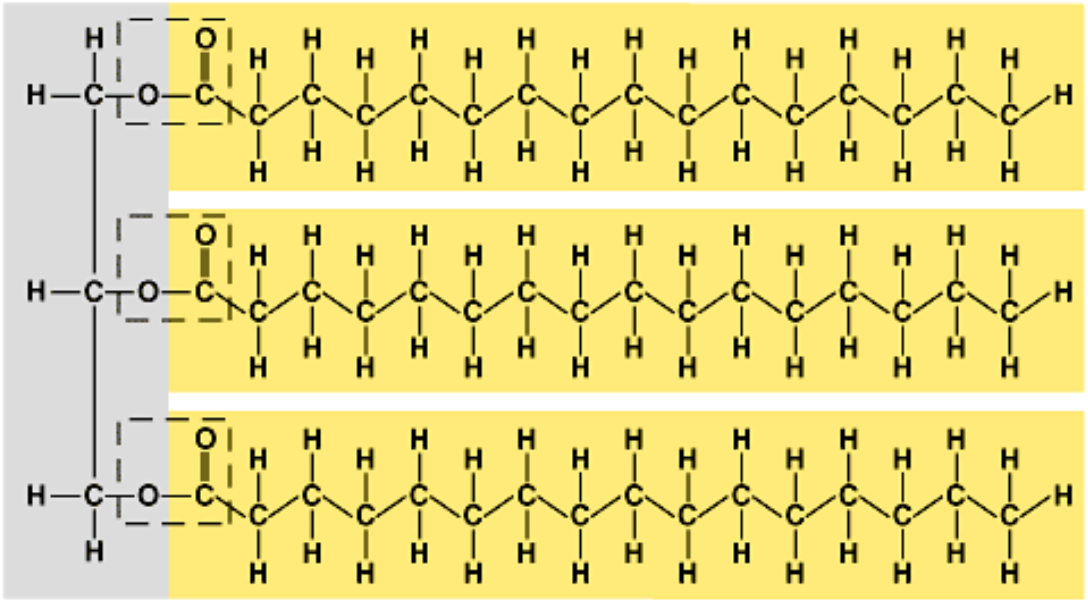
Name the Organic Molecule







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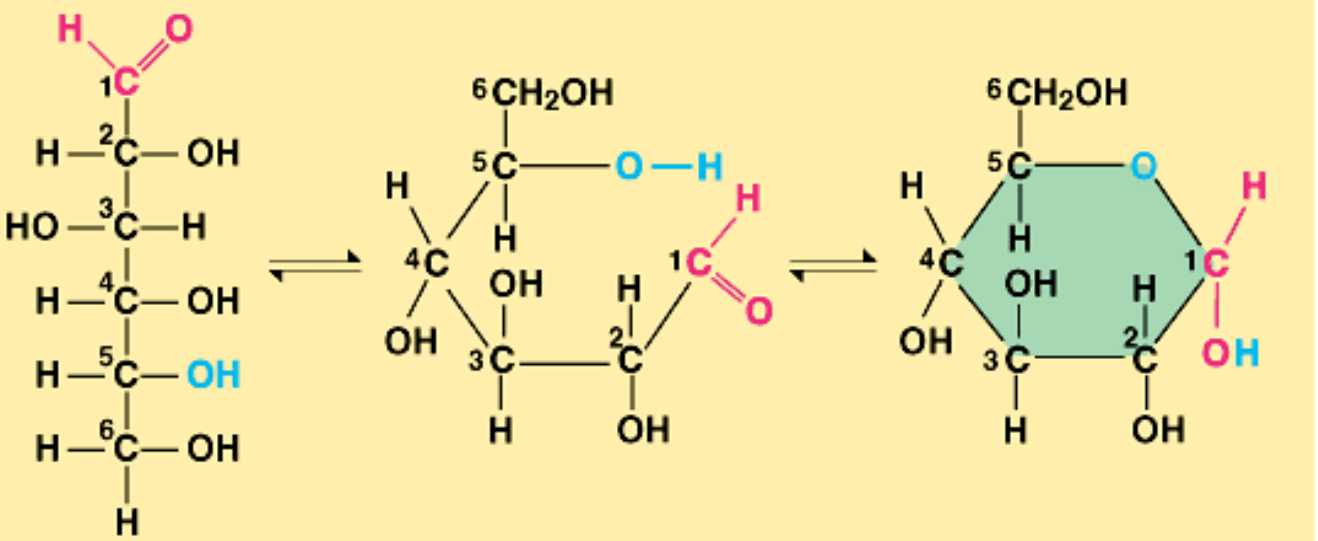

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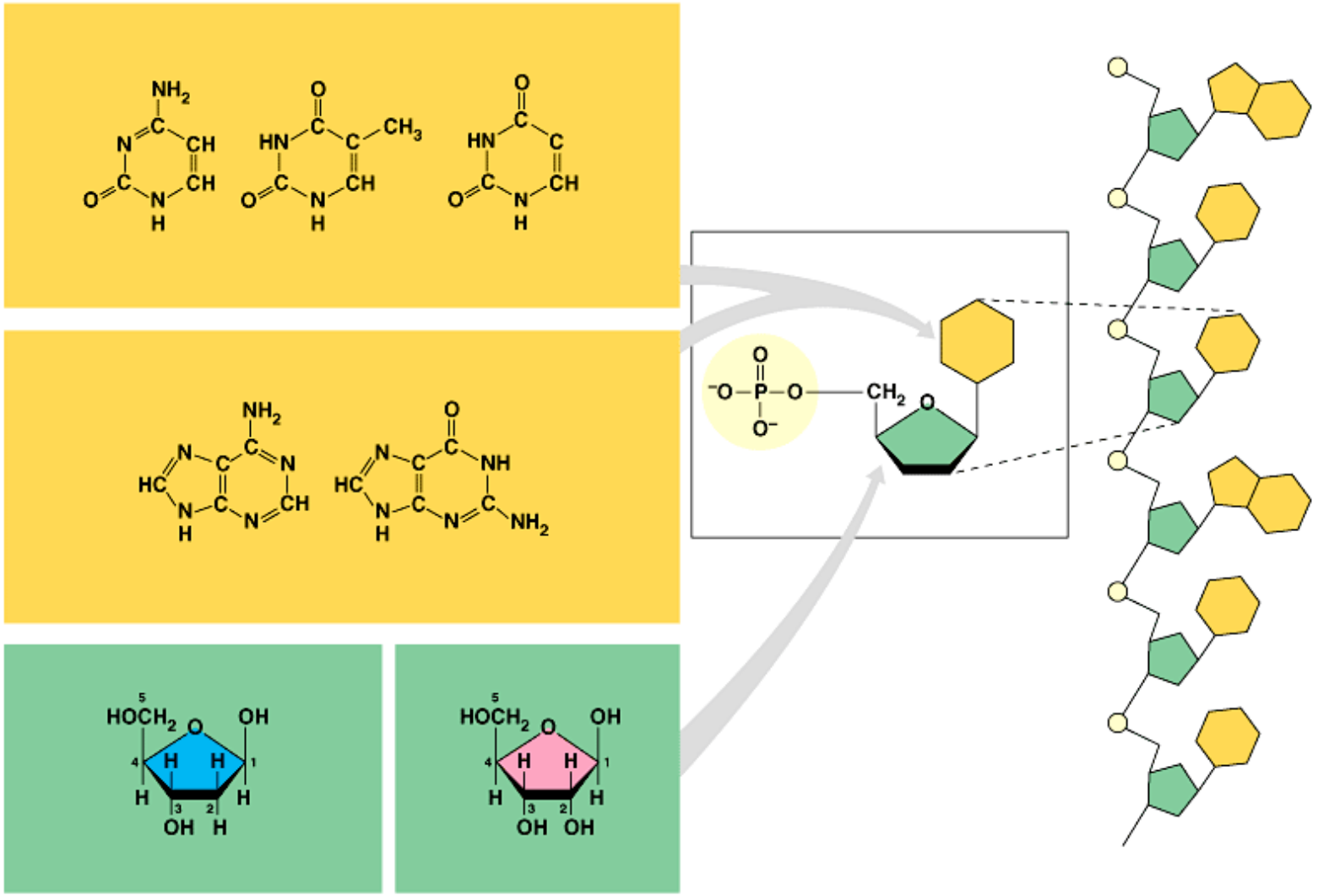

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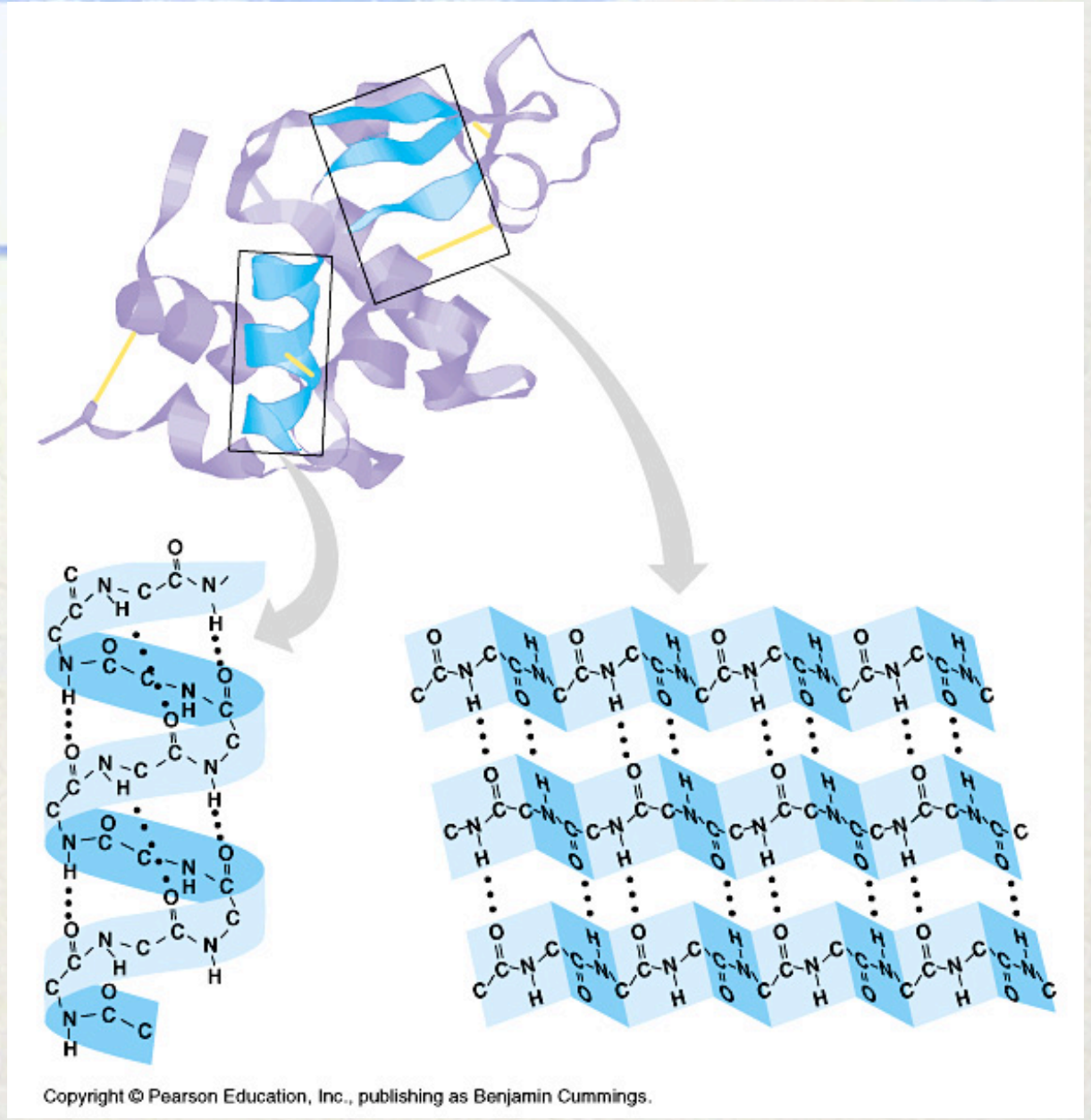

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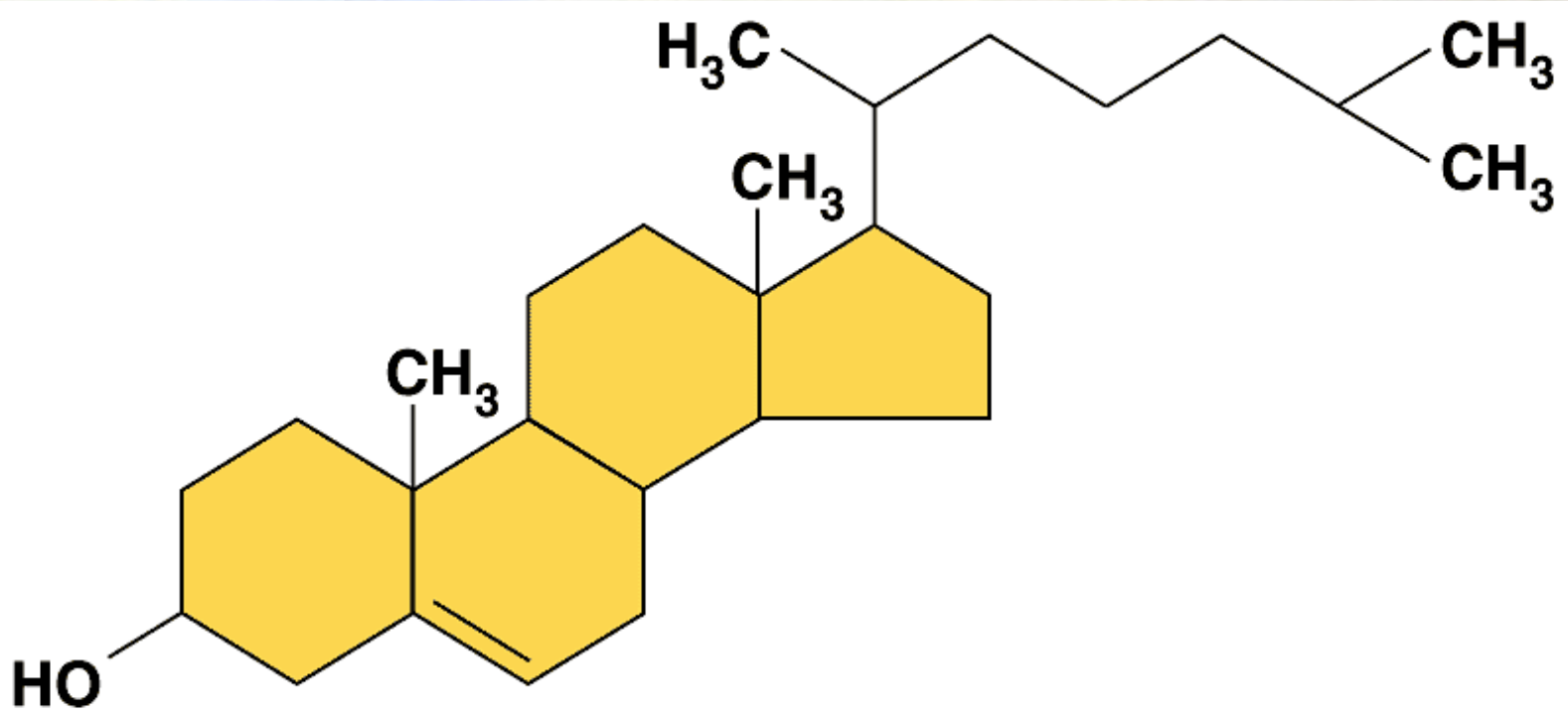

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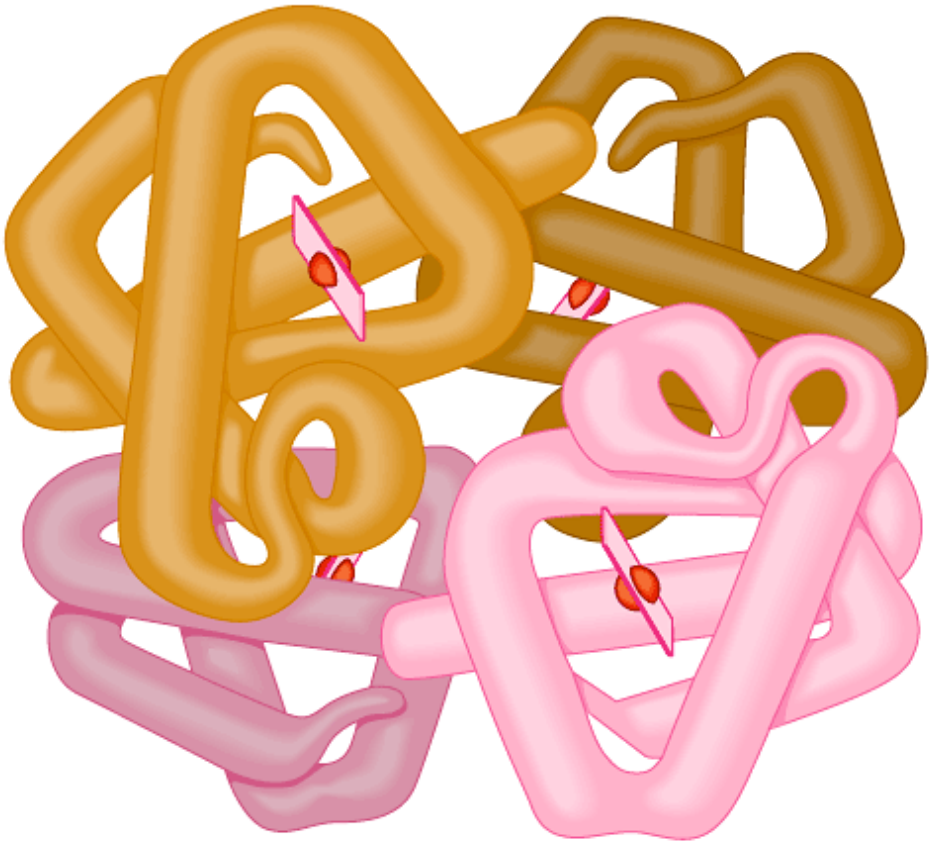

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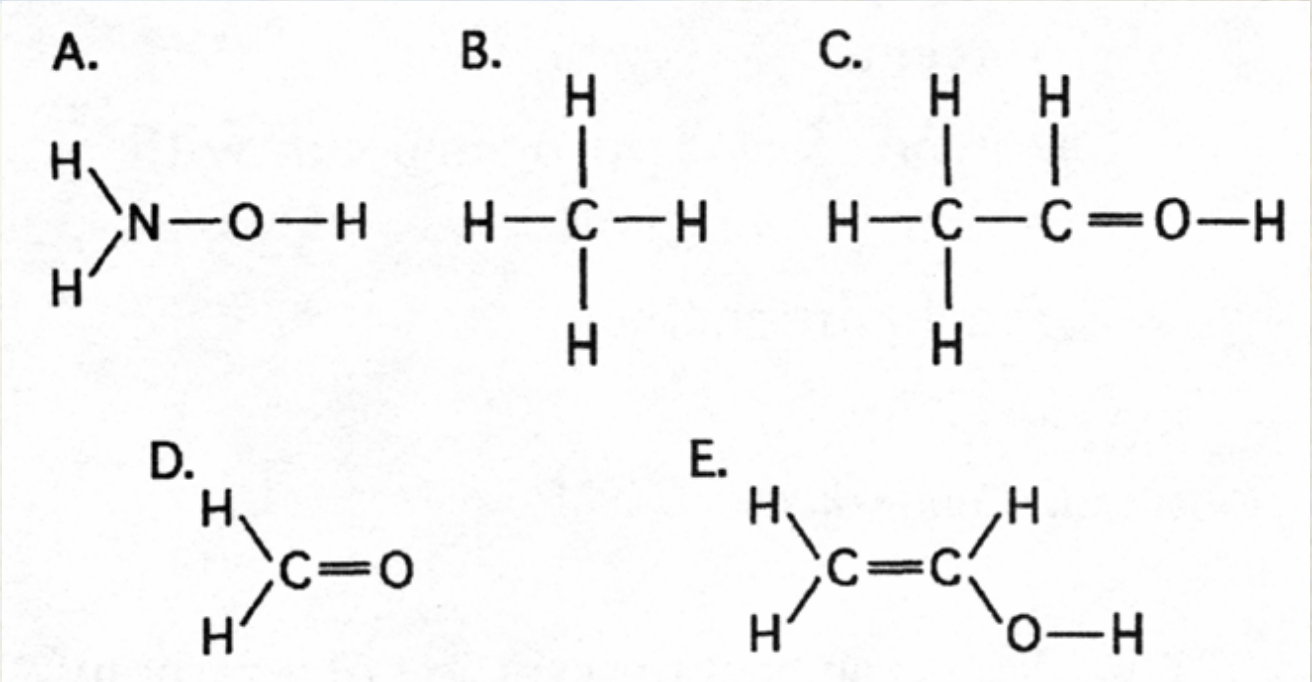
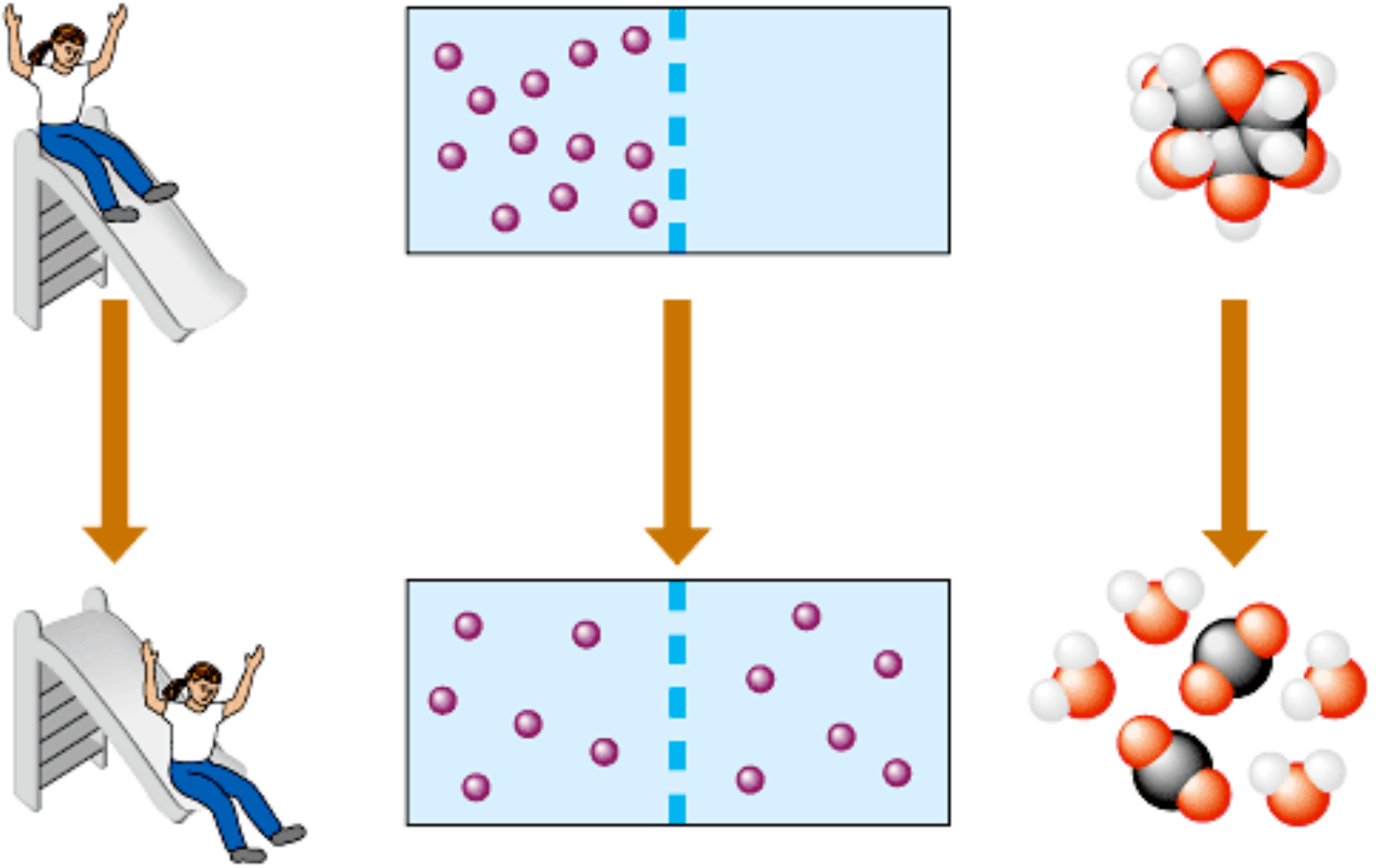
- What happens when a protein denatures?
  a. It loses its primary structure.
  b. It loses its secondary and tertiary structure.
  c. It becomes irreversibly insoluble and precipitates.
  d. It hydrolyzes into component amino acids.
  e. Its hydrogen bonds, ionic bonds, and peptide bonds are disrupted.

- Which of the structures in this figure is an impossible covalently bonded molecule?
  - A
  - B
  - C
  - D
  - E



Energy and Metabolism



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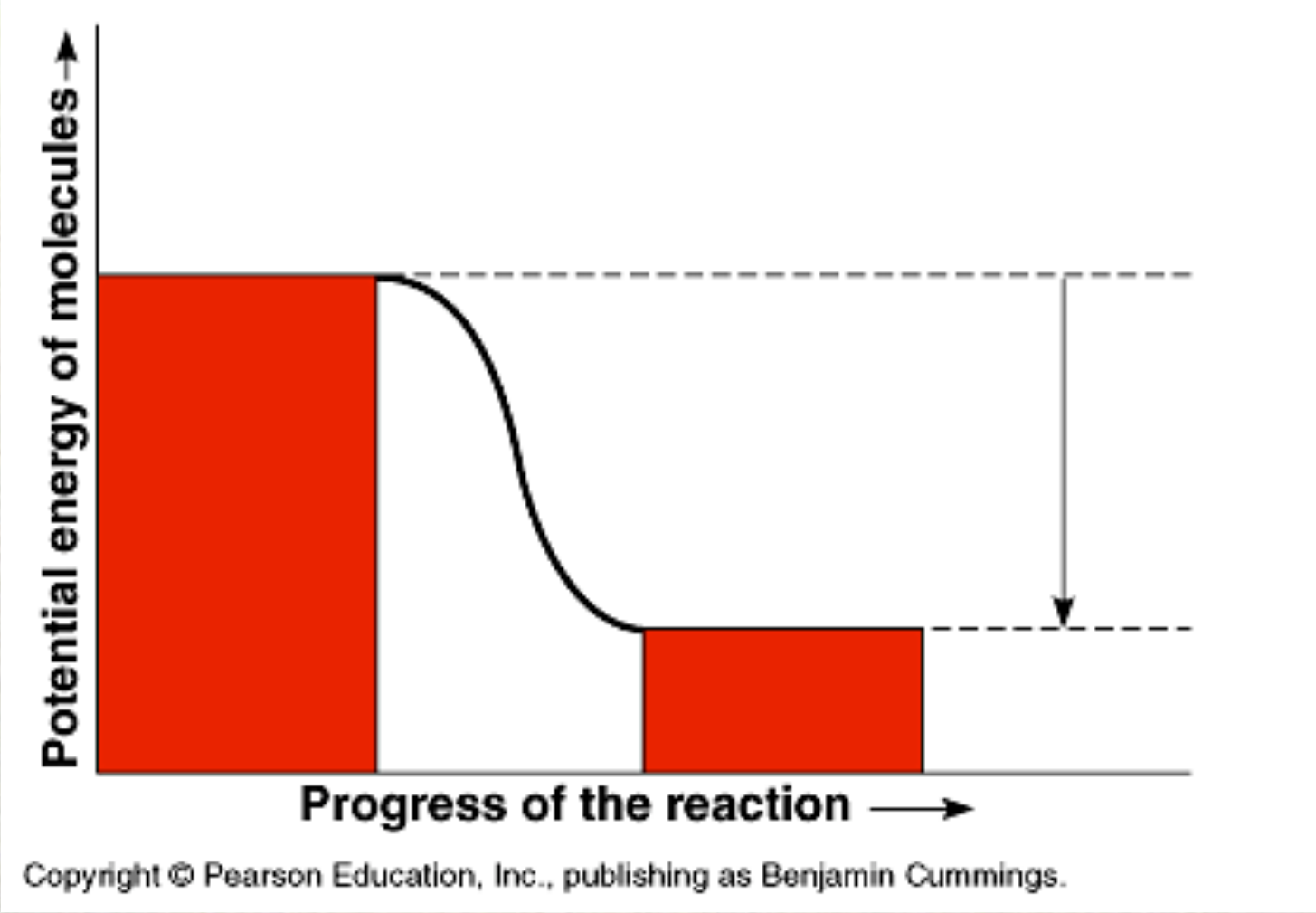
What is occurring in these Pictures?



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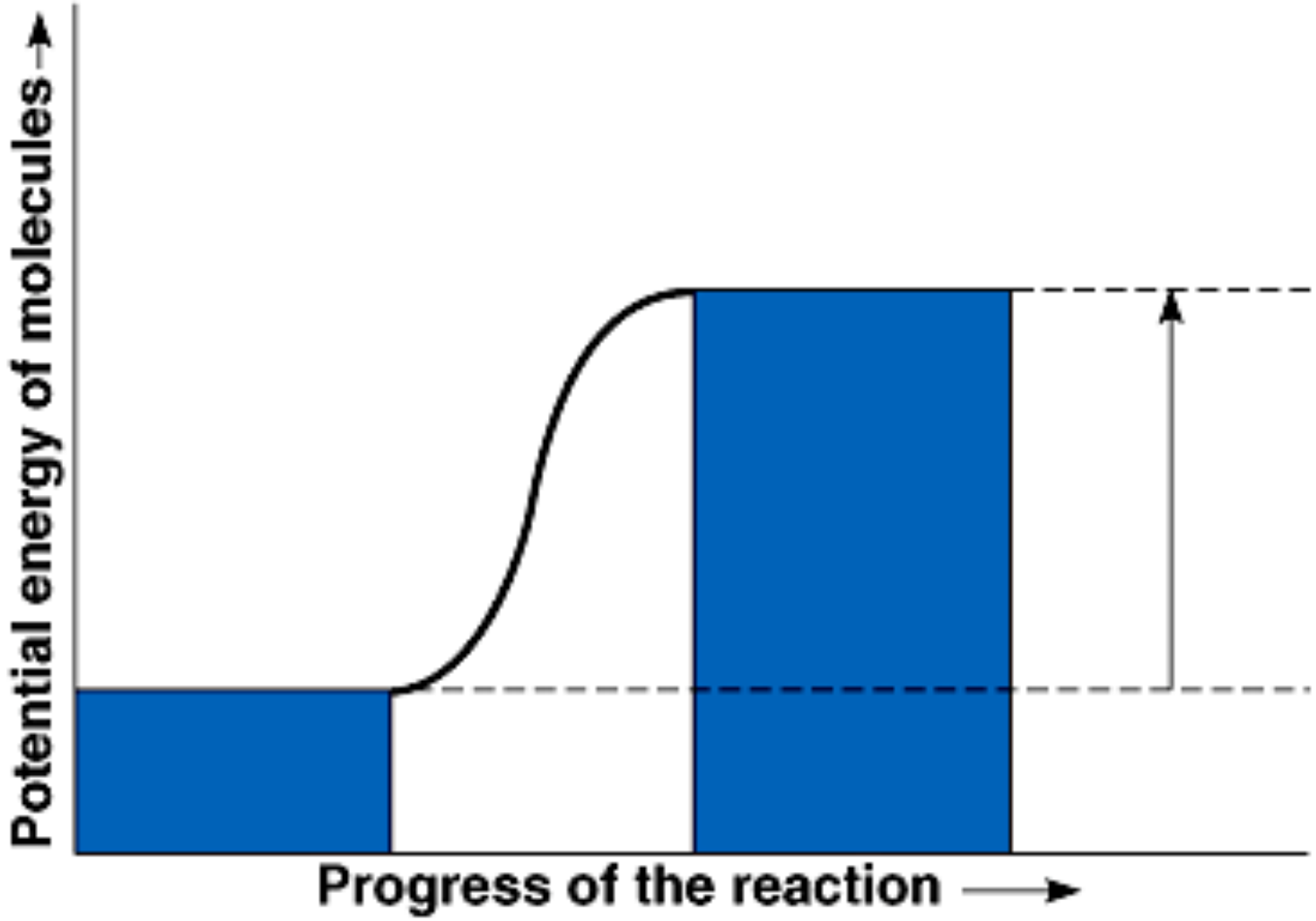
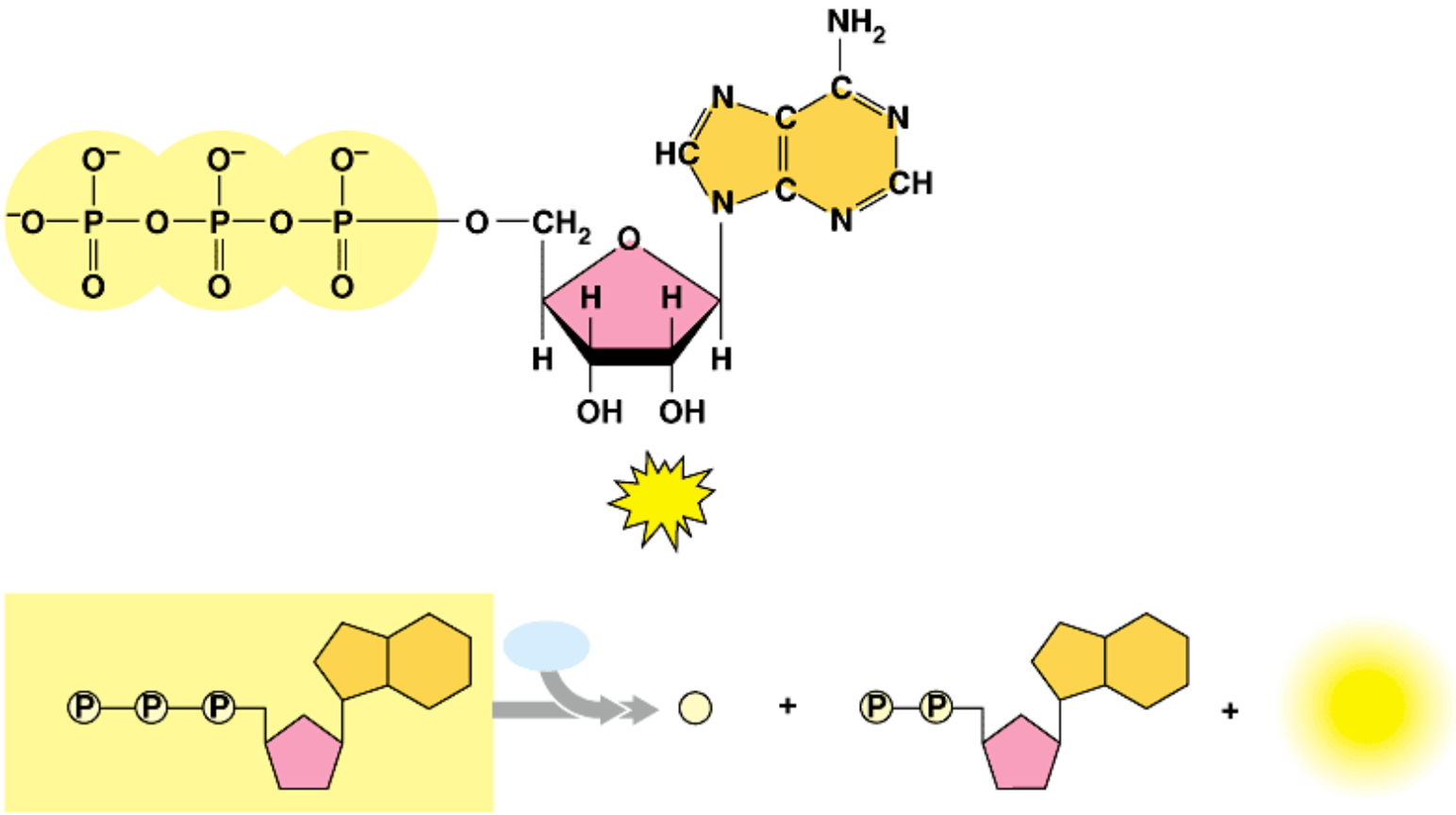

Potential energy of molecules
Progress of the reaction



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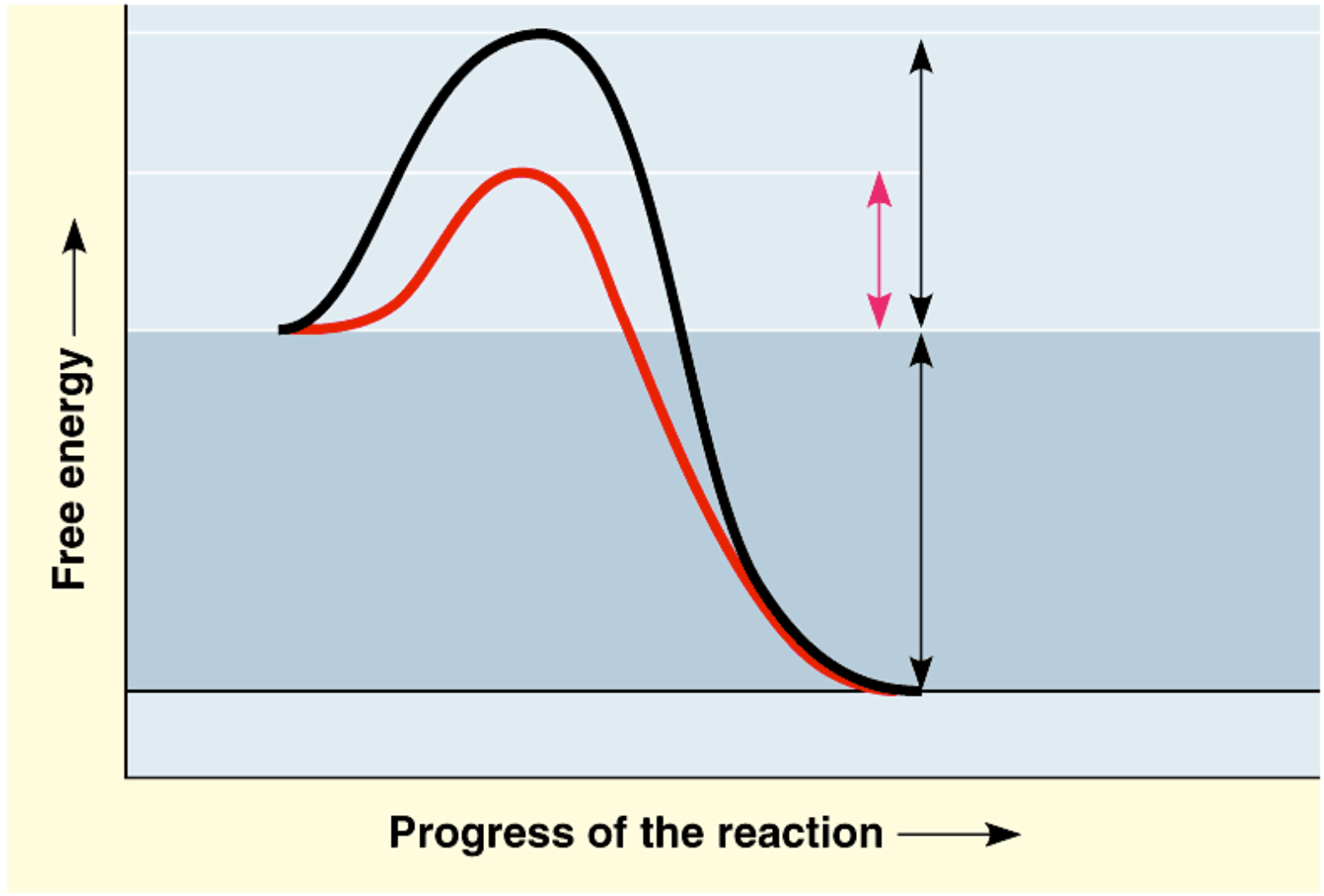

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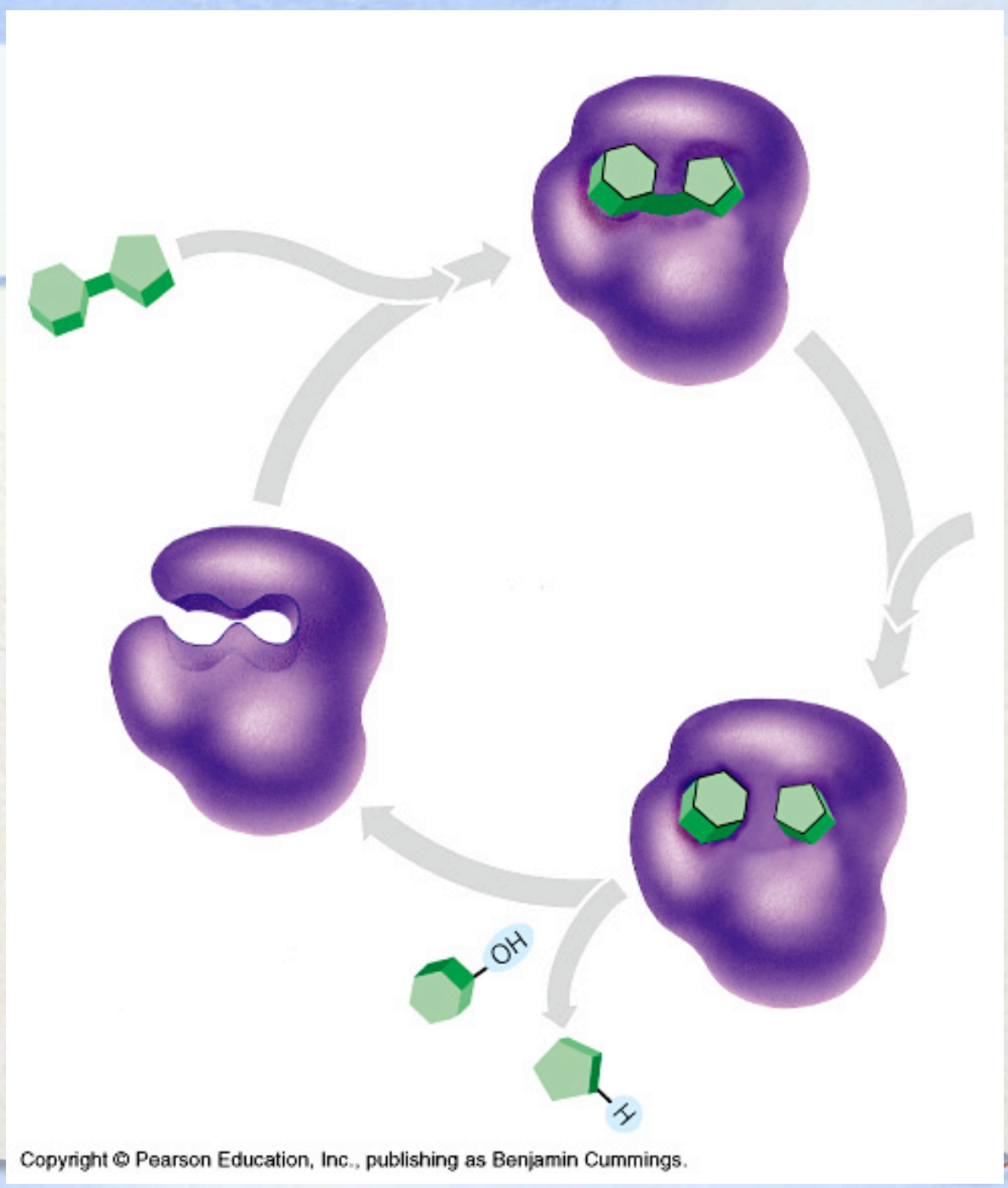

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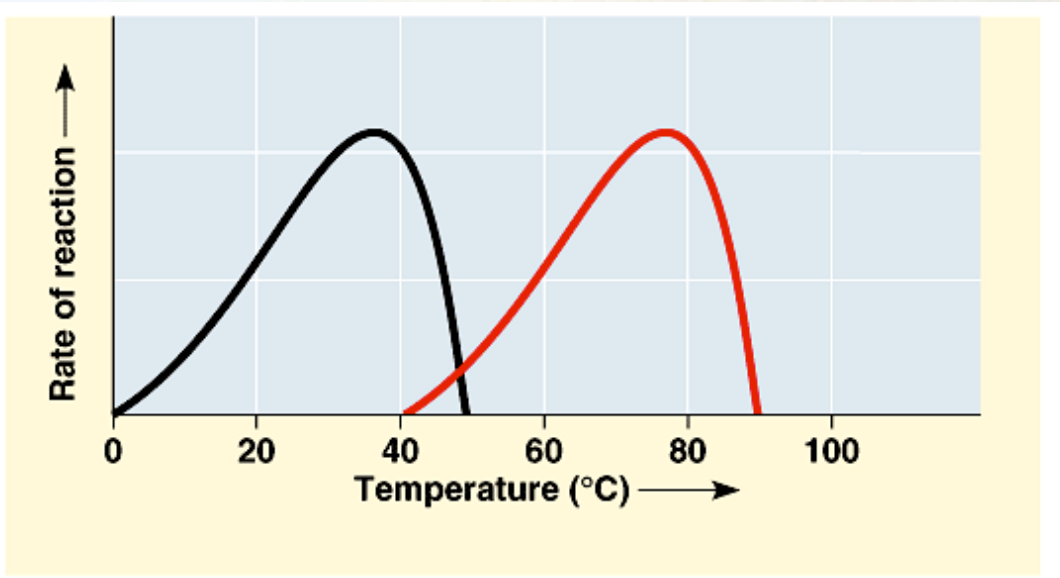

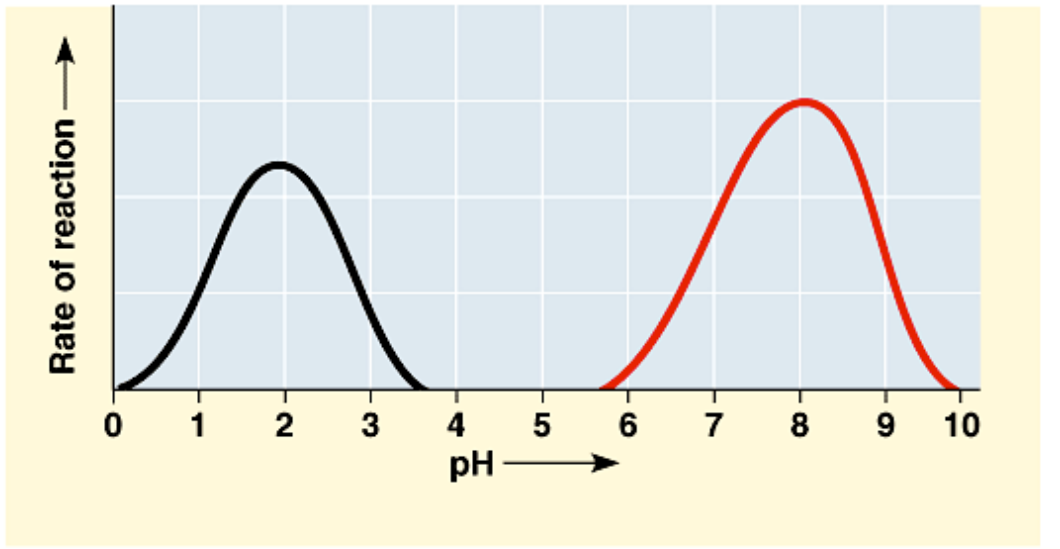

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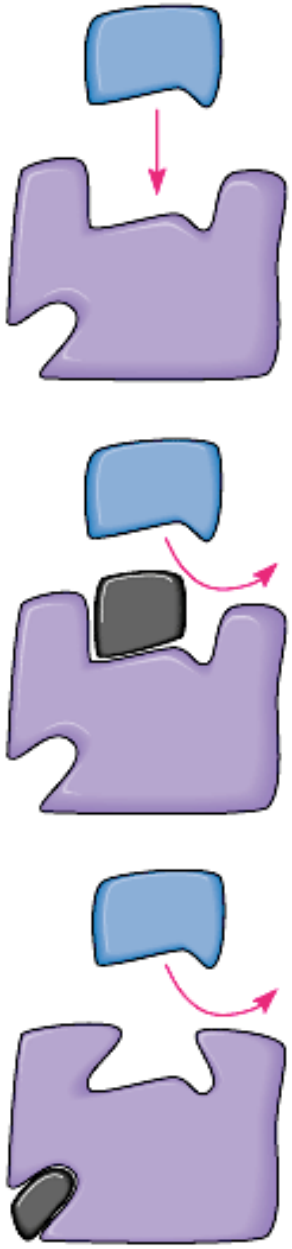

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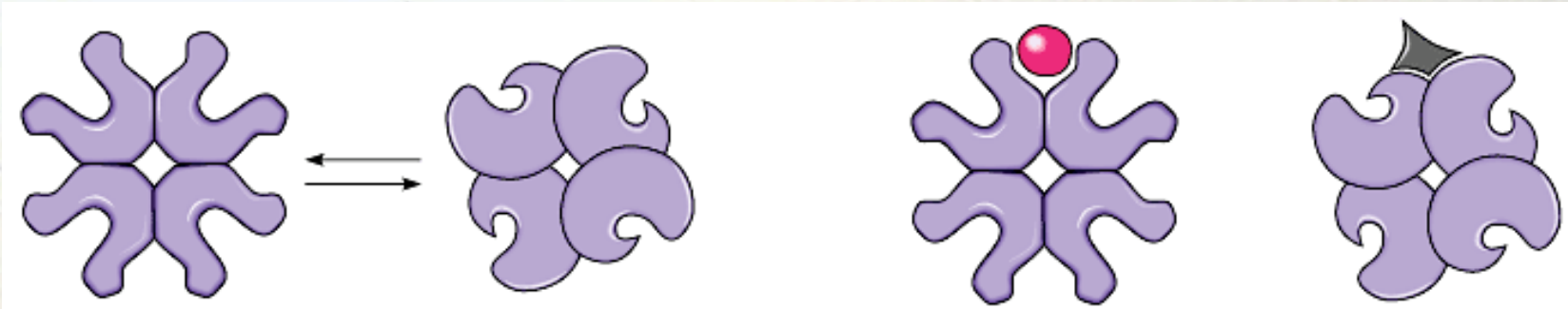

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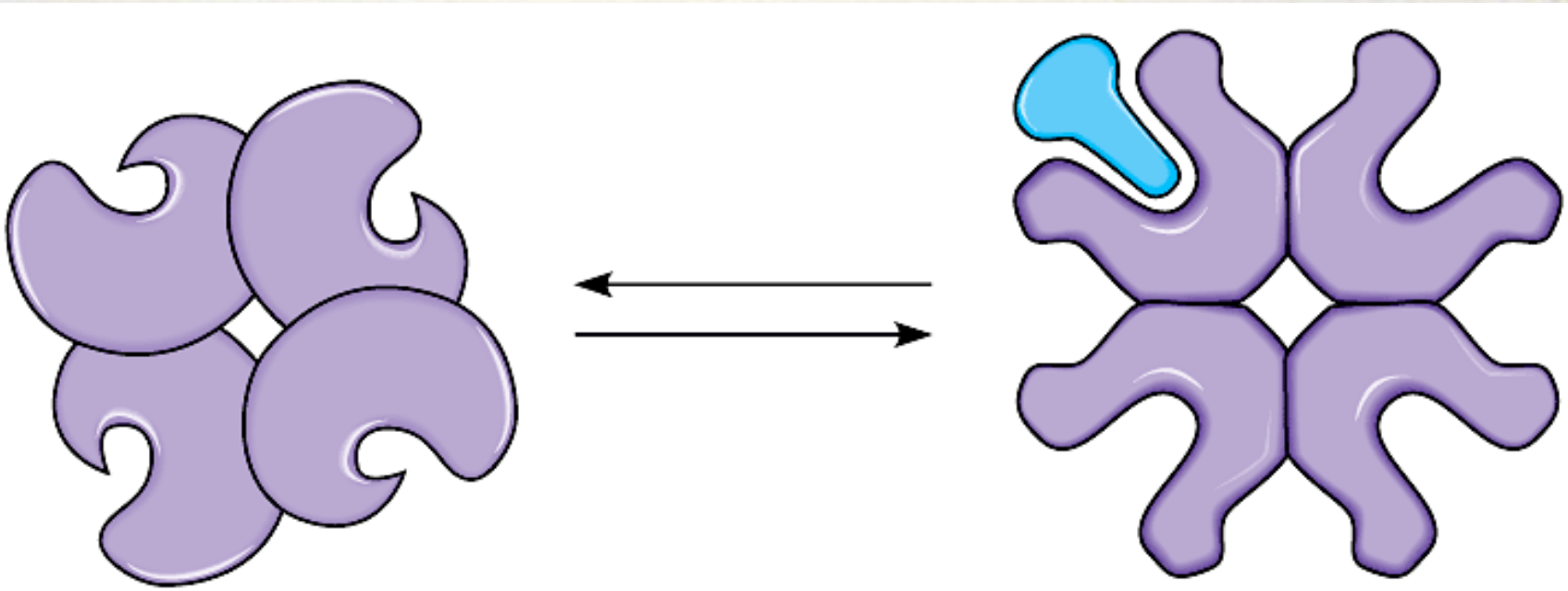

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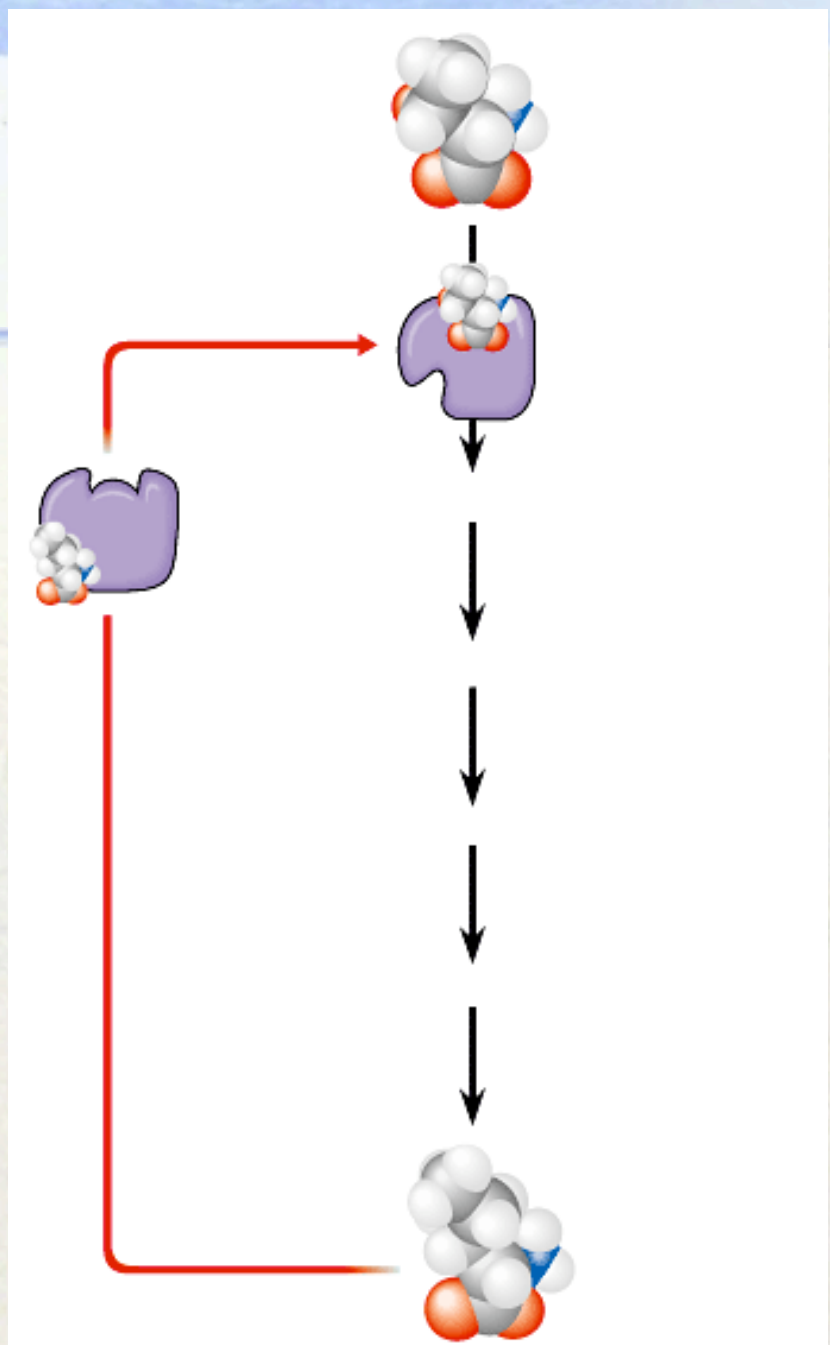

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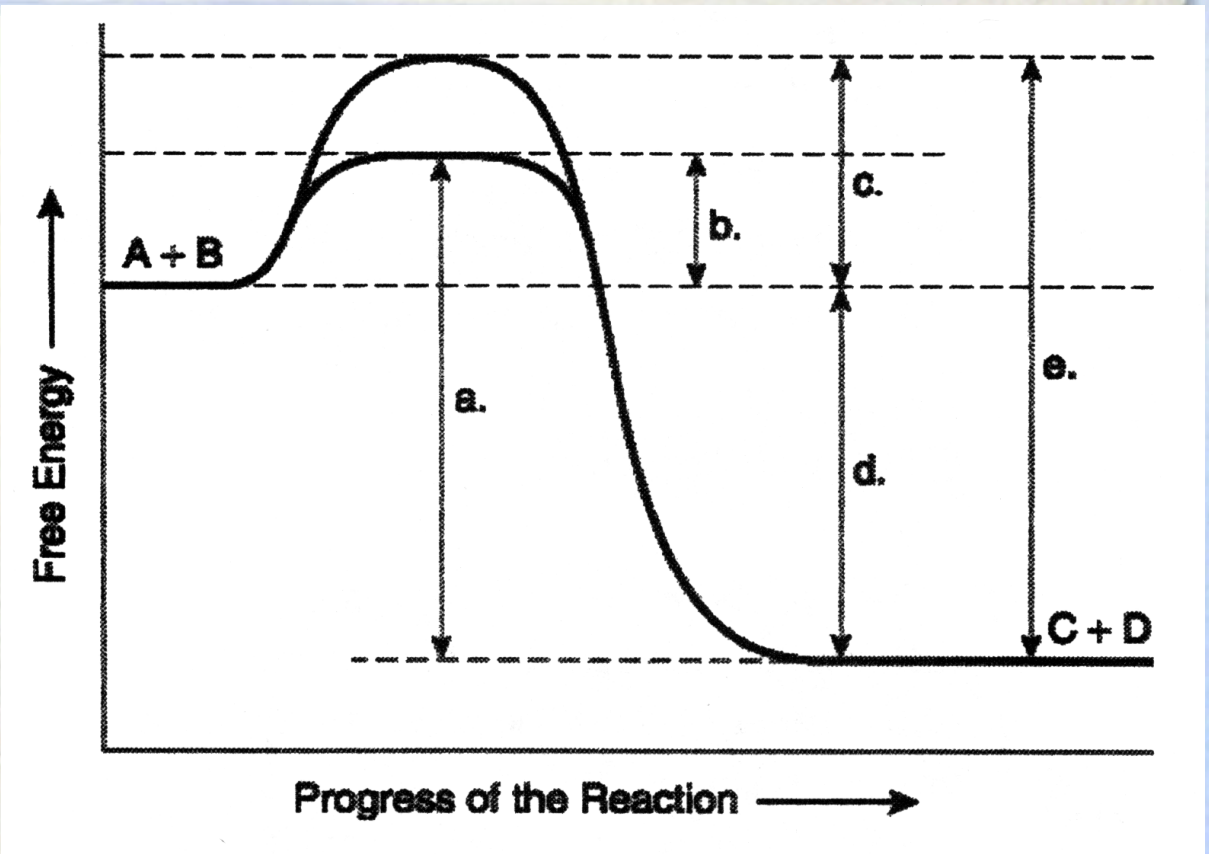
- Which of the following reactions could be coupled to the reaction ATP + $H_2O \rightarrow$ ADP + P*i* (-7.3 kcal/mol)?
  a. A + P*i* $\rightarrow$ AP (+10 kcal/mol)
  b. B + P*i* $\rightarrow$ BP (+8 kcal/mol)
  c. CP $\rightarrow$ C + P*i* (-4 kcal/mol)
  d. DP $\rightarrow$ D + P*i* (-10 kcal/mol)
  e. E + P*i* $\rightarrow$ EP (+5 kcal/mol)

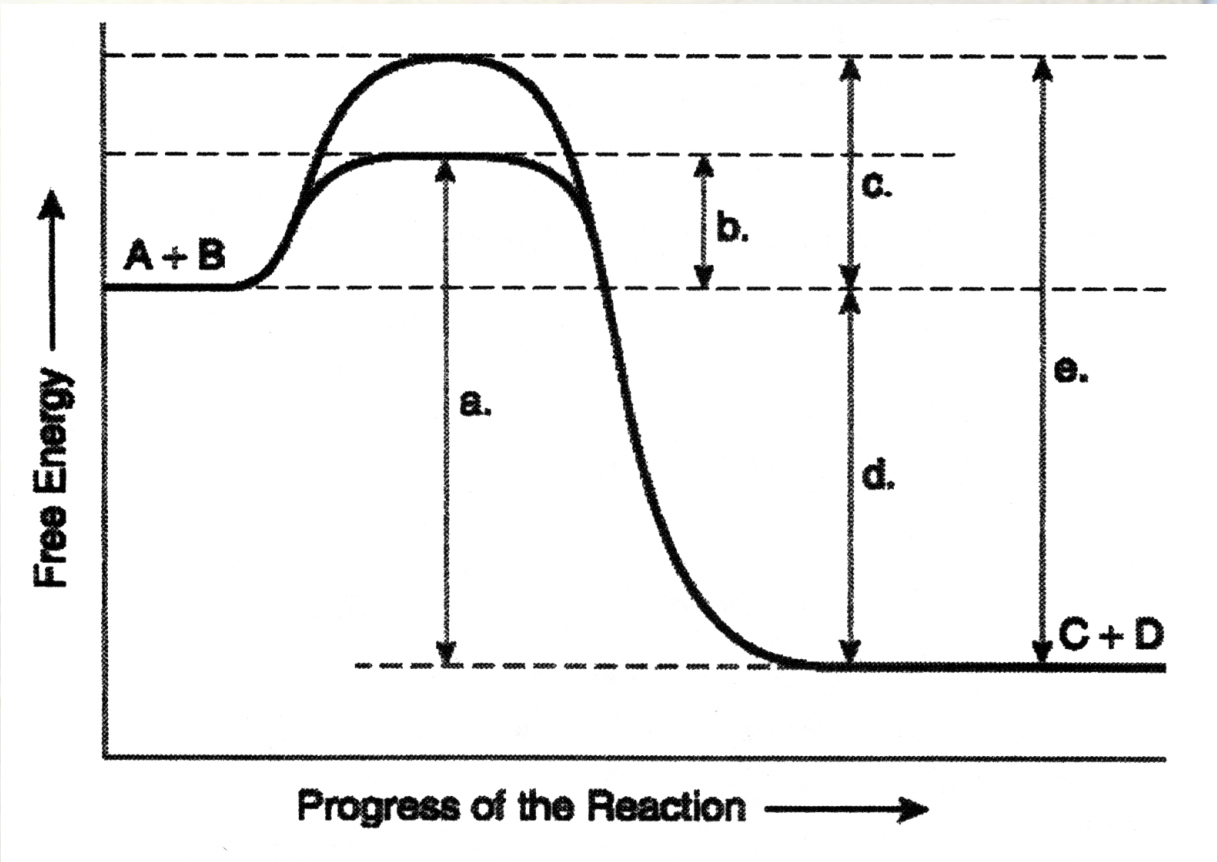
- A solution of starch at room temperature does not decompose rapidly to a sugar solution because
  a. the starch solution has less free energy than the sugar solution.
  b. the hydrolysis of starch to sugar is endergonic.
  c. the activation energy barrier cannot be surmounted in most of the starch molecules.
  d. starch cannot be hydrolyzed in the presence of so much water.
  e. starch hydrolysis is nonspontaneous.

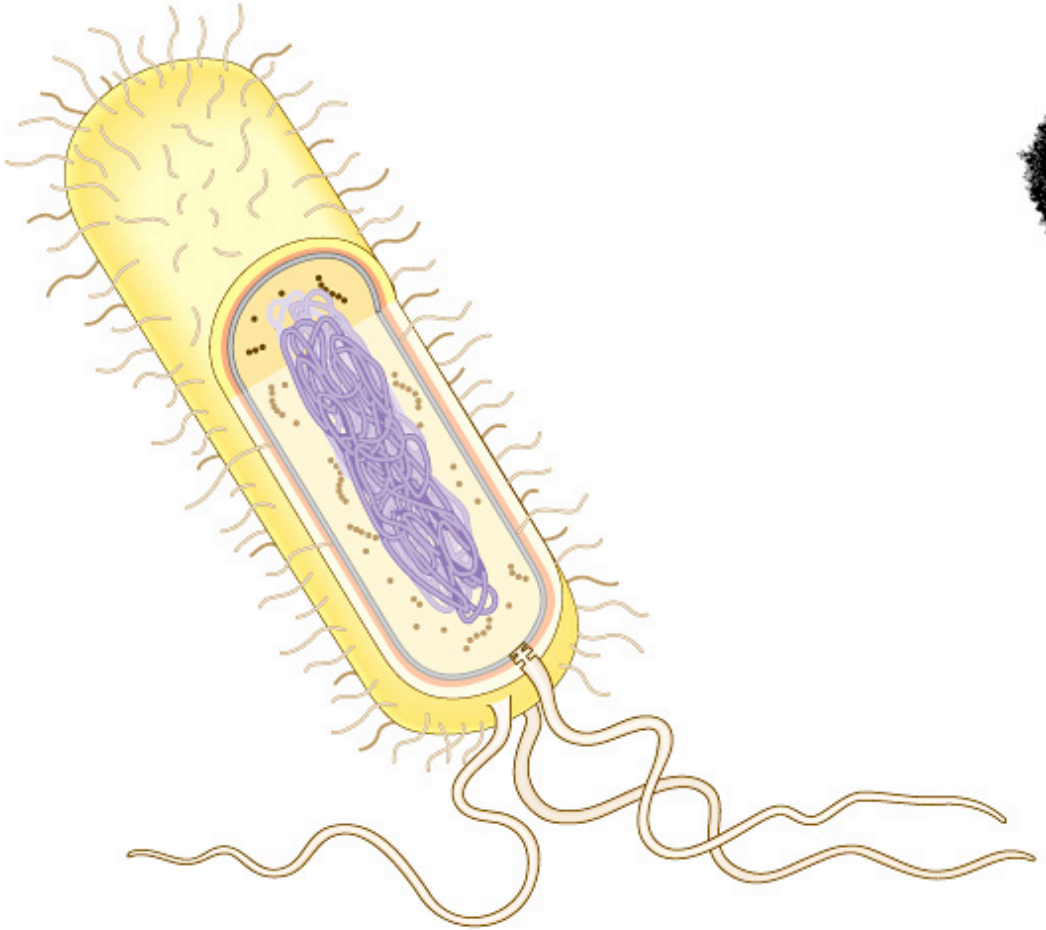
- Increasing the substrate concentration in an enzymatic reaction could overcome which of the following?
  a. denaturization of the enzyme
  b. allosteric inhibition
  c. competitive inhibition
  d. noncompetitive inhibition
  e. insufficient cofactors

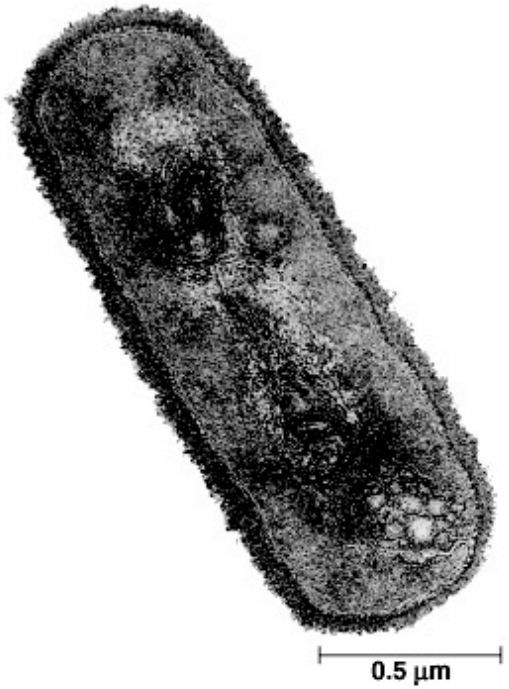
- Which of the following represents the ΔG of the reaction?
  - a
  - b
  - c
  - d
  - e



- Which of the following would be the same in an enzyme-catalyzed or -uncatalyzed reaction?
  - a
  - b
  - c
  - d
  - e







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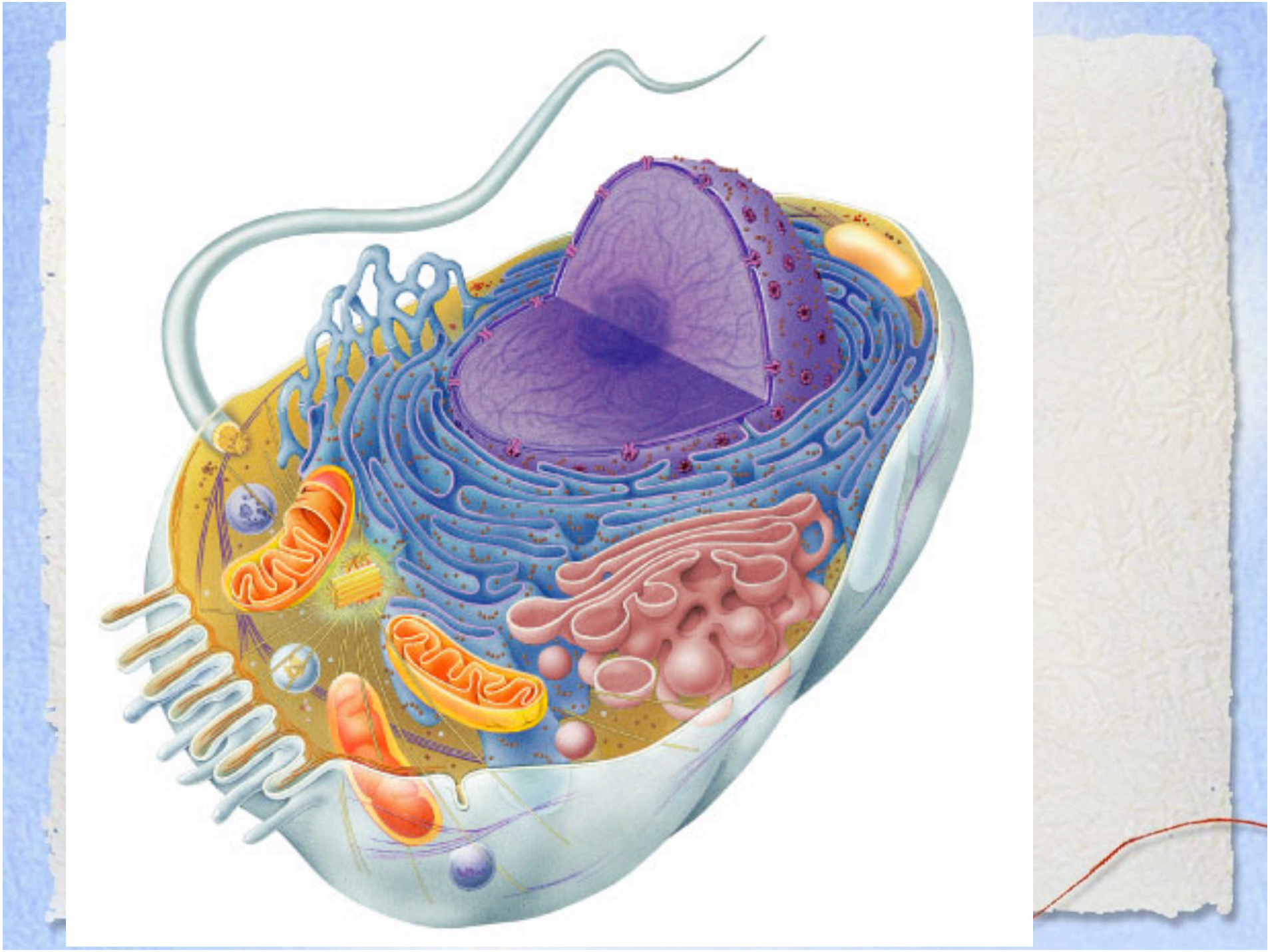

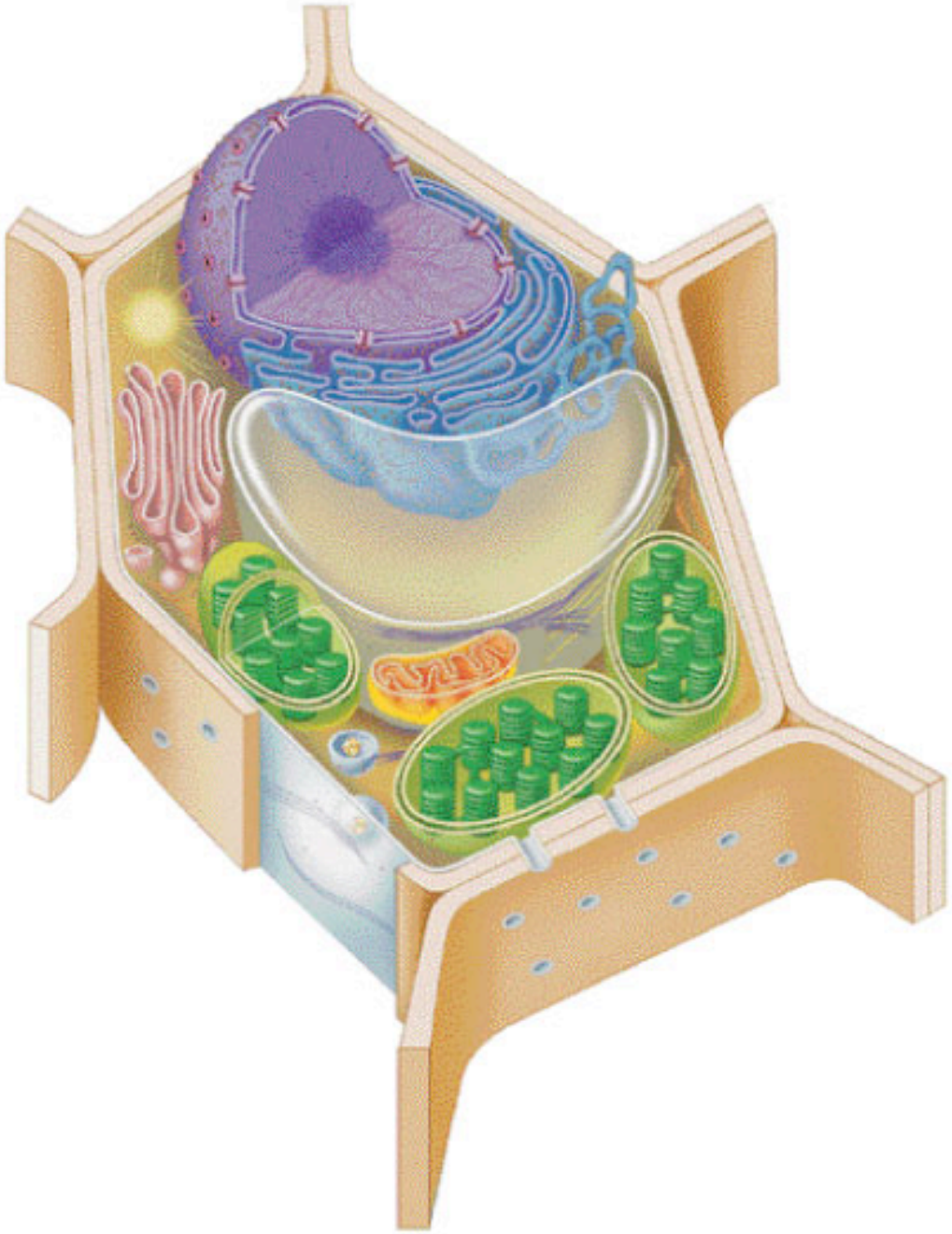

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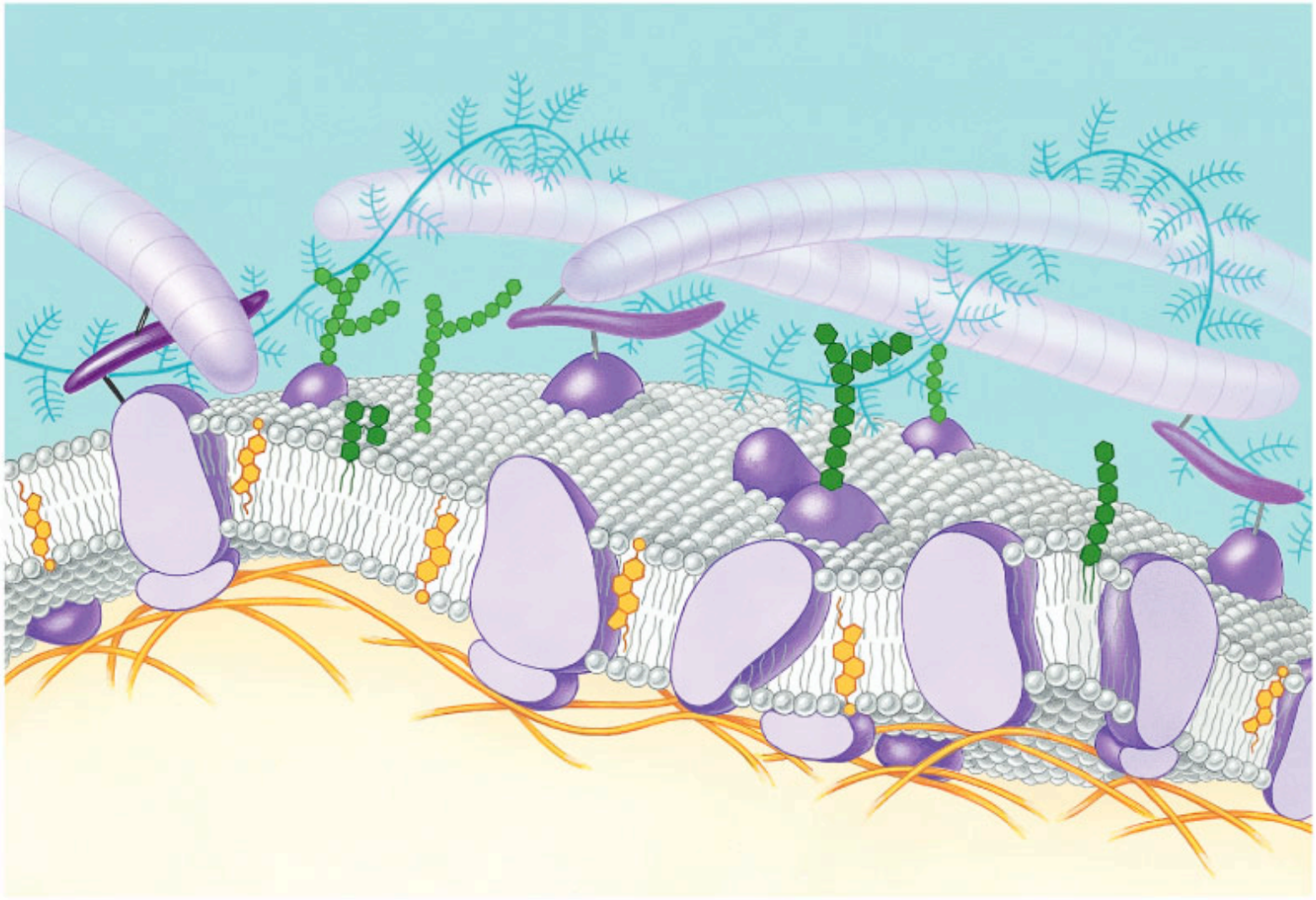

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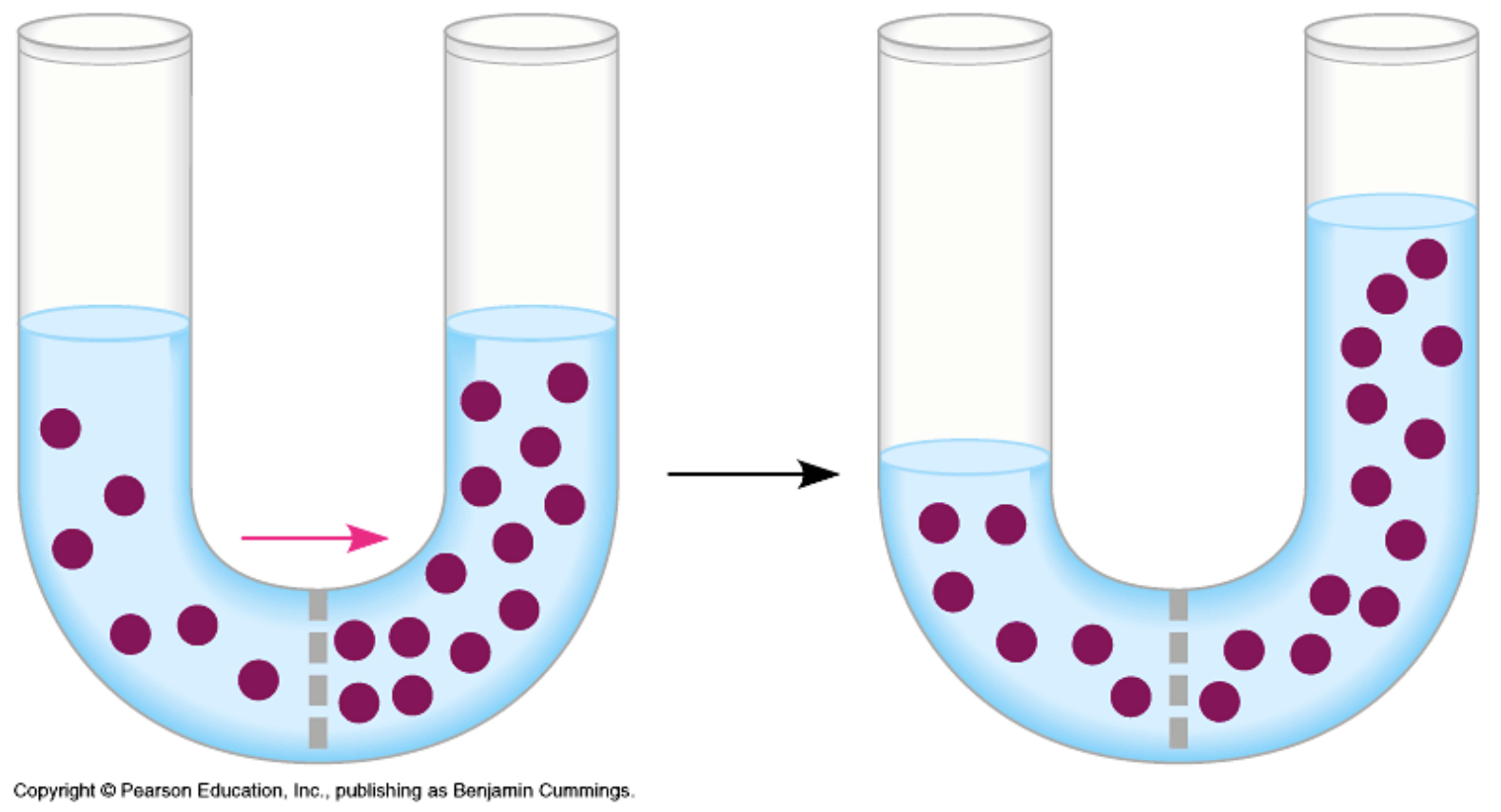
- In which cell would you expect to find the most tight junctions?
  a. Muscle cell in the thigh muscle of a long-distance runner
  b. Pancreatic cell that manufactures digestive enzymes
  c. Macrophage (white blood cell) that engulfs bacteria
  d. Epithelial cells lining the digestive tract
  e. Ovarian cell that produces estrogen (a steroid hormone)

- In which cell would you expect to find the most lysosomes?
  a. Muscle cell in the thigh muscle of a long-distance runner
  b. Pancreatic cell that manufactures digestive enzymes
  c. Macrophage (white blood cell) that engulfs bacteria
  d. Epithelial cells lining the digestive tract
  e. Ovarian cell that produces estrogen (a steroid hormone)



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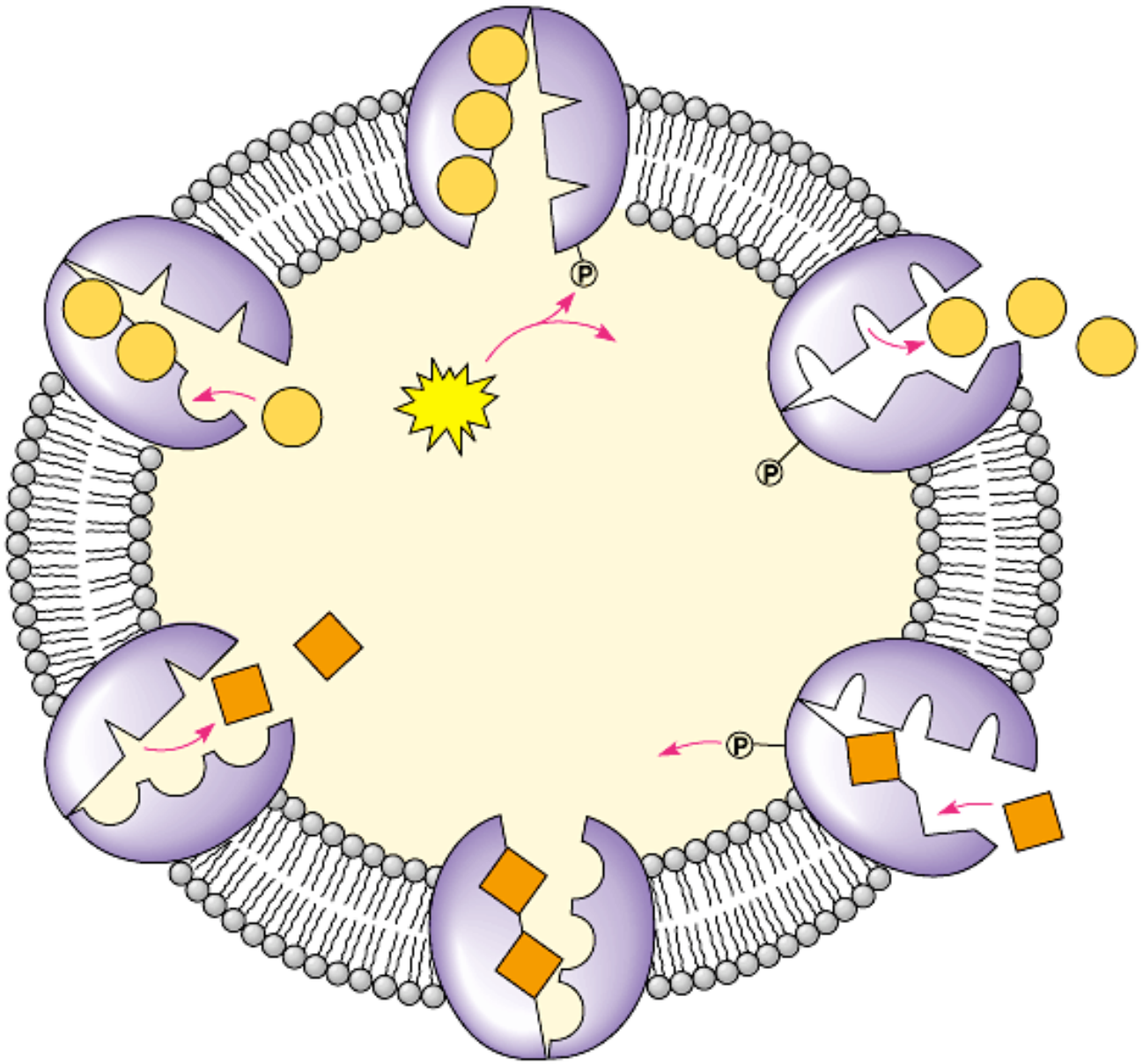

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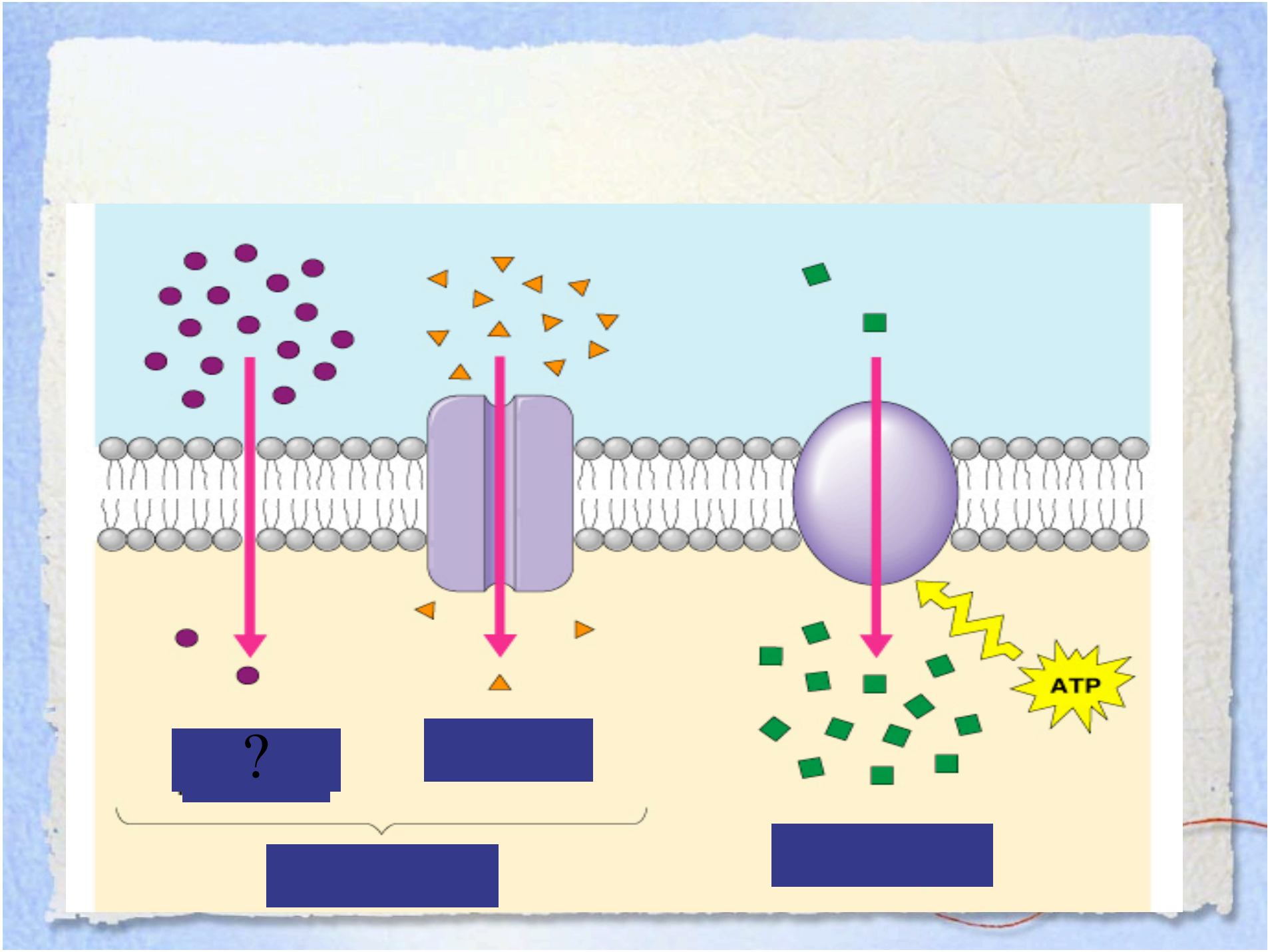
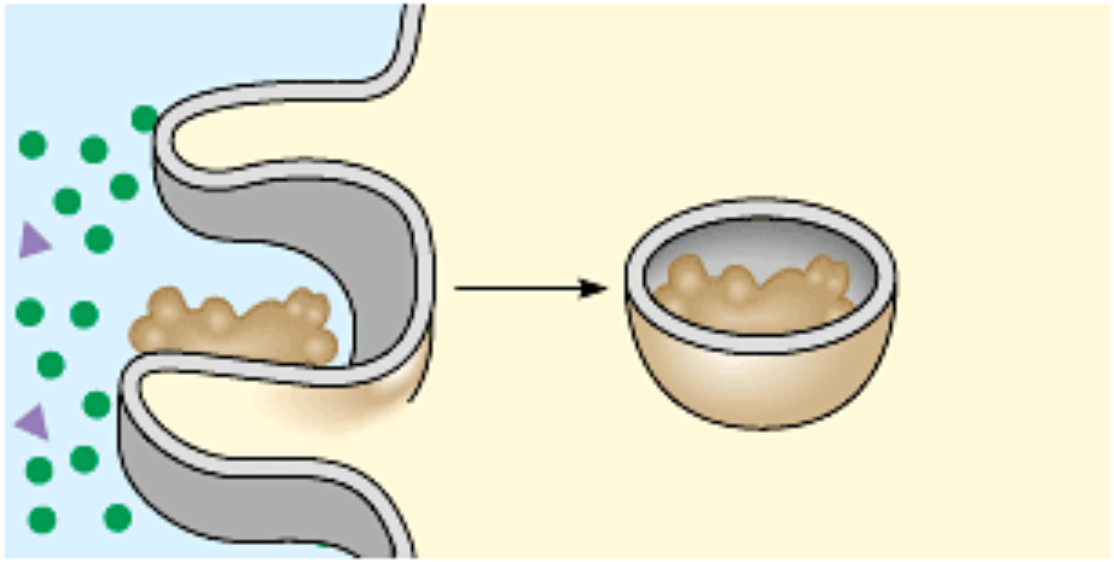
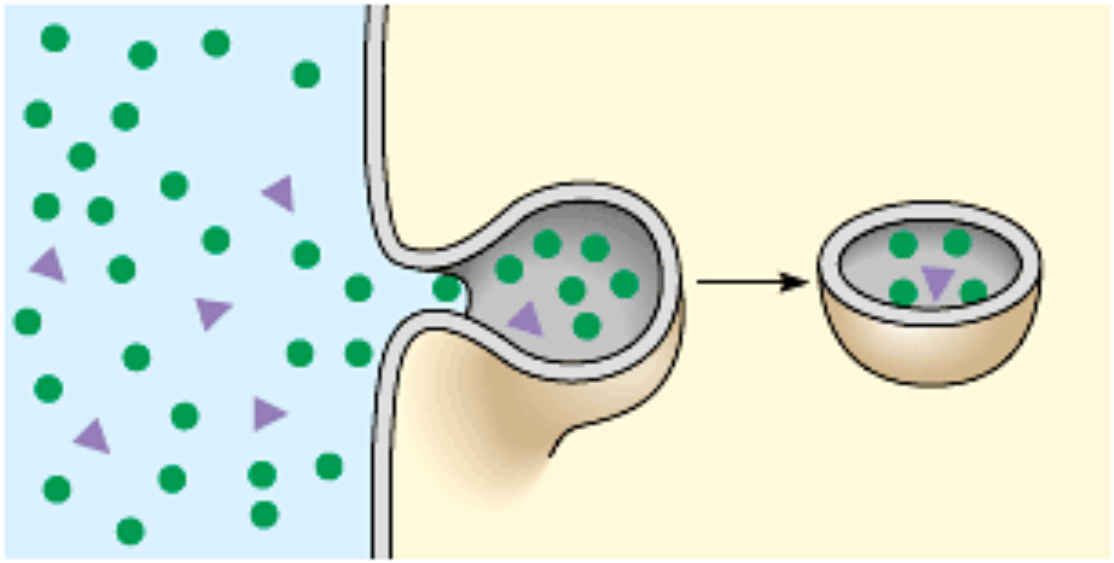
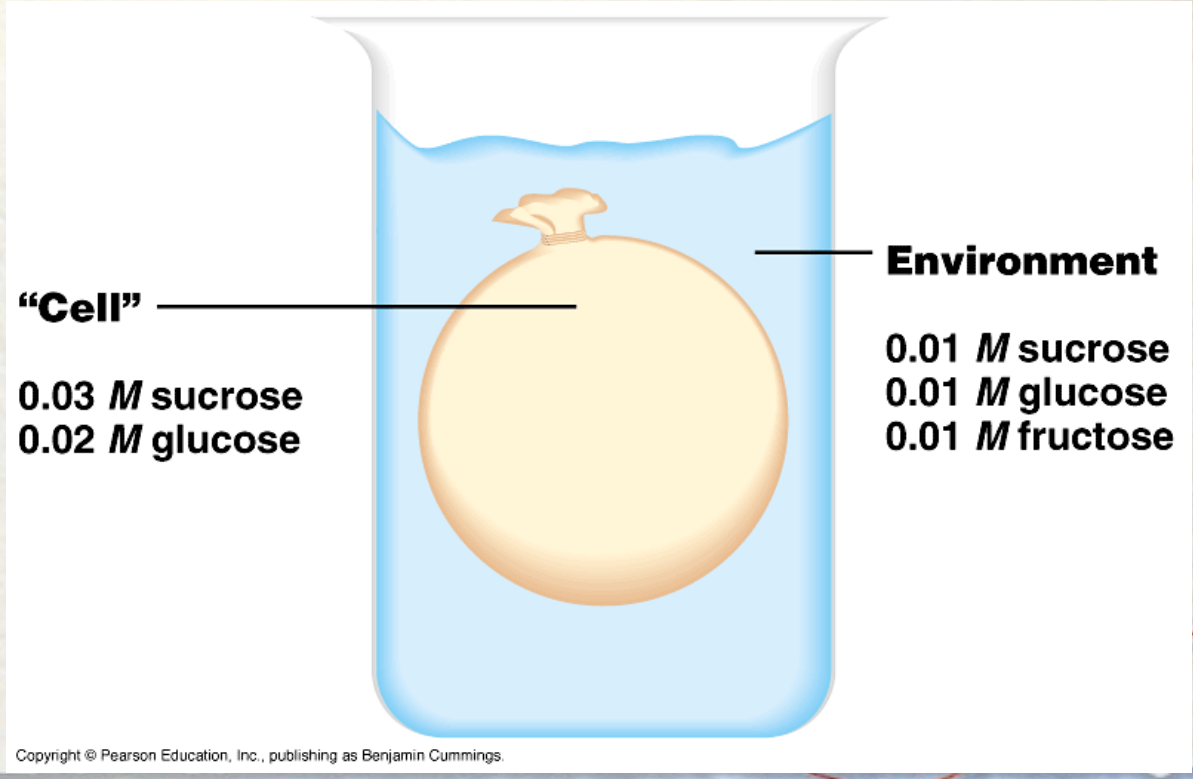

?
ATP





An artificial cell consisting of an aqueous solution enclosed in a selectively permeable membrane has just been immersed in a beaker containing a different solution. The membrane is permeable to water and to the simple sugars glucose and fructose but completely impermeable to the disaccharide sucrose.



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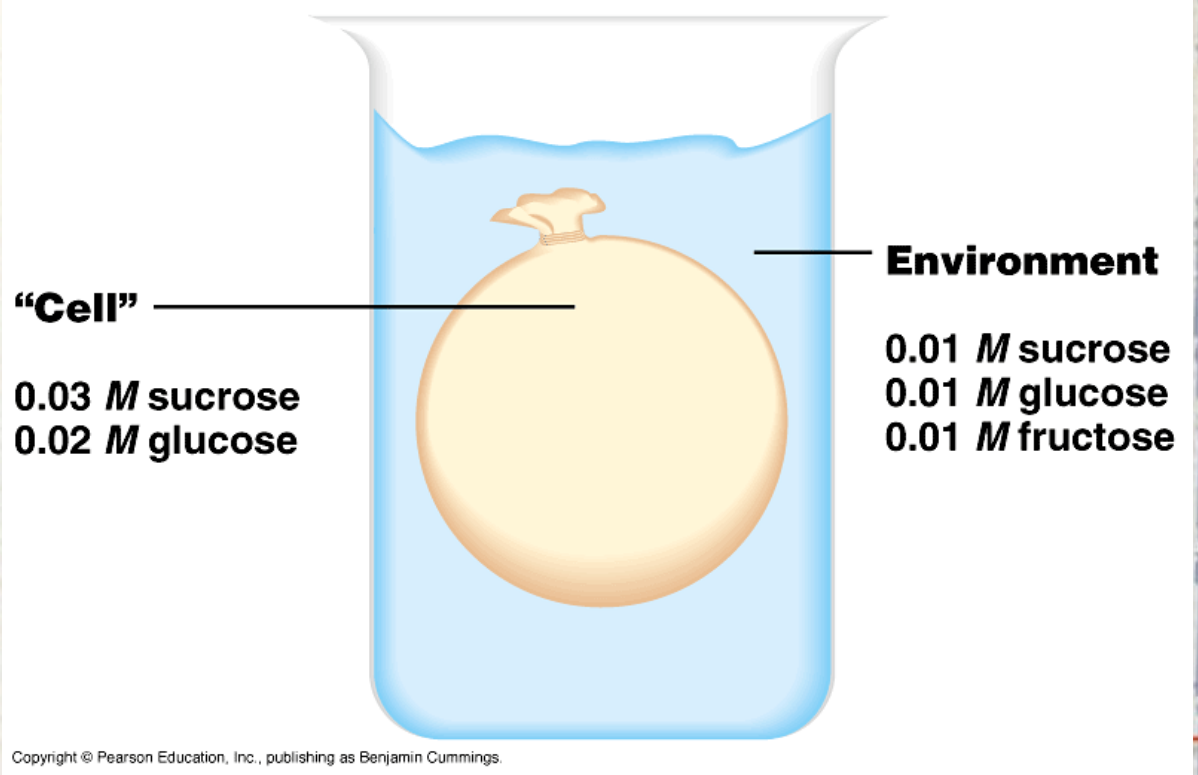
- Which solute(s) will exhibit a net diffusion into the cell?

a. sucrose
b. glucose
c. fructose



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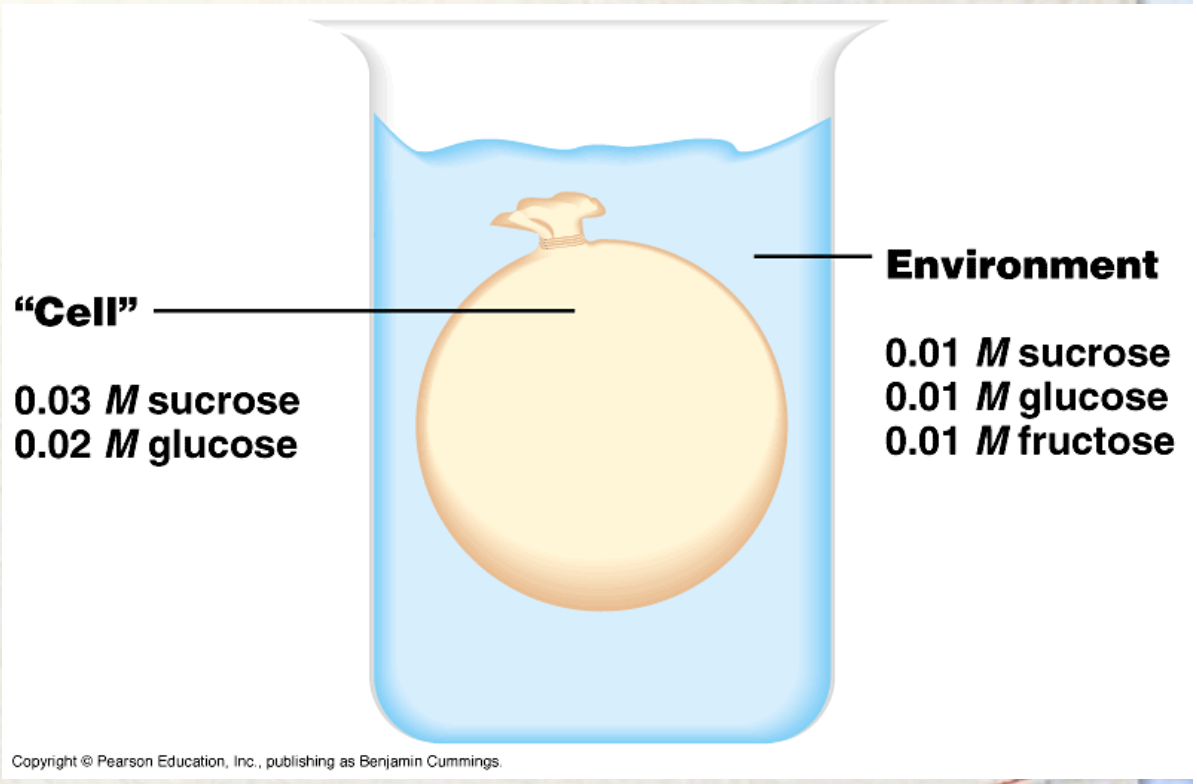
- Which solute(s) will exhibit a net diffusion out of the cell?

a. sucrose
b. glucose
c. fructose



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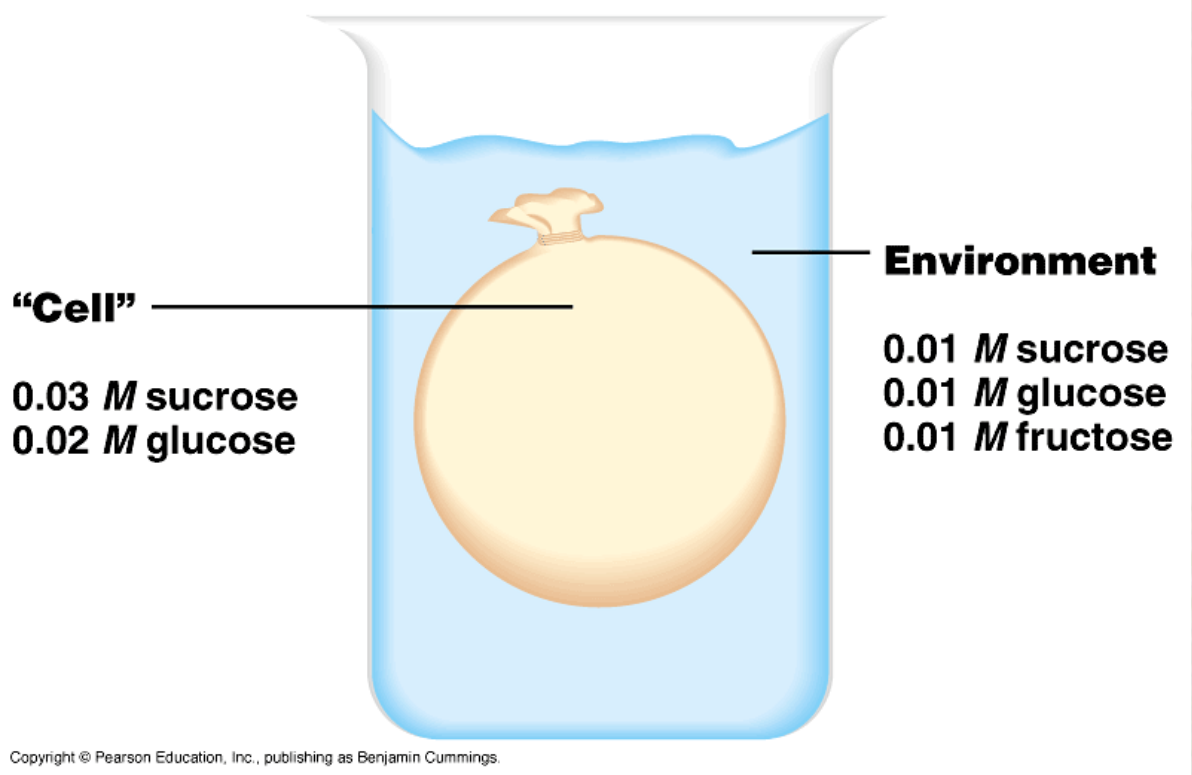
- Which solution is hypertonic to the other?
  a. the cell contents
  b. the environment



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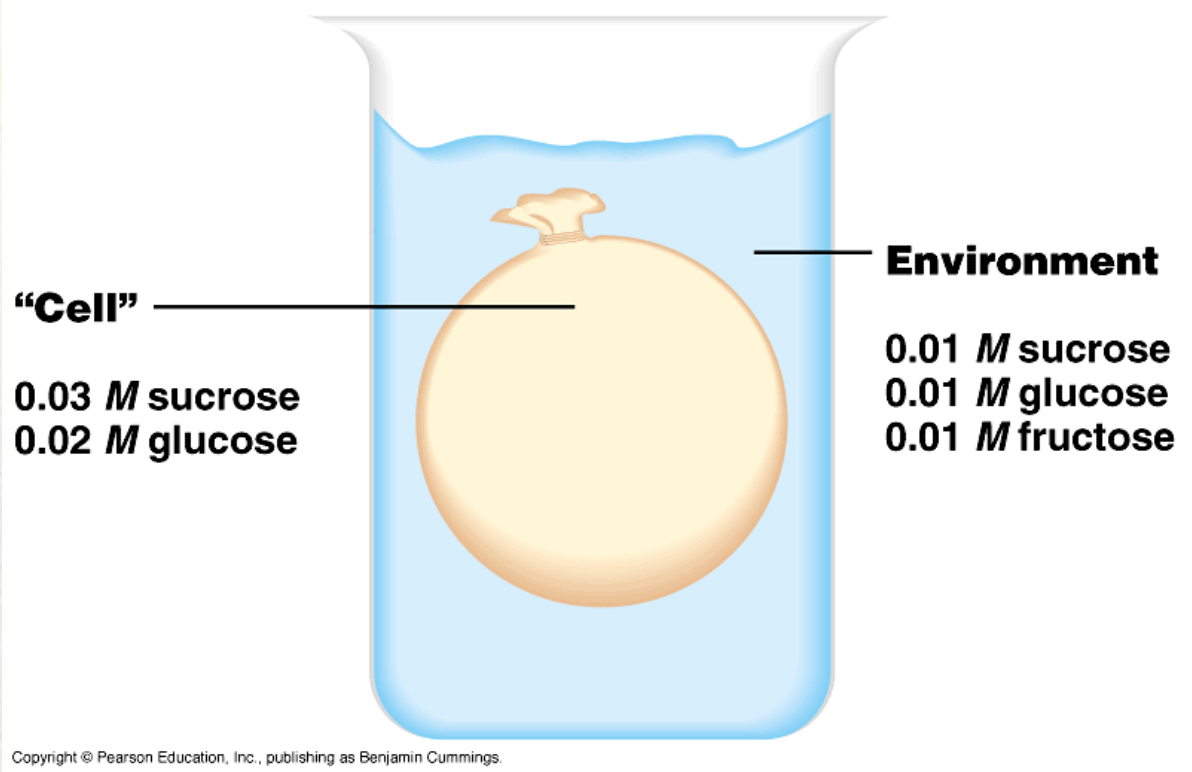
- In which direction will there be a net osmotic movement of water?
  a. out of the cell
  b. into the cell
  c. neither



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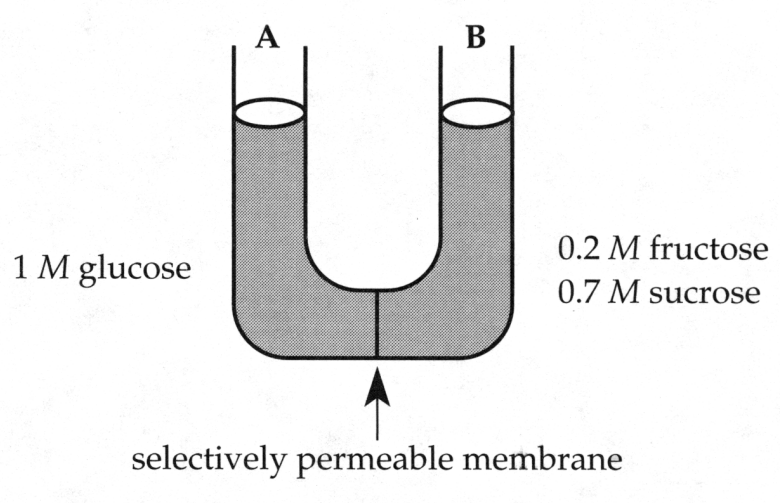
- After the cell is placed in the beaker, which of the following changes will occur?
  a. The artificial cell will become more flaccid.
  b. The artificial cell will become more turgid.
  c. The entropy of the system (cell plus surrounding solution) will decrease.
  d. The overall free energy stored in the system will increase.
  e. The membrane potential will decrease

- A solution of 1 *M* glucose is separated by a selectively permeable membrane from a solution of 0.2 *M* fructose and 0.7 *M* sucrose. The membrane is not permeable to the sugar molecules. Which of the following statements is correct?



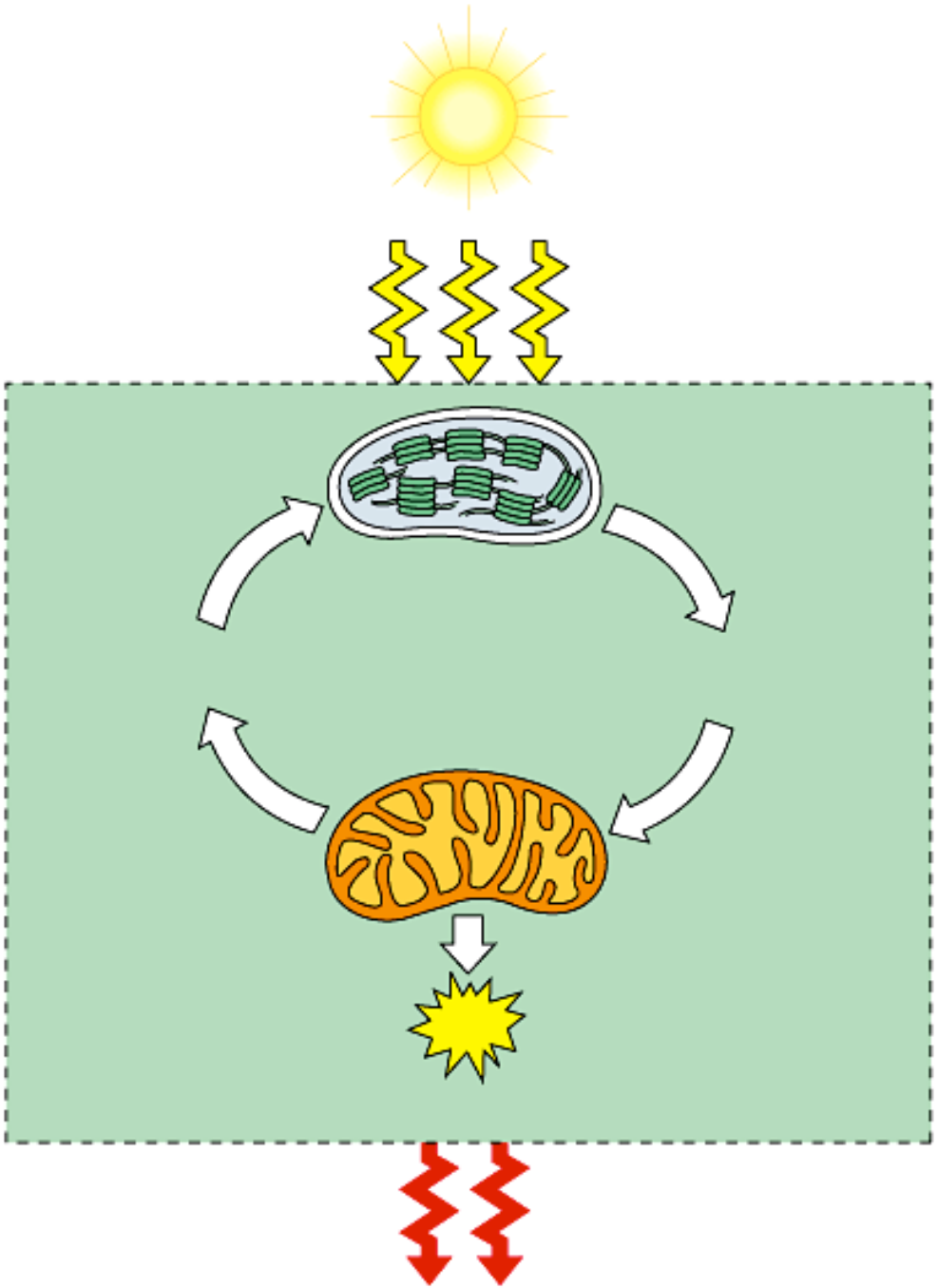
a. Side A is hypotonic relative to side B.

b. The net movement of water will be from side B to side A.

c. The net movement of water will be from side A to side B.

d. Side B is hypertonic relative to side A.

e. There will be no net movement of water.



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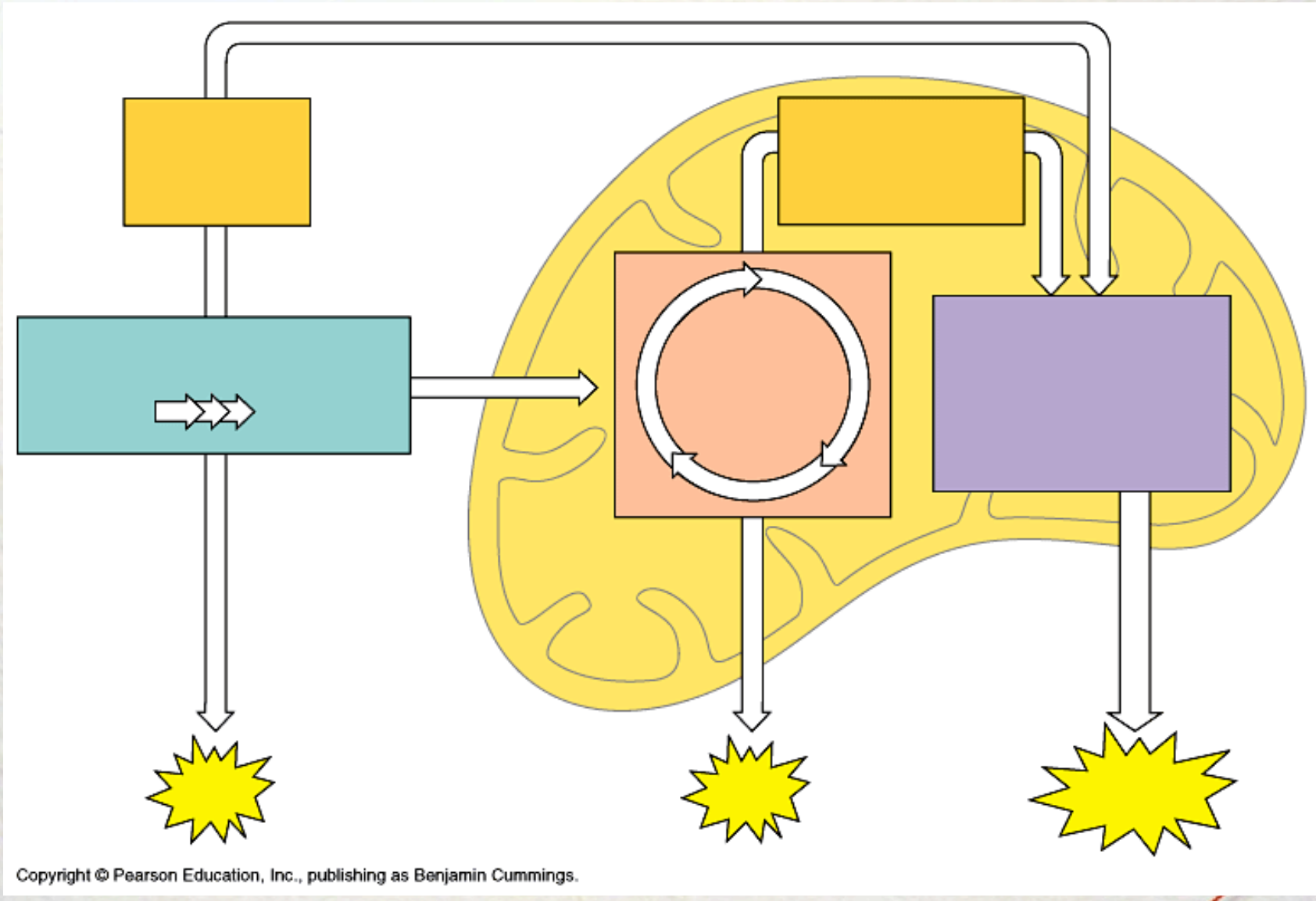

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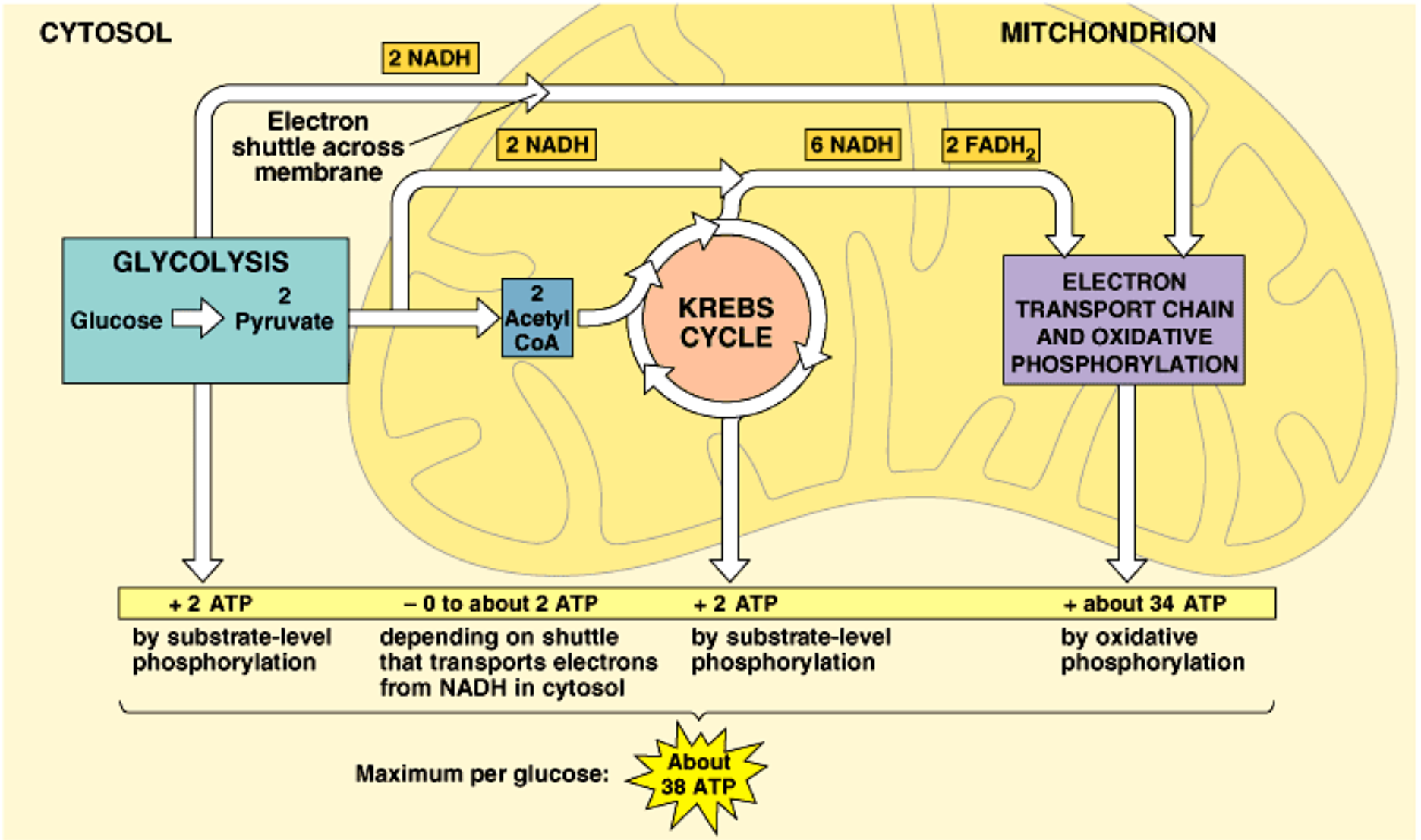

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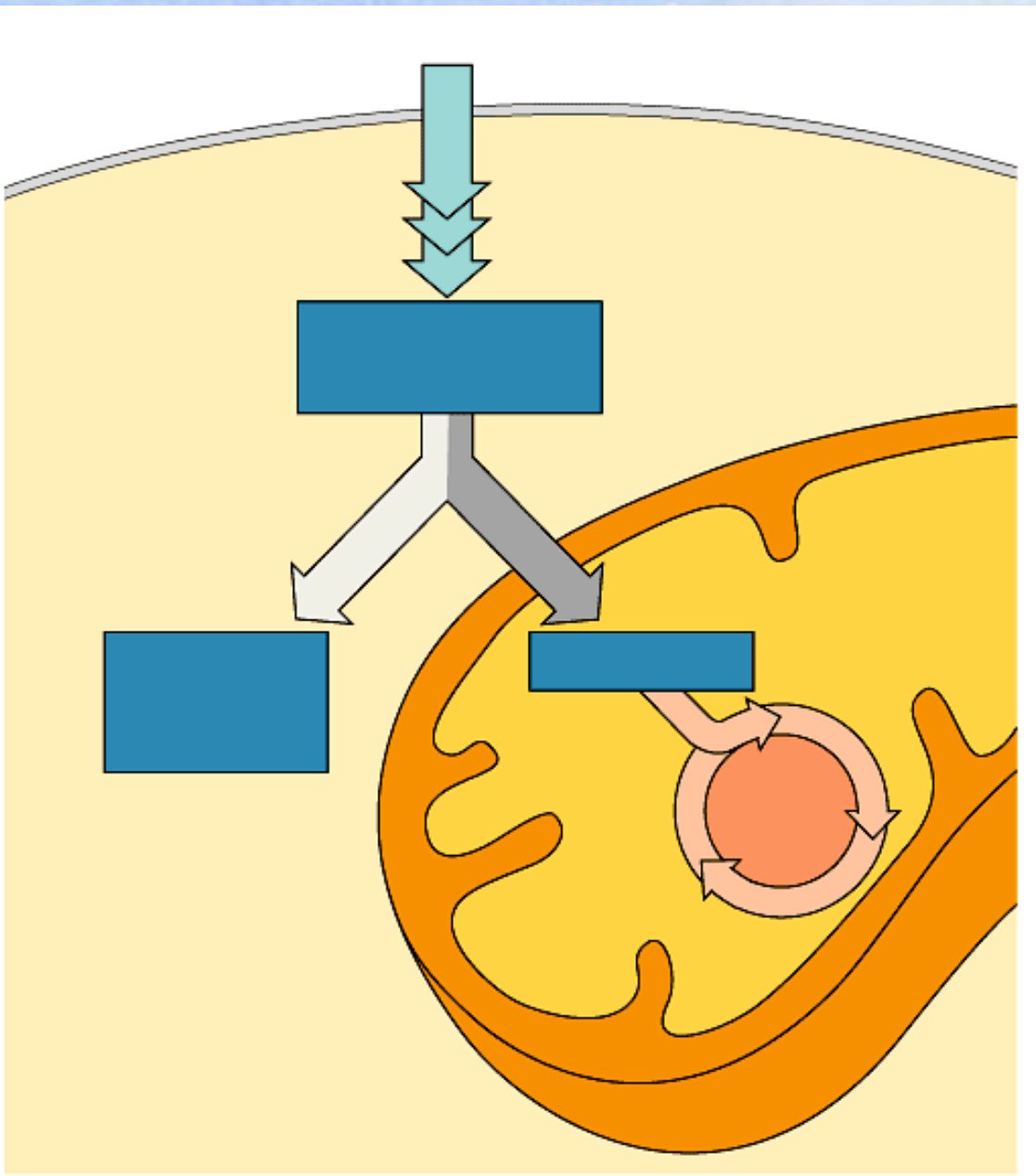

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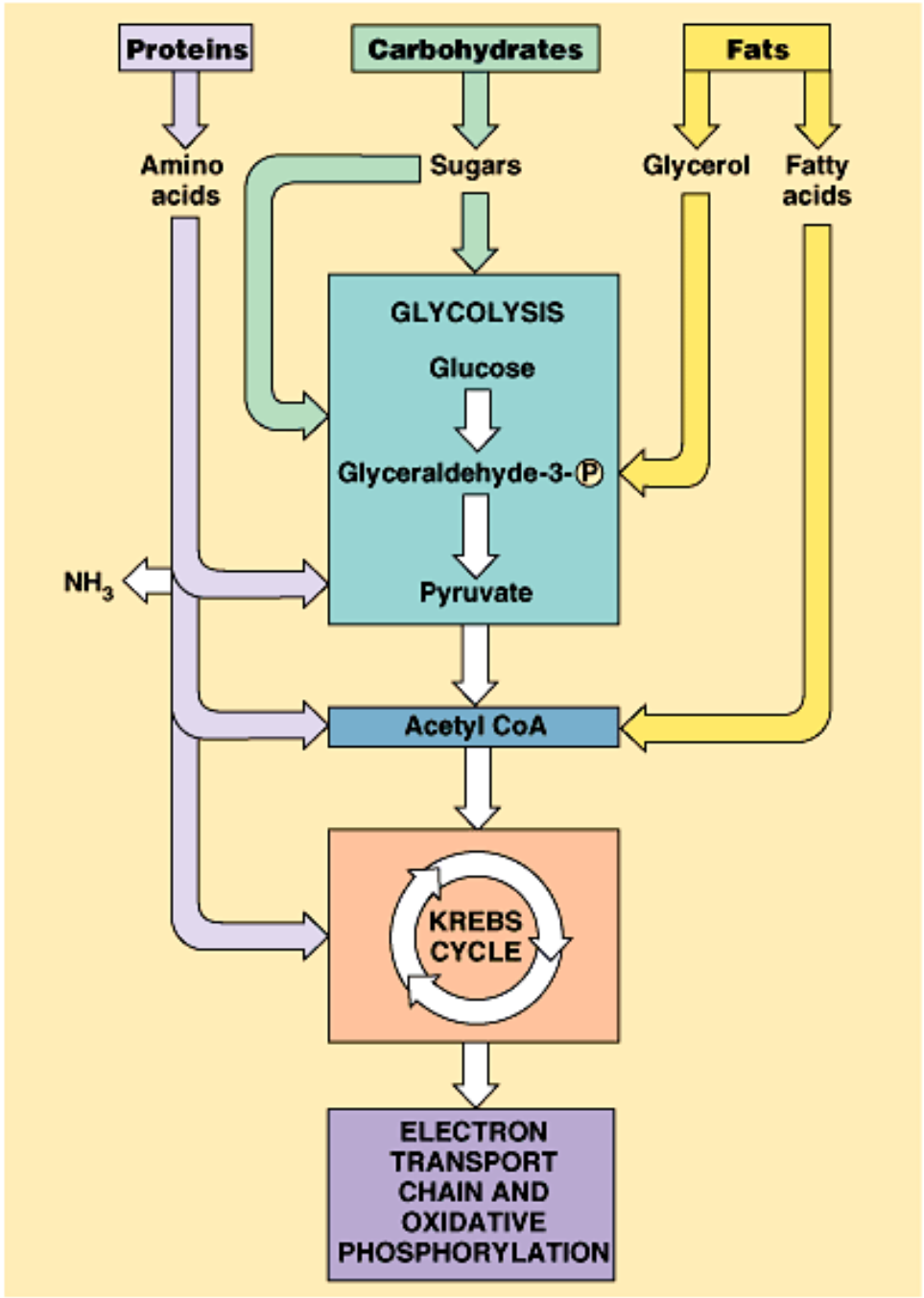

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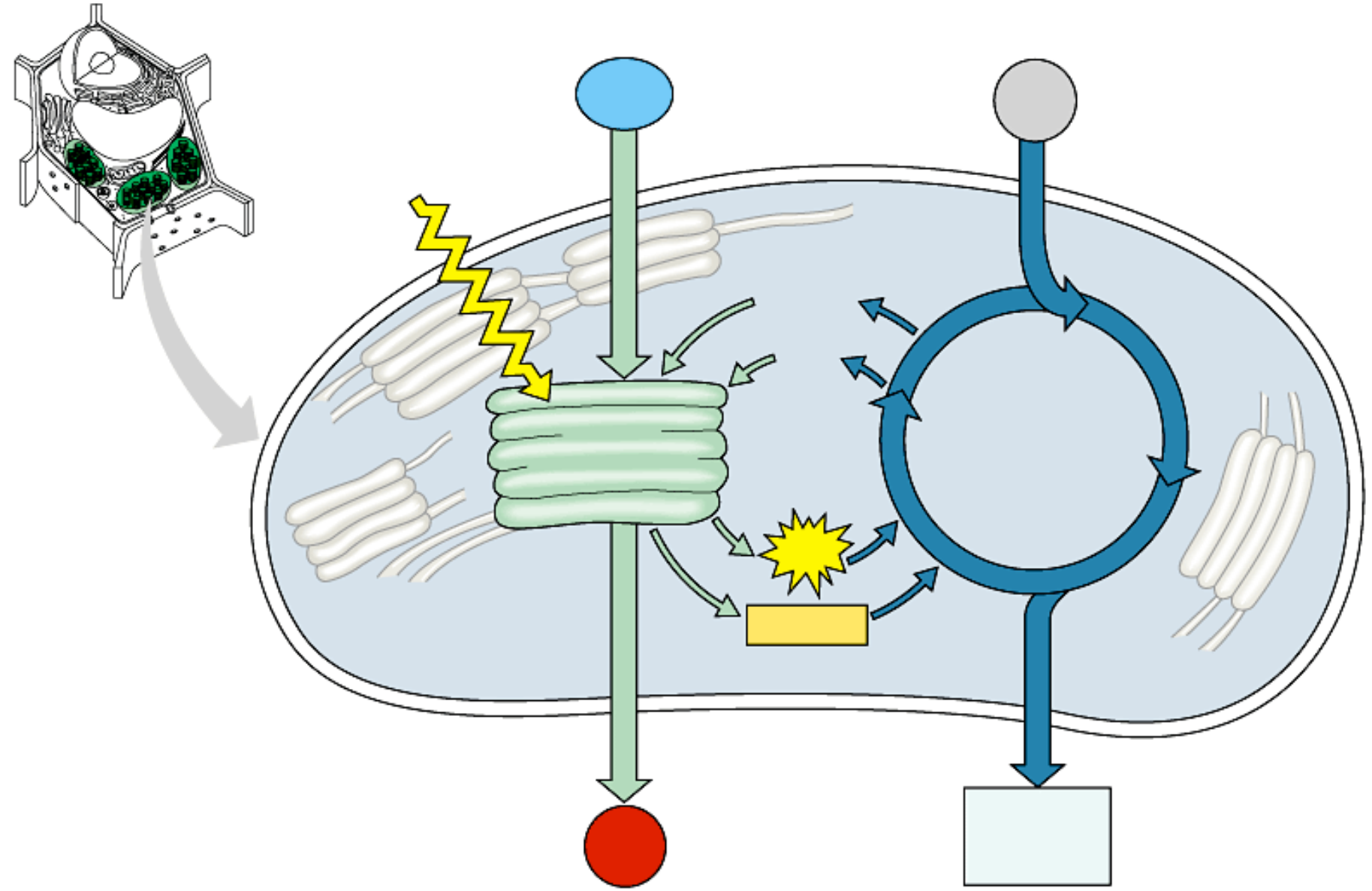

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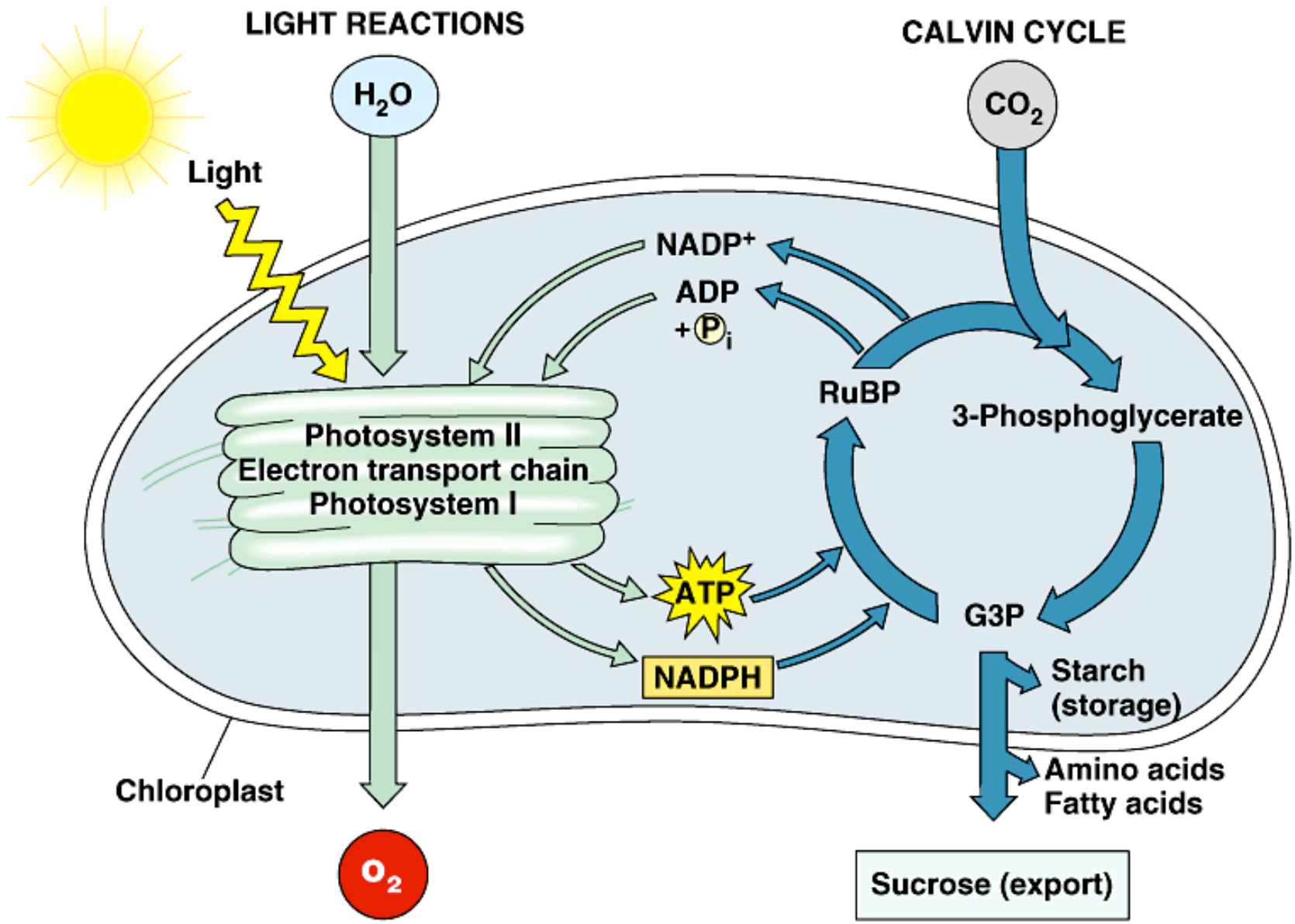

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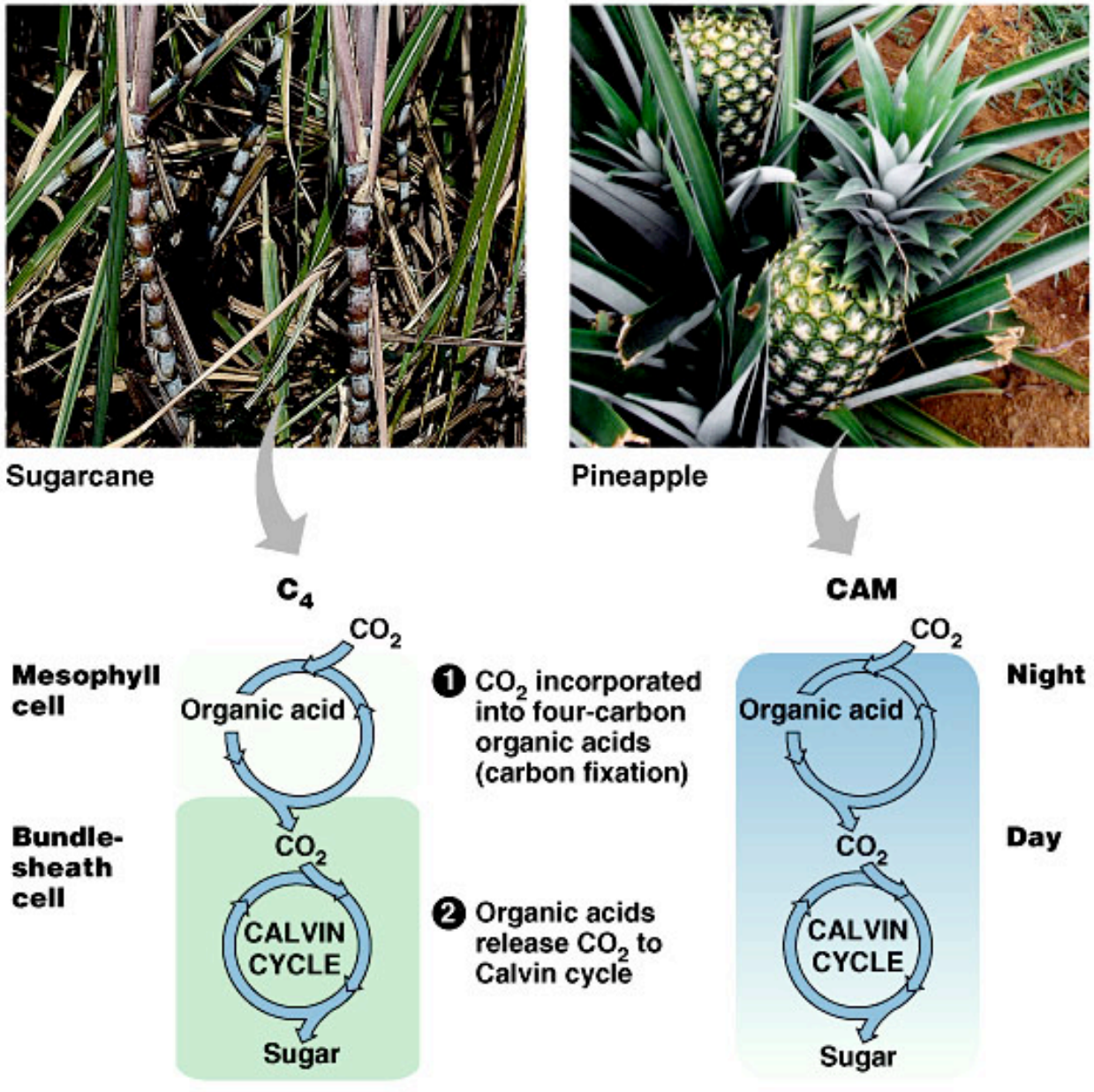

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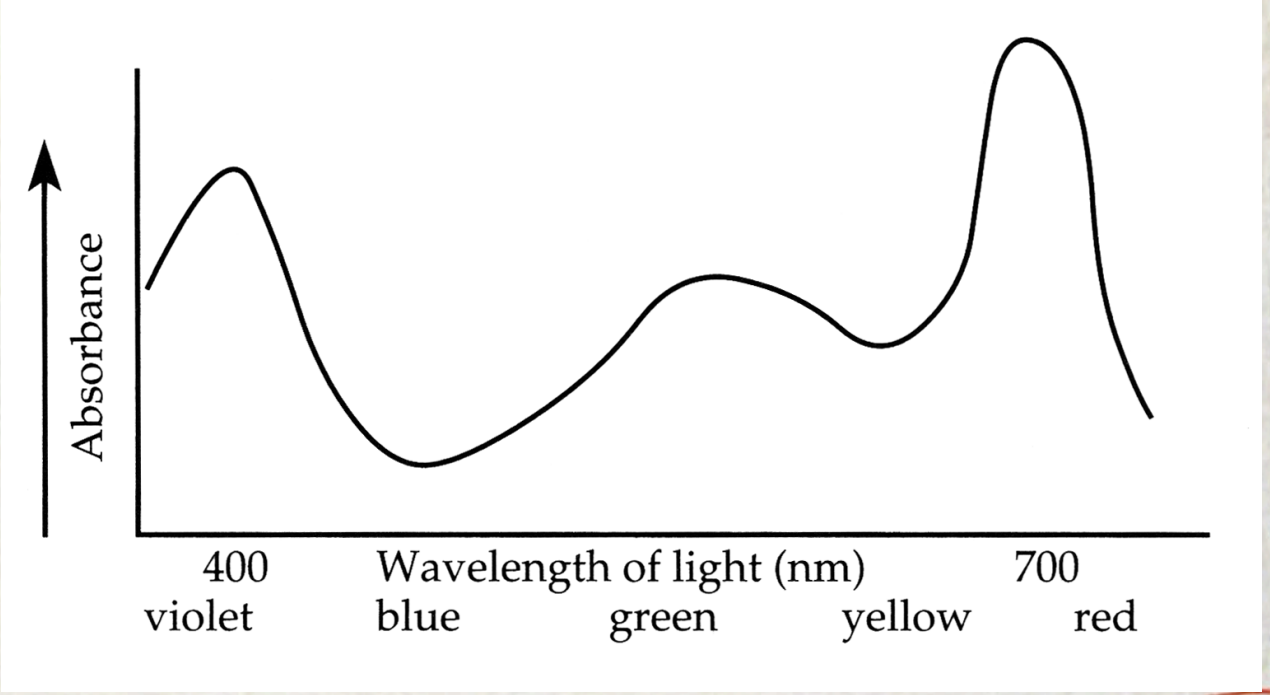
- Below is an absorption spectrum for an unknown pigment molecule. What color would this pigment appear to you?

a. violet
b. blue
c. green
d. yellow
e. red



- In green plants, most of the ATP for synthesis of proteins, cytoplasmic streaming, and other cellular activities comes directly from
  a. photosystem I.
  b. the Calvin cycle.
  c. oxidative phosphorylation.
  d. noncyclic photophosphorylation.
  e. cyclic photophosphorylation.

- What portion of an illuminated plant cell would you expect to have the lowest pH?
  a. nucleus
  b. vacuole
  c. chloroplast
  d. stroma of chloroplast
  e. thylakoid space

- A new flower species has a unique photosynthetic pigment. The leaves of this plant appear to be reddish yellow. What wavelengths of visible light are *not* being absorbed by this pigment?
  a. red and yellow
  b. blue and violet
  c. green and yellow
  d. blue, green, and red
  e. green, blue, and violet

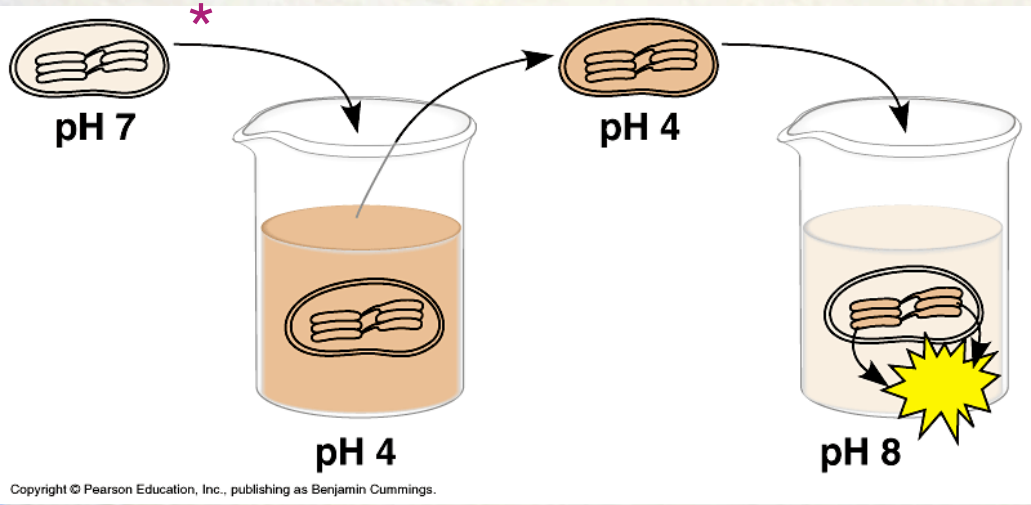
- Some photosynthetic organisms contain chloroplasts that lack photosystem II, yet are able to survive. The best way to detect the lack of photosystem II in these organisms would be
  a. to determine if they have thylakoids in the chloroplasts.
  b. to test for liberation of O_2 in the light.
  c. to test for CO_2 fixation in the dark.
  d. to do experiments to generate an action spectrum.
  e. to test for production of either sucrose or starch.

- Assume a thylakoid is somehow punctured so that the interior of the thylakoid is no longer separated from the stroma. This damage will have the most direct effect on which of the following processes?
  a. the splitting of water
  b. the absorption of light energy by chlorophyll
  c. the flow of electrons from photosystem II to photosystem I
  d. the synthesis of ATP
  e. the reduction of $NADP^+$

- Which of the following conclusions does *not* follow from studying the absorption spectrum for chlorophyll *a* and the action spectrum for photosynthesis?
  a. Not all wavelengths are equally effective for photosynthesis.
  b. There must be accessory pigments that broaden the spectrum of light that contributes energy for photosynthesis.
  c. The red and blue areas of the spectrum are most effective in driving photosynthesis.
  d. Chlorophyll owes its color to the absorption of green light.
  e. Chlorophyll *a* has two absorption peaks.

- Which of the following processes could still occur in a chloroplast in the presence of an inhibitor that prevents H^+ from passing through ATP synthase complexes?
  a. sugar synthesis
  b. generation of a proton-motive force
  c. photophosphorylation
  d. the Calvin cycle
  e. oxidation of NADPH

- The diagram below represents an experiment with isolated chloroplasts. The chloroplasts were first made acidic by soaking them in a solution at pH 4. After the thylakoid space reached pH 4, the chloroplasts were transferred to a basic solution at pH 8. The chloroplasts are then placed in the dark. Which of these compounds would you expect to be produced?



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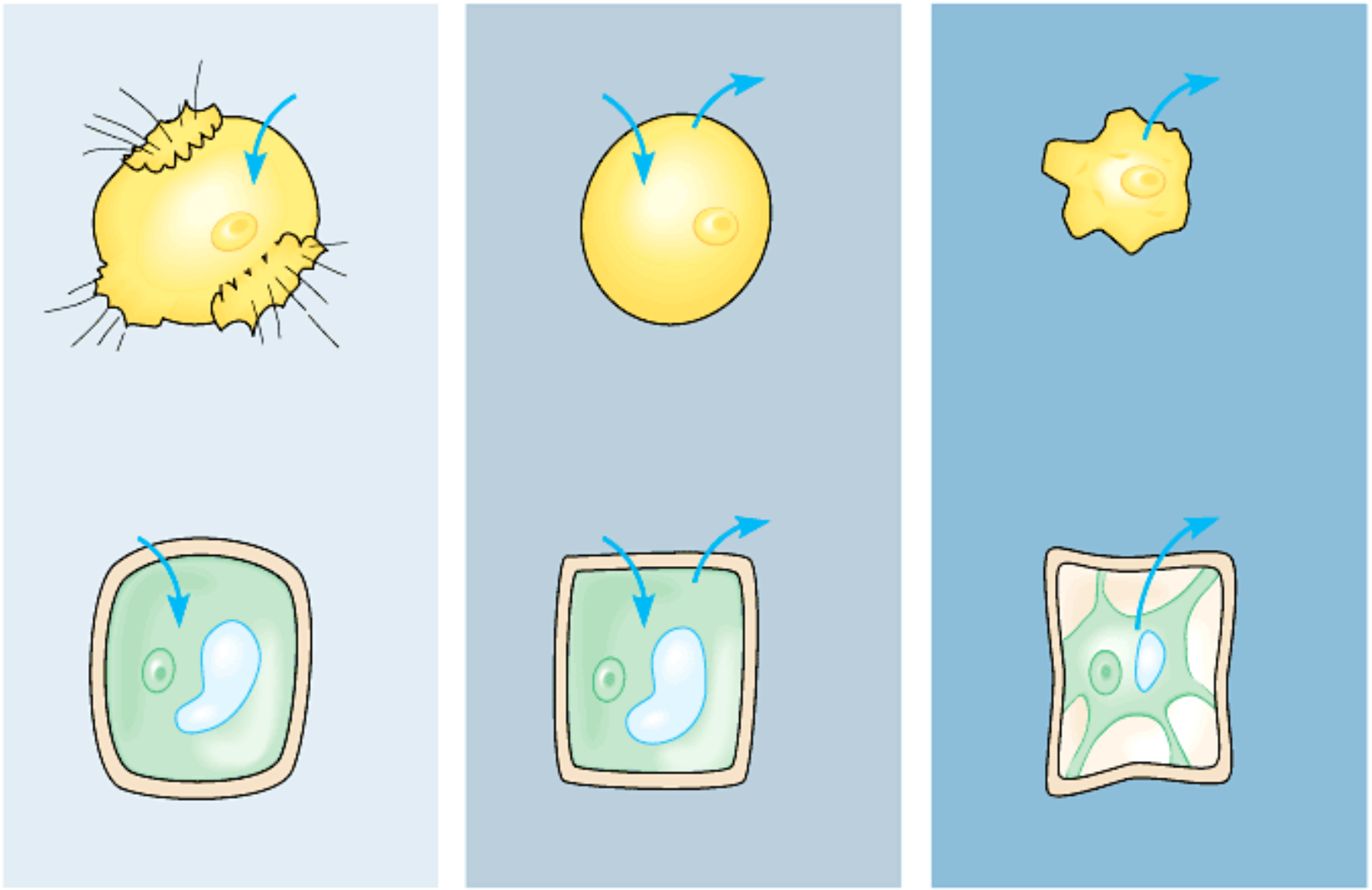
a. ATP
b. NADPH + H^+
c. G3P
d. ATP and NADPH + H^+
e. ATP, NADPH + H^+, and G3P



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- When electrons flow along the electron transport chains of mitochondria, which of the following changes occur?
  a. The pH of the matrix increases.
  b. ATP synthase pumps protons by active transport.
  c. The electrons gain free energy.
  d. The cytochromes of the chain phosphorylate ADP to form ATP.
  e. NAD^+ is oxidized.

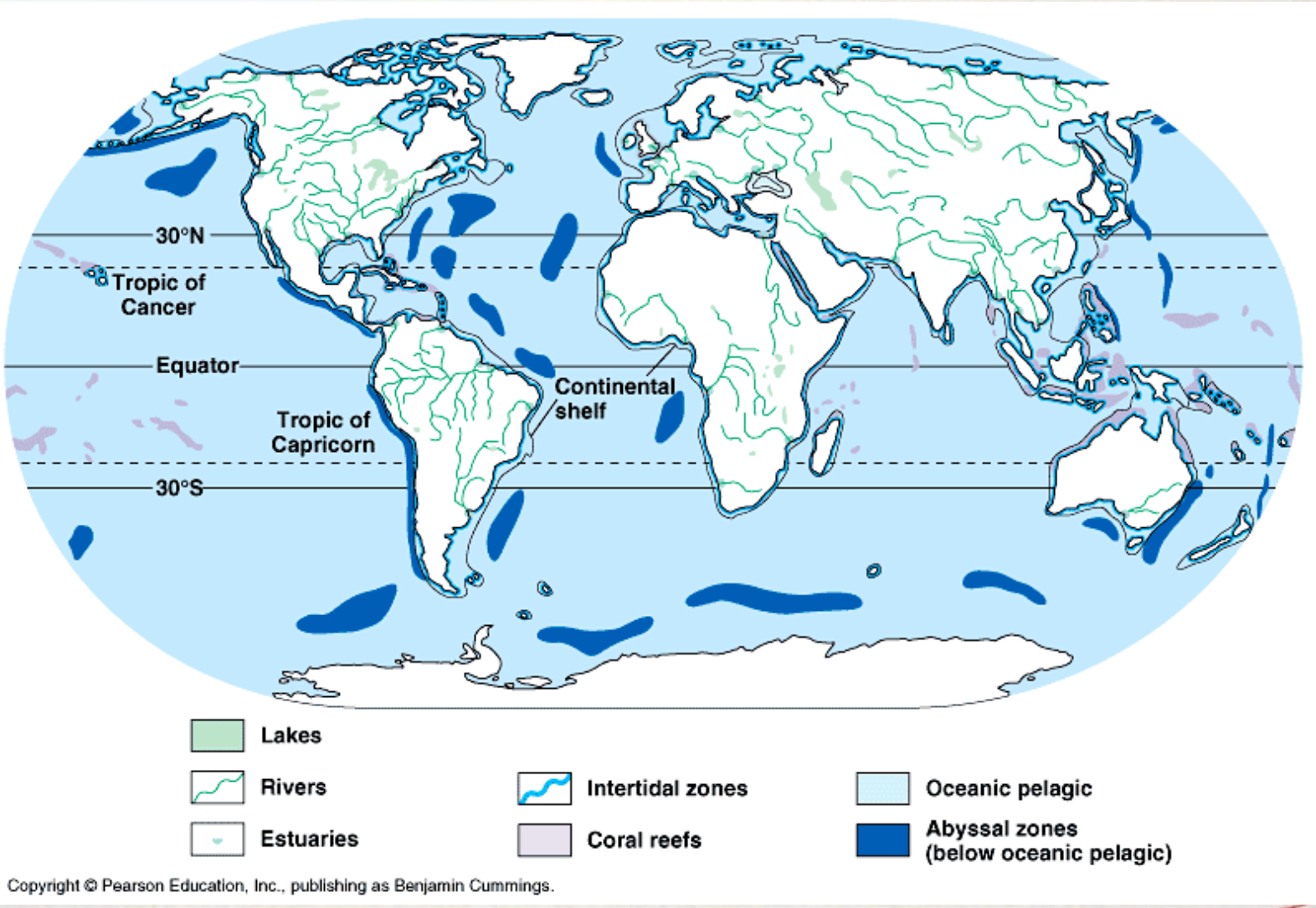
- In the 1940s, some physicians prescribed low doses of a drug called dinitrophenol (DNP) to help patients lose weight. This unsafe method was abandoned after a few patients died. DNP uncouples the chemiosmotic machinery by making the lipid bilayer of the inner mitochondrial membrane leaky to H+. What impact does this have on ATP production? *

a. reduces substrate level phosphorylations
b. increases substrate level phosphorylations
c. reduces oxidative level phosphorylations
d. increase oxidative level phosphorylations
e. This would have no impact on ATP production.

- Cyanide is a poison that blocks the passage of electrons along the electron transport chain. Which of the following is a metabolic effect of this poison?
  a. The lower pH of the intermembrane space is much lower than normal.
  b. Electrons are passed directly to oxygen, causing cells to explode.
  c. Alcohol would build up in the cells.
  d. NADH supplies would be exhausted, and ATP synthesis would cease.
  e. No proton gradient would be produced, and ATP synthesis would cease.

- Which kind of metabolic poison would most directly interfere with glycolysis?
  a. an agent that reacts with oxygen and depletes its concentration in the cell
  b. an agent that binds to pyruvate and inactivates it
  c. an agent that closely mimics the structure of glucose but is not metabolized
  d. an agent that reacts with NADH and oxidizes it to NAD^+
  e. an agent that inhibits the formation of acetyl coenzyme A

- You have a friend who lost 15 pounds of fat on a diet. Where did the fat go (how was it lost)? *
  a. It was released as CO_2 and H_2O.
  b. Chemical energy was converted to heat and then released.
  c. It was converted to ATP, which weighs much less than fat.
  d. It was broken down to amino acids and eliminated from the body.
  e. It was converted to urine and eliminated from the body.



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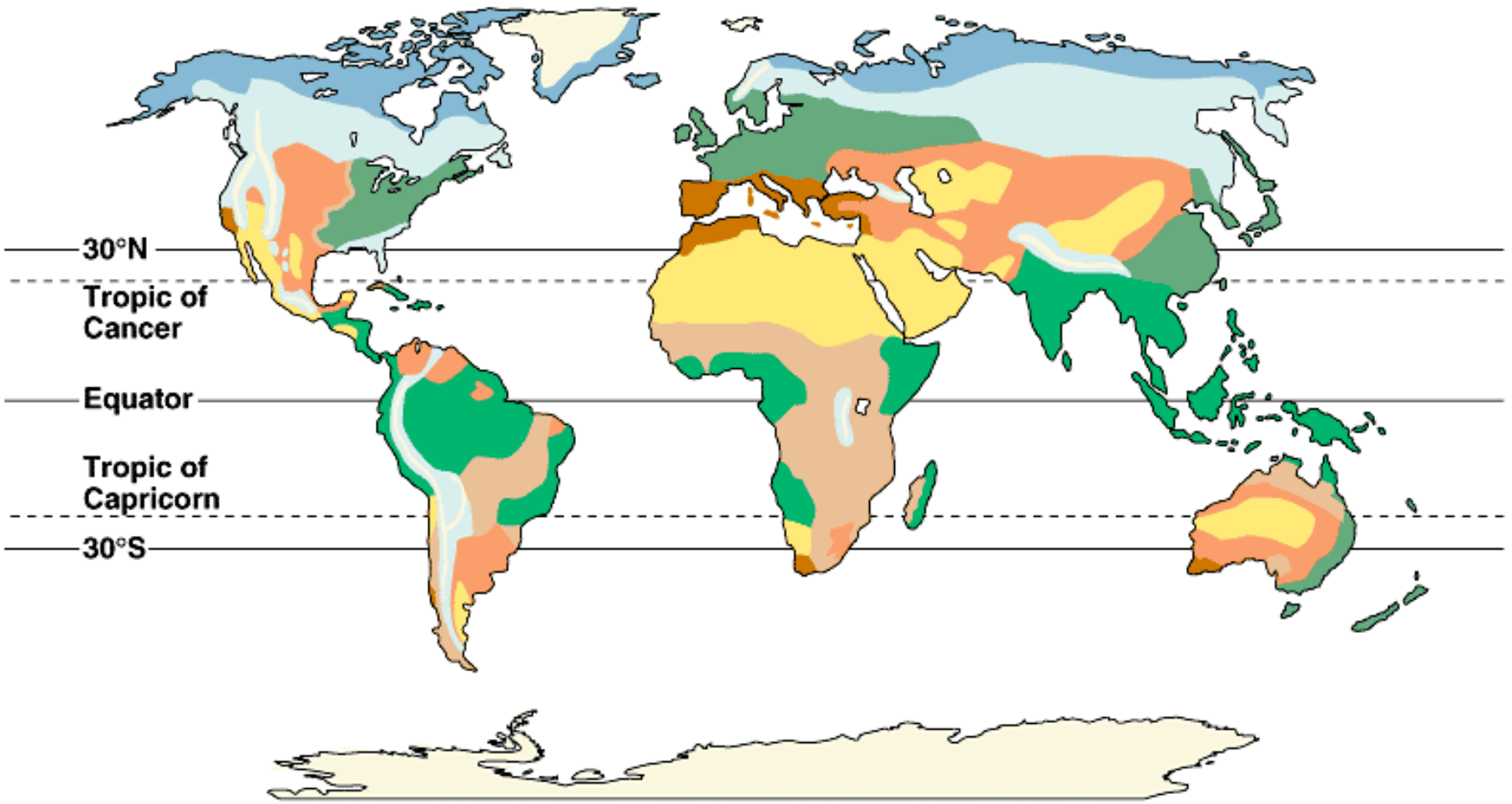

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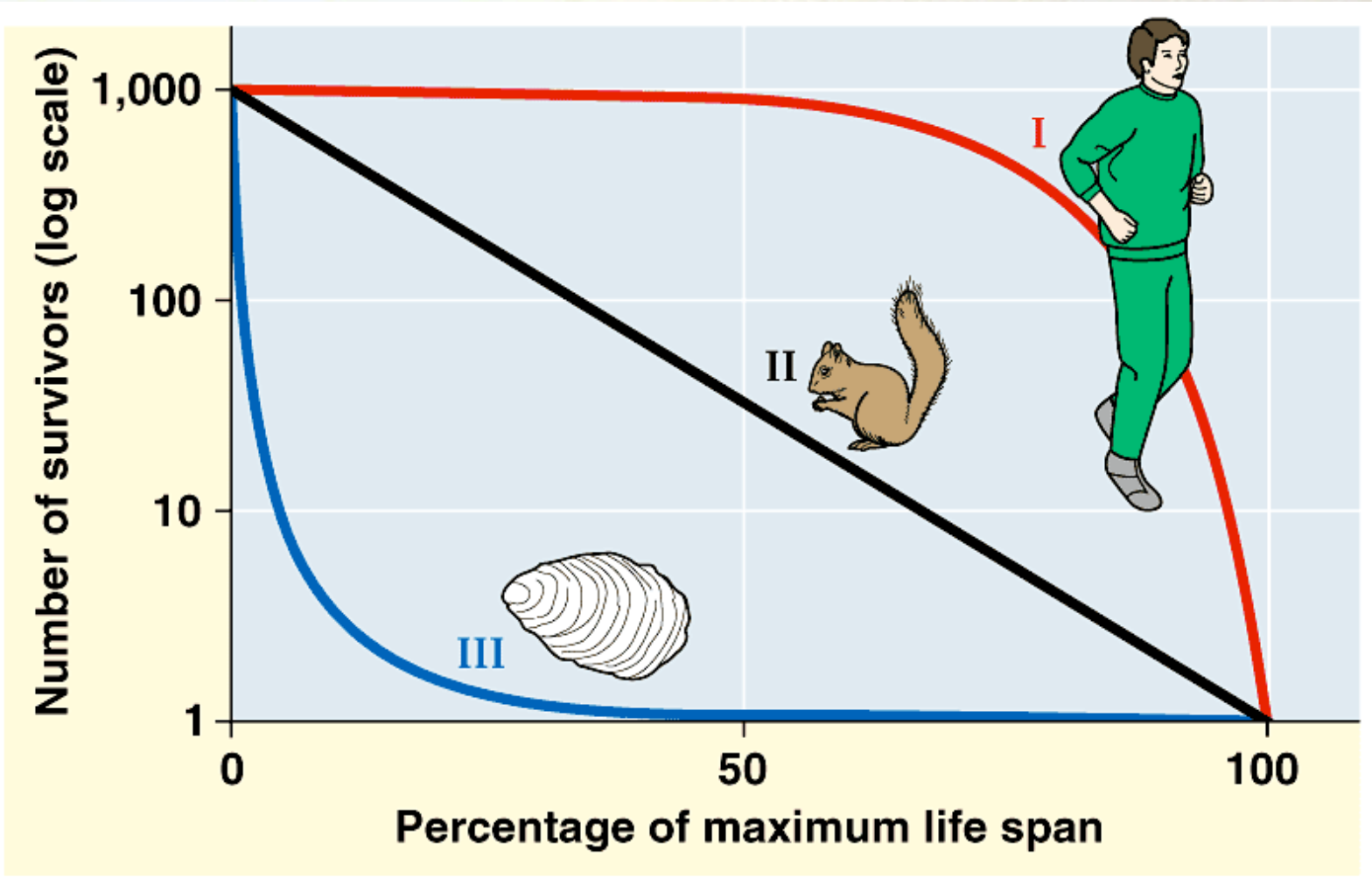
Behavioral Ecology

- Innate Behavior
  - FAP
- Learning
  - Imprinting – critical period
  - Associative learning
    - Classical conditioning (pavlov)
    - Operant conditioning
  - Play

- Animal Cognition (percieption and processing)
  - Taxis
  - Kinesis
  - Migration
- Social Behavior
  - Hierarchy
  - Agonistic
  - Territoriality
  - Courtship rituals



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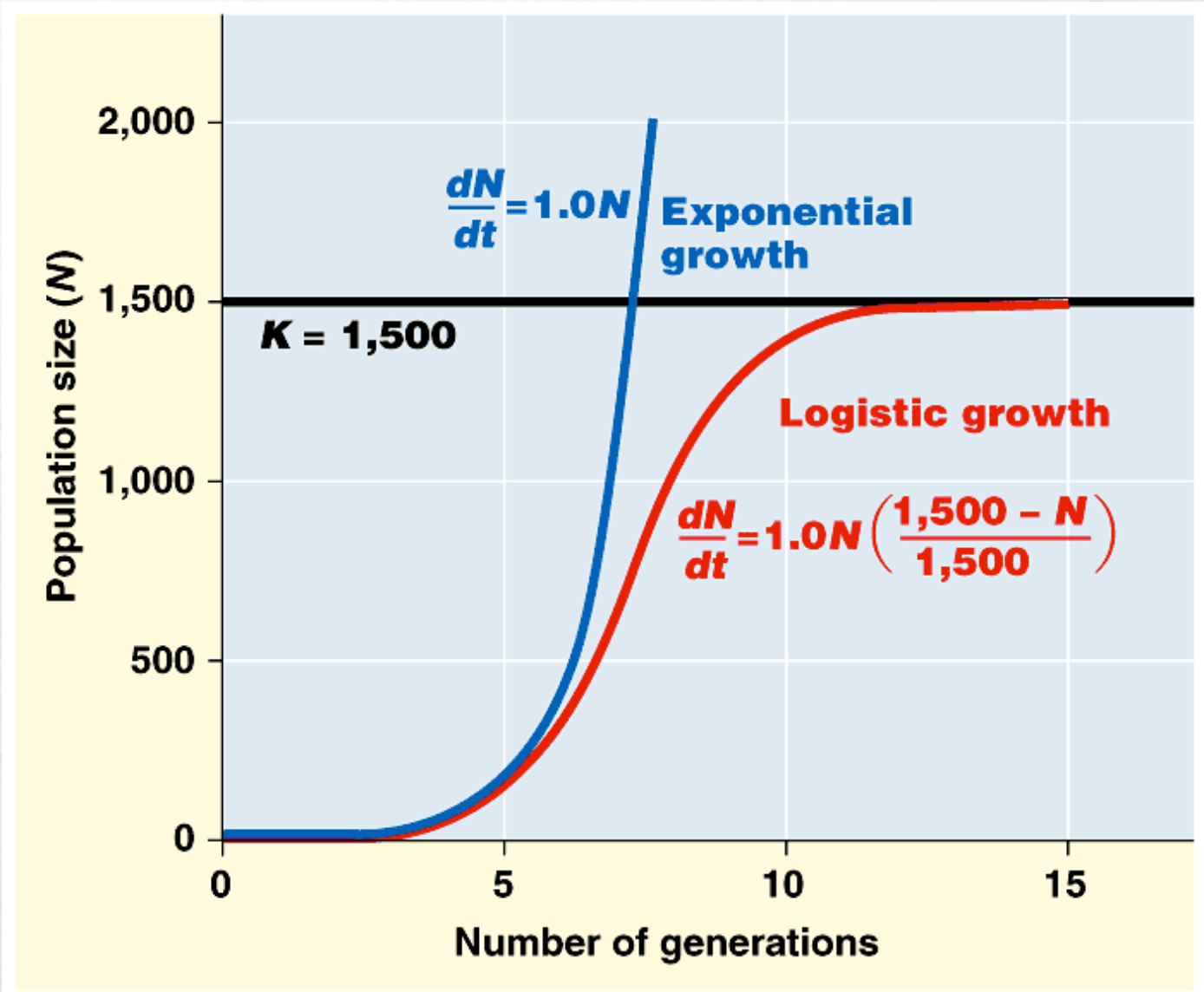

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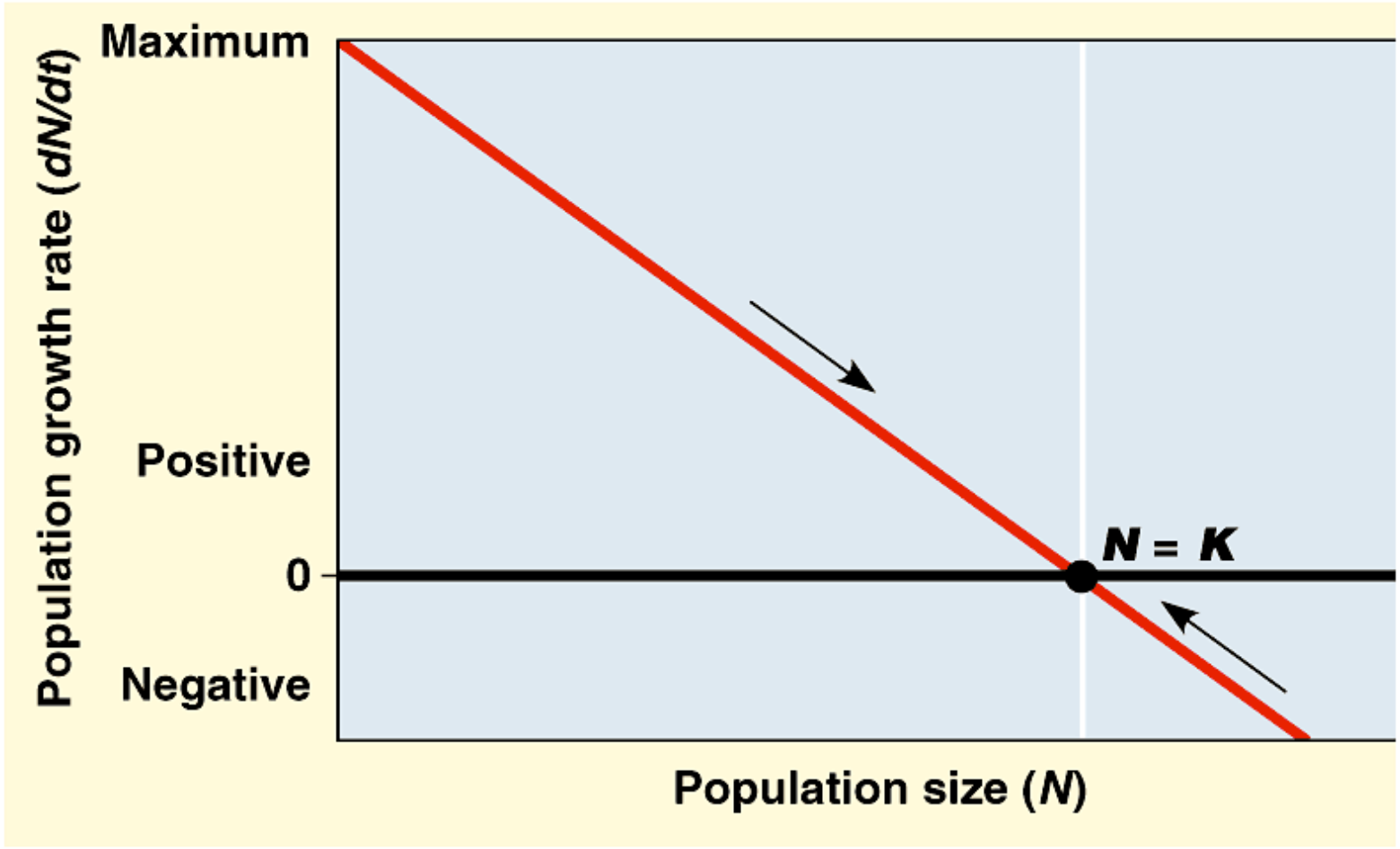

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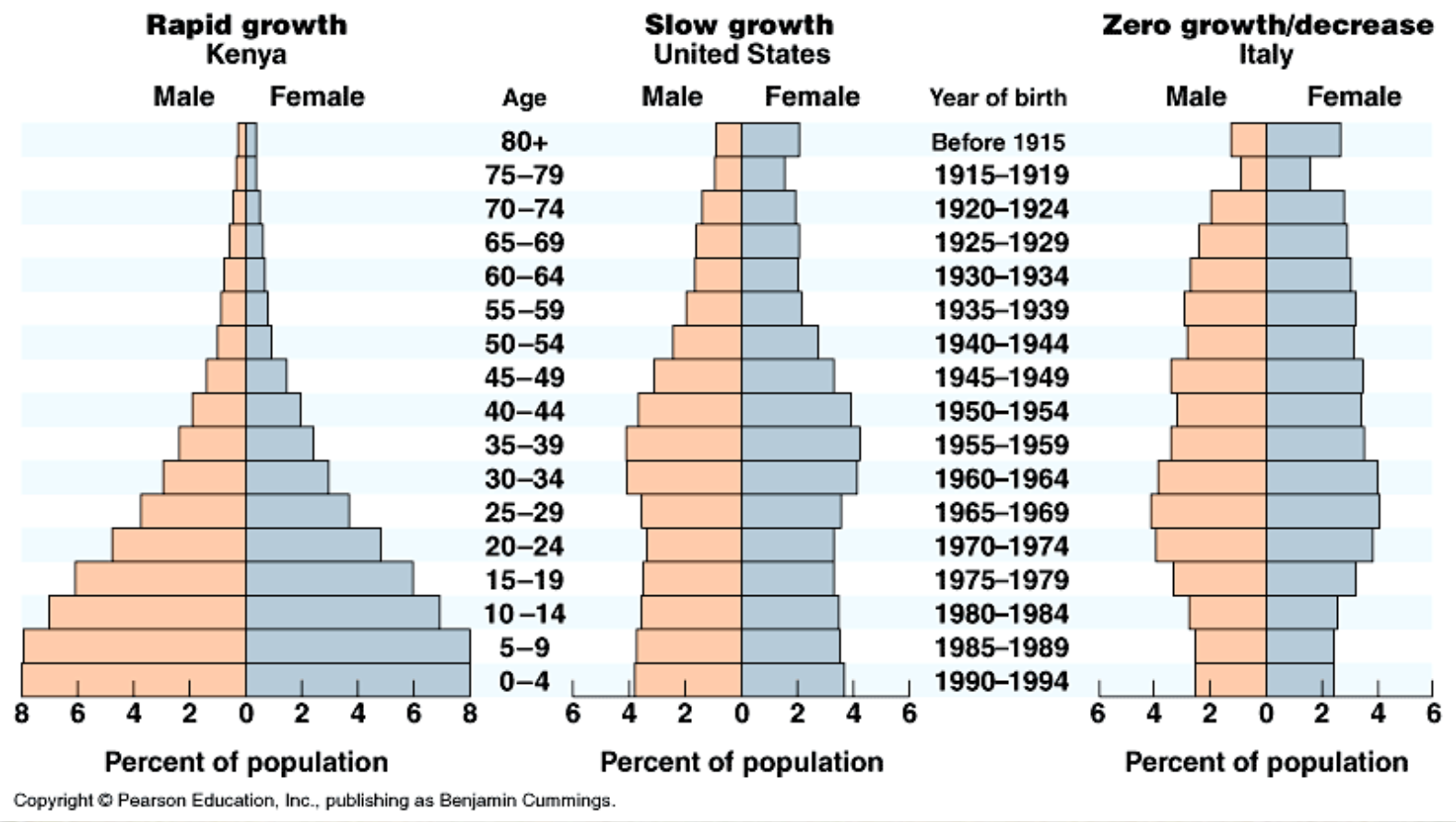
- Density dependant inhibition
- Density independent inhibition
- R selected species
- K selected species



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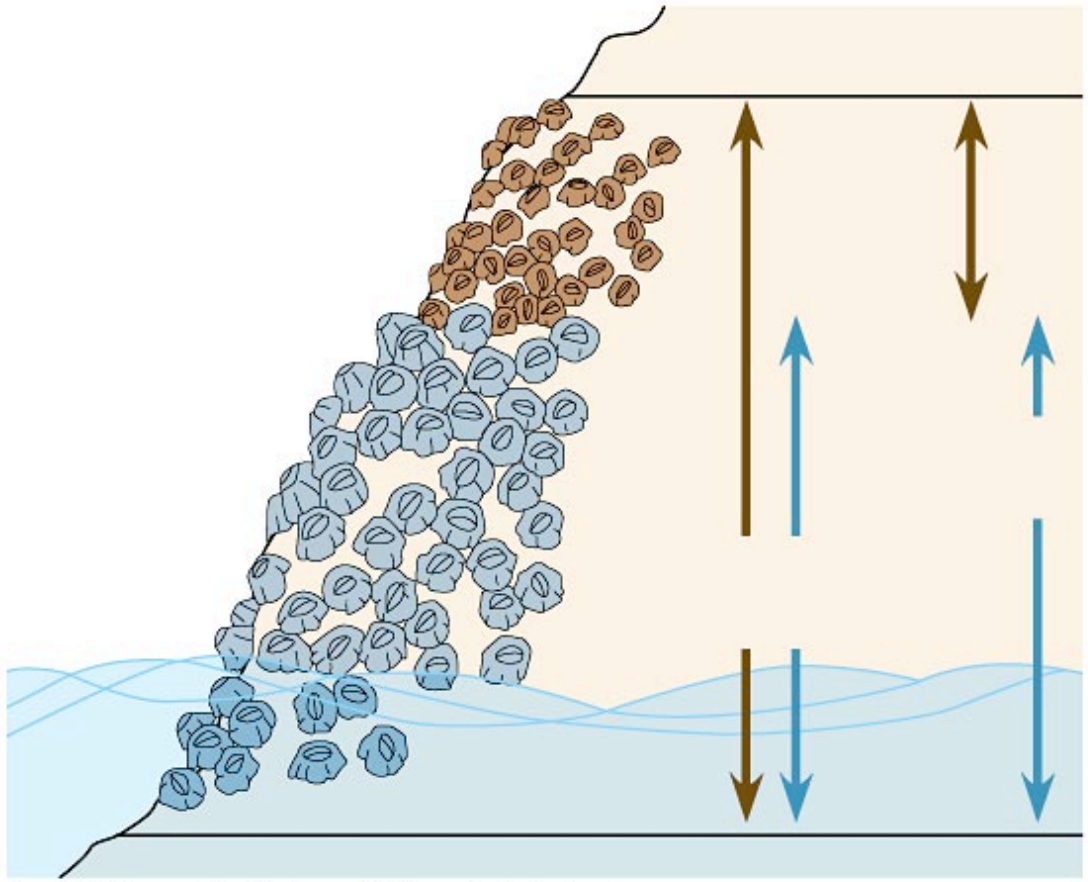

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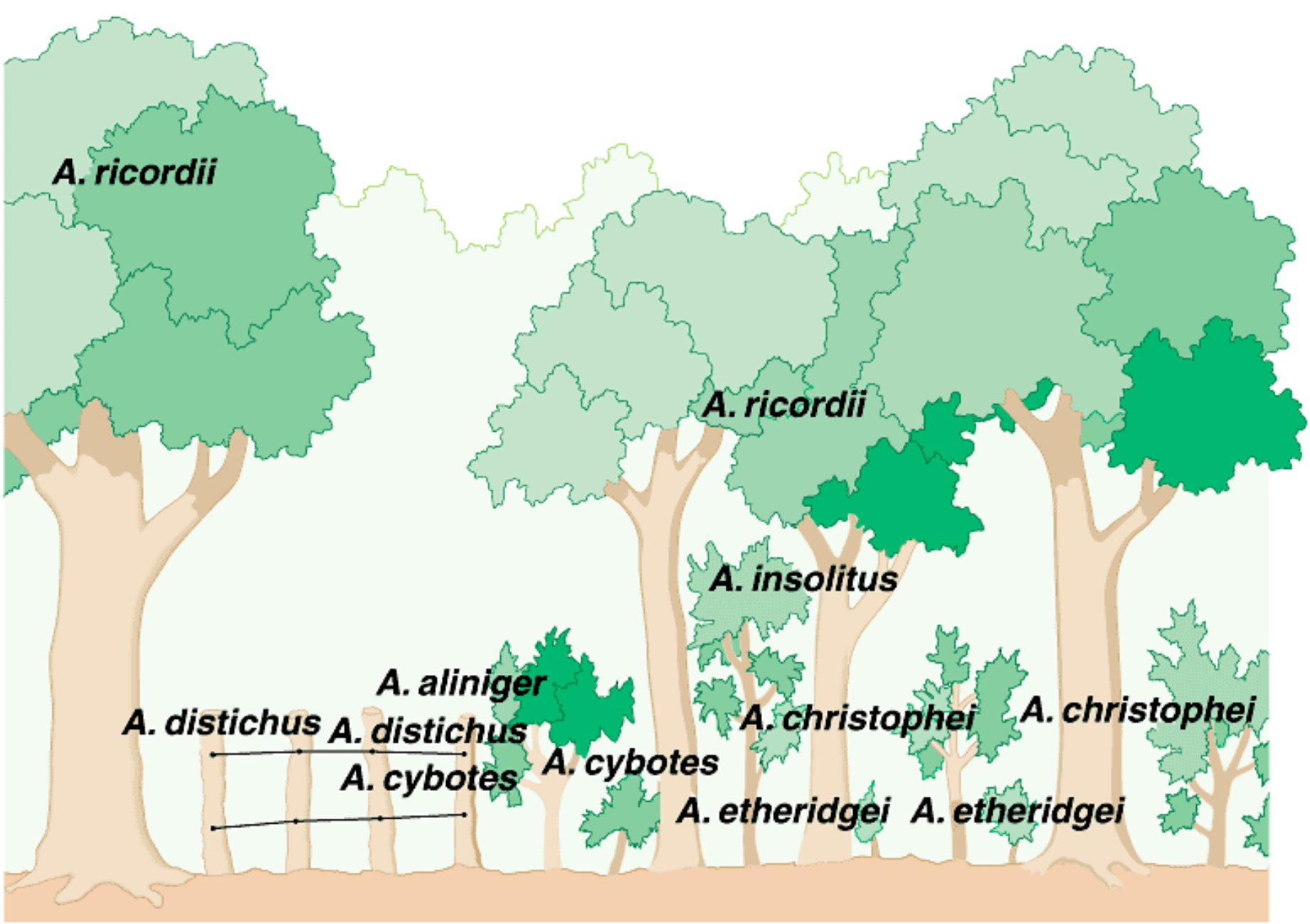

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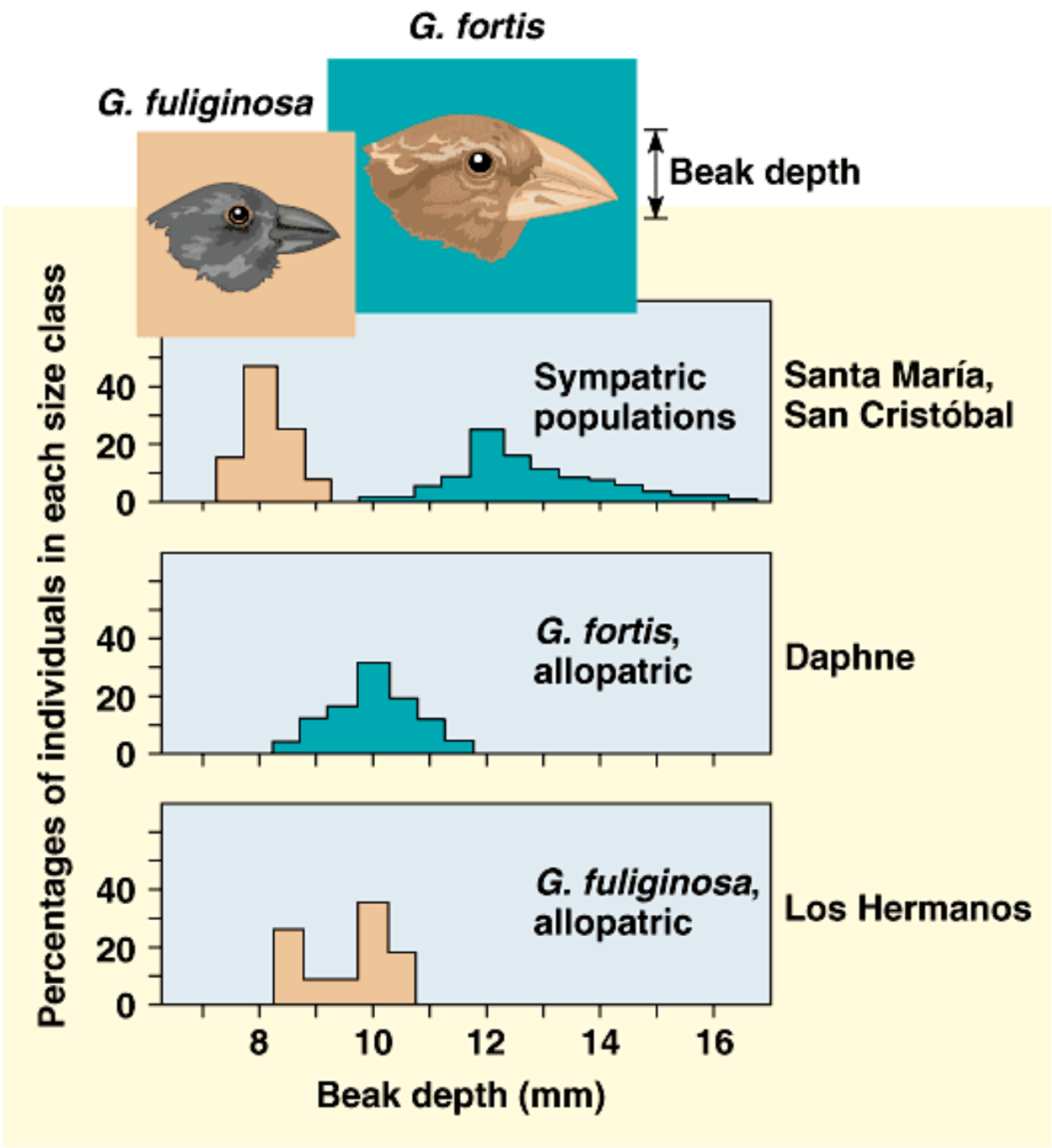

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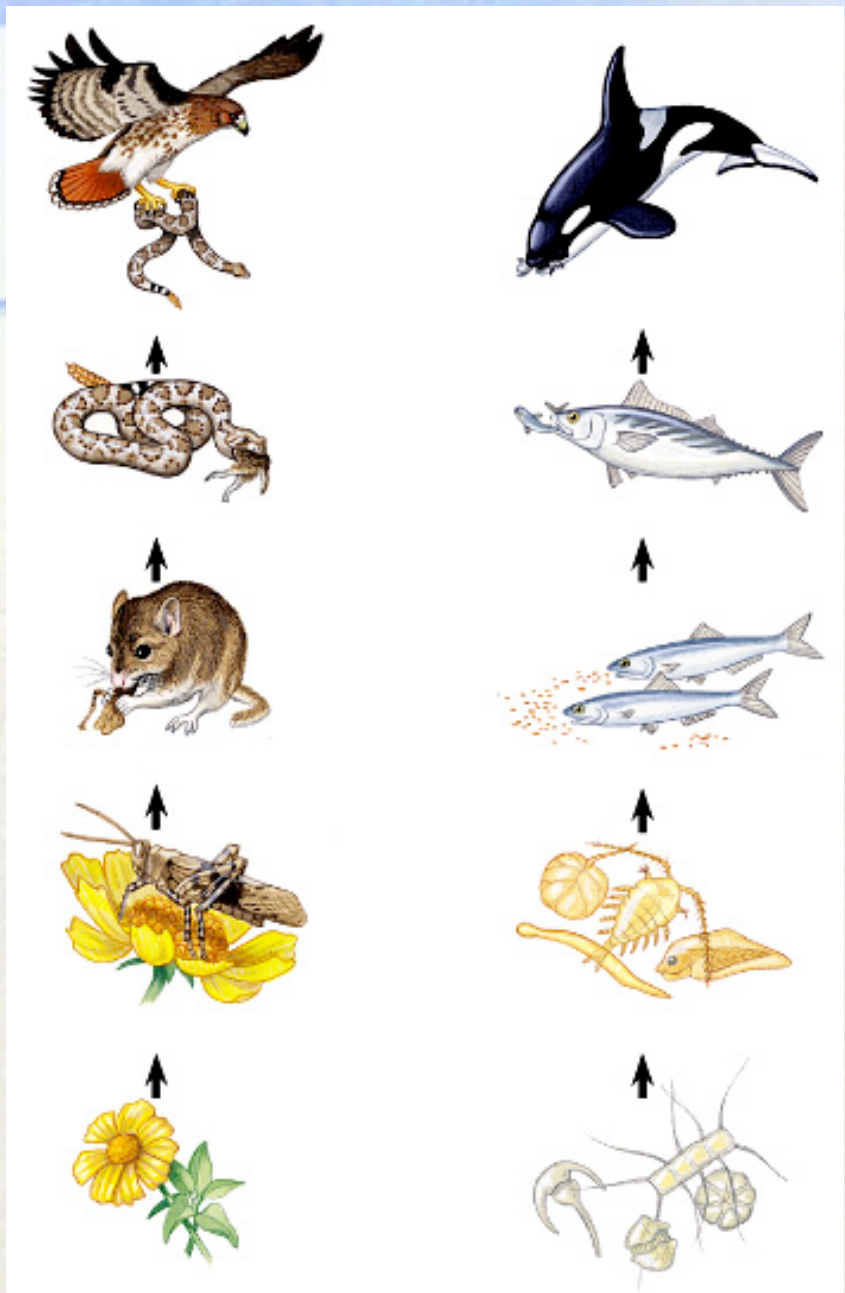

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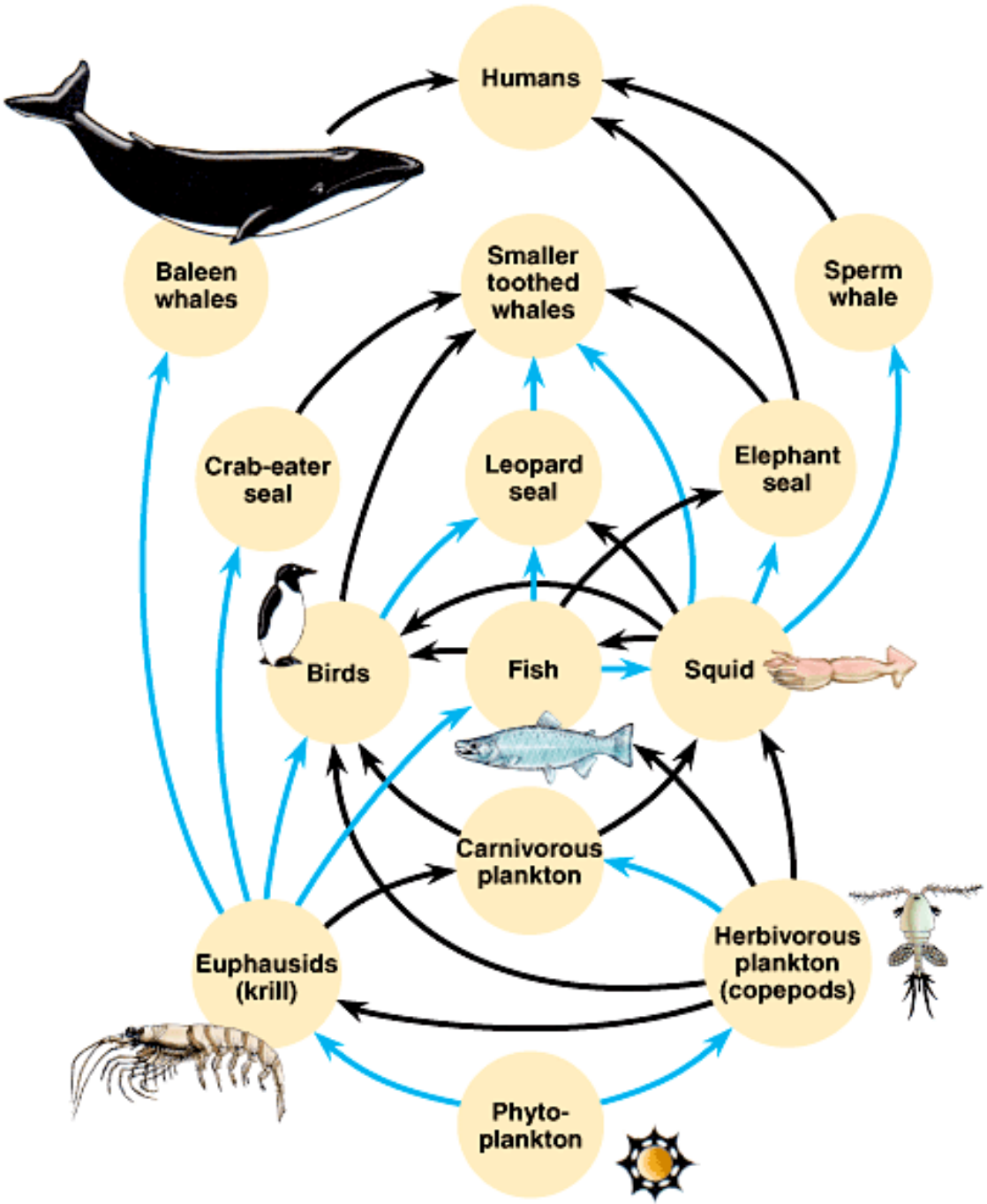

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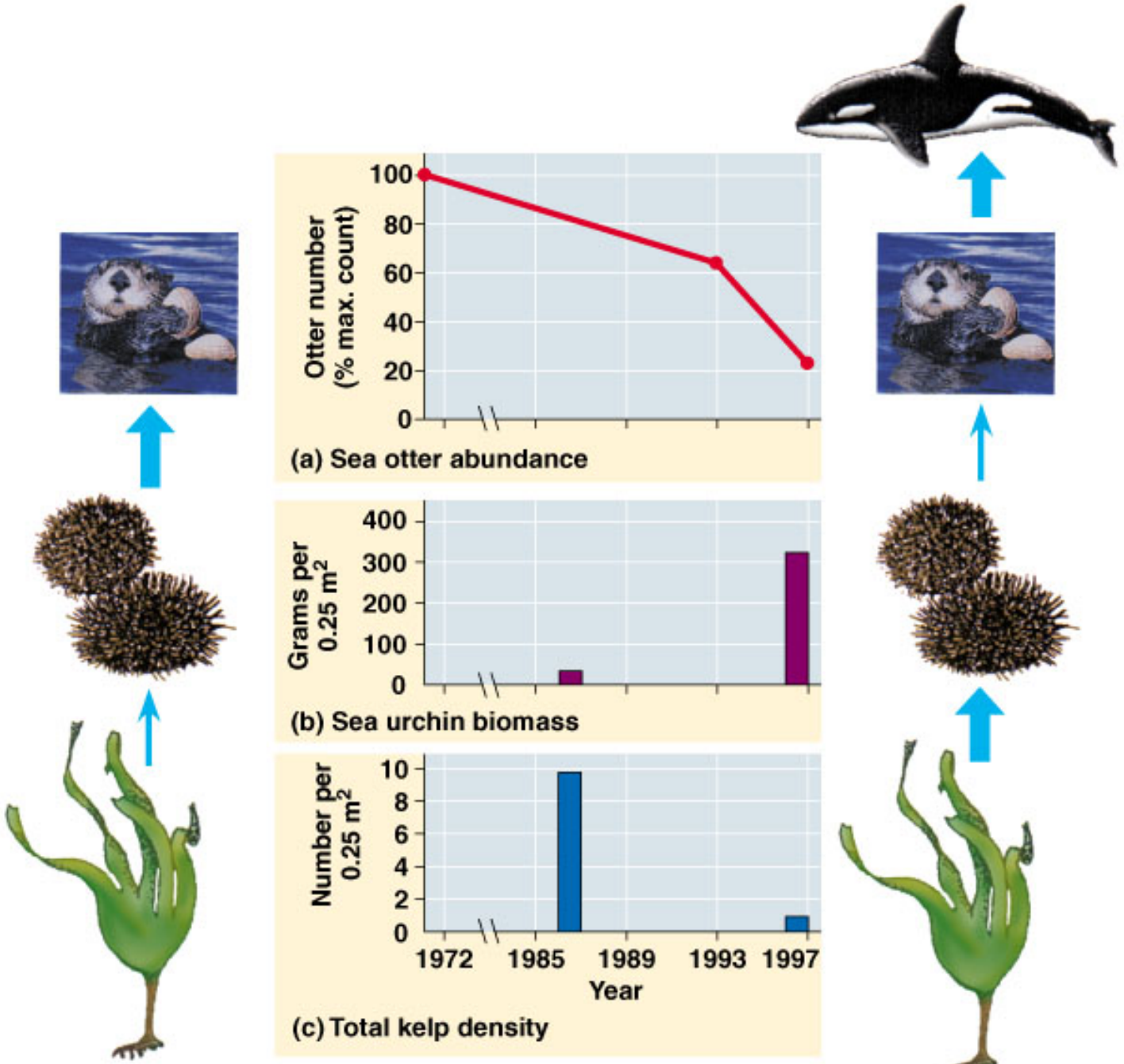
Symbiotic Relationships

- Parasitism
- Mutualism
- Commensualism



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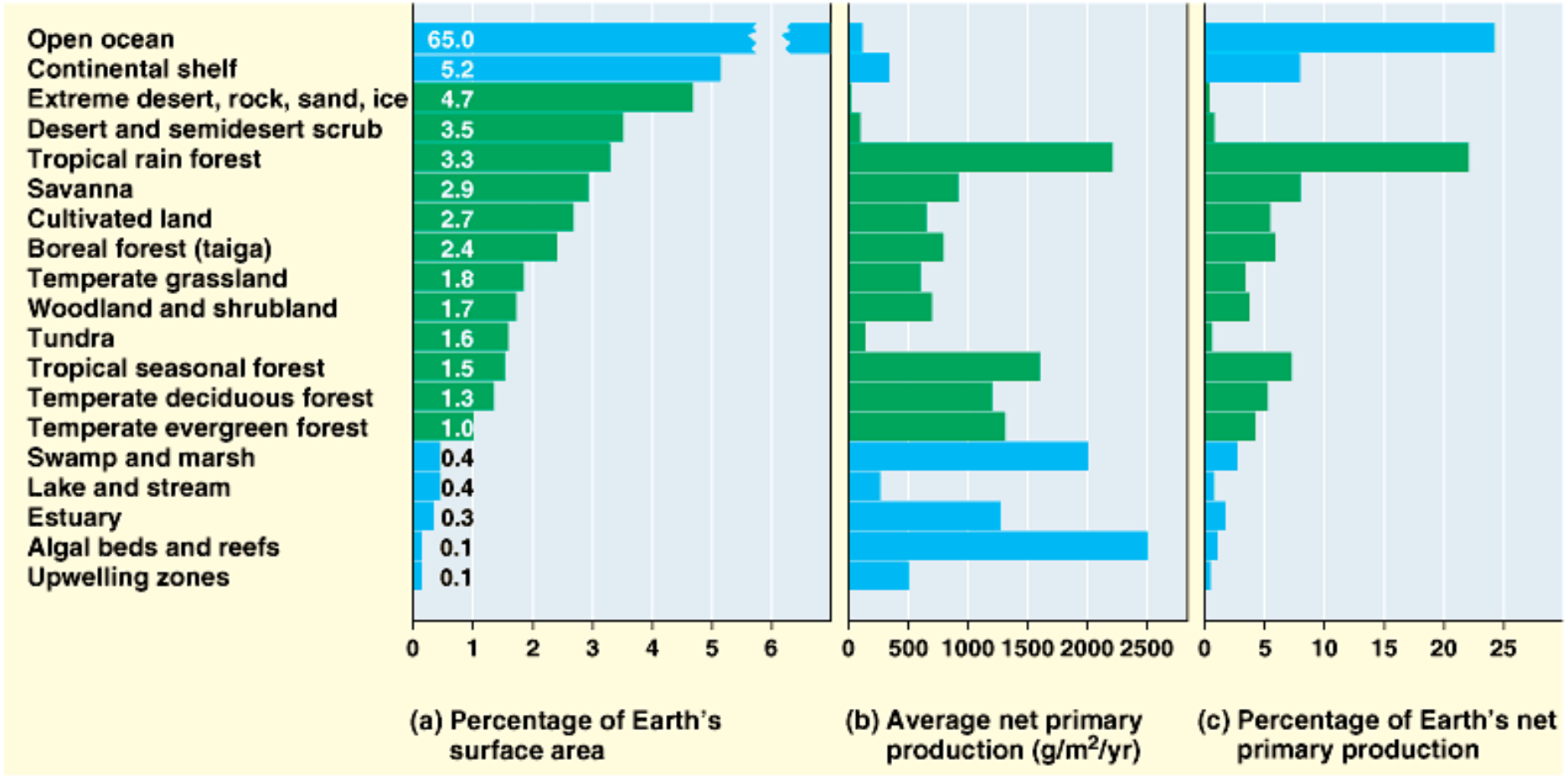

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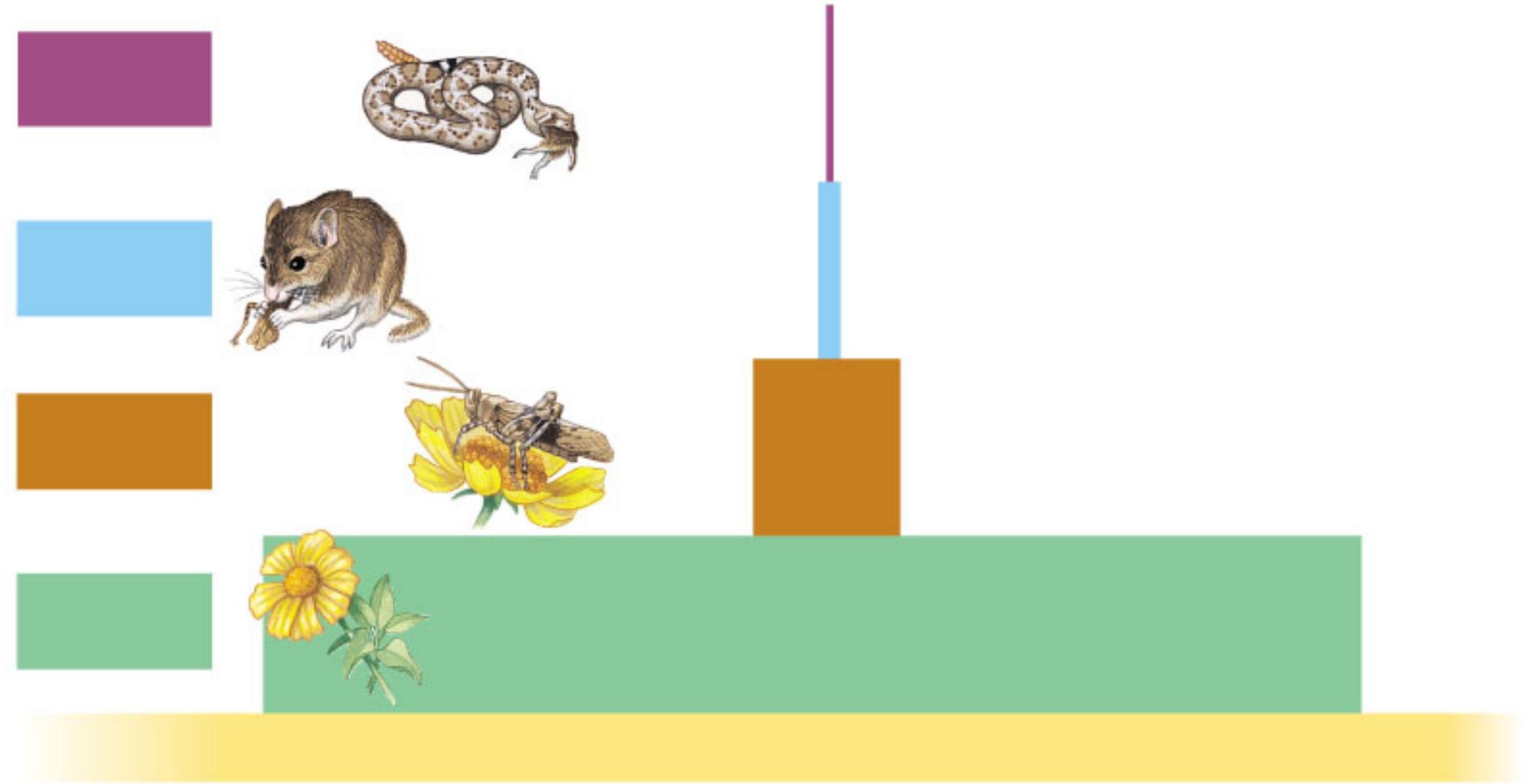

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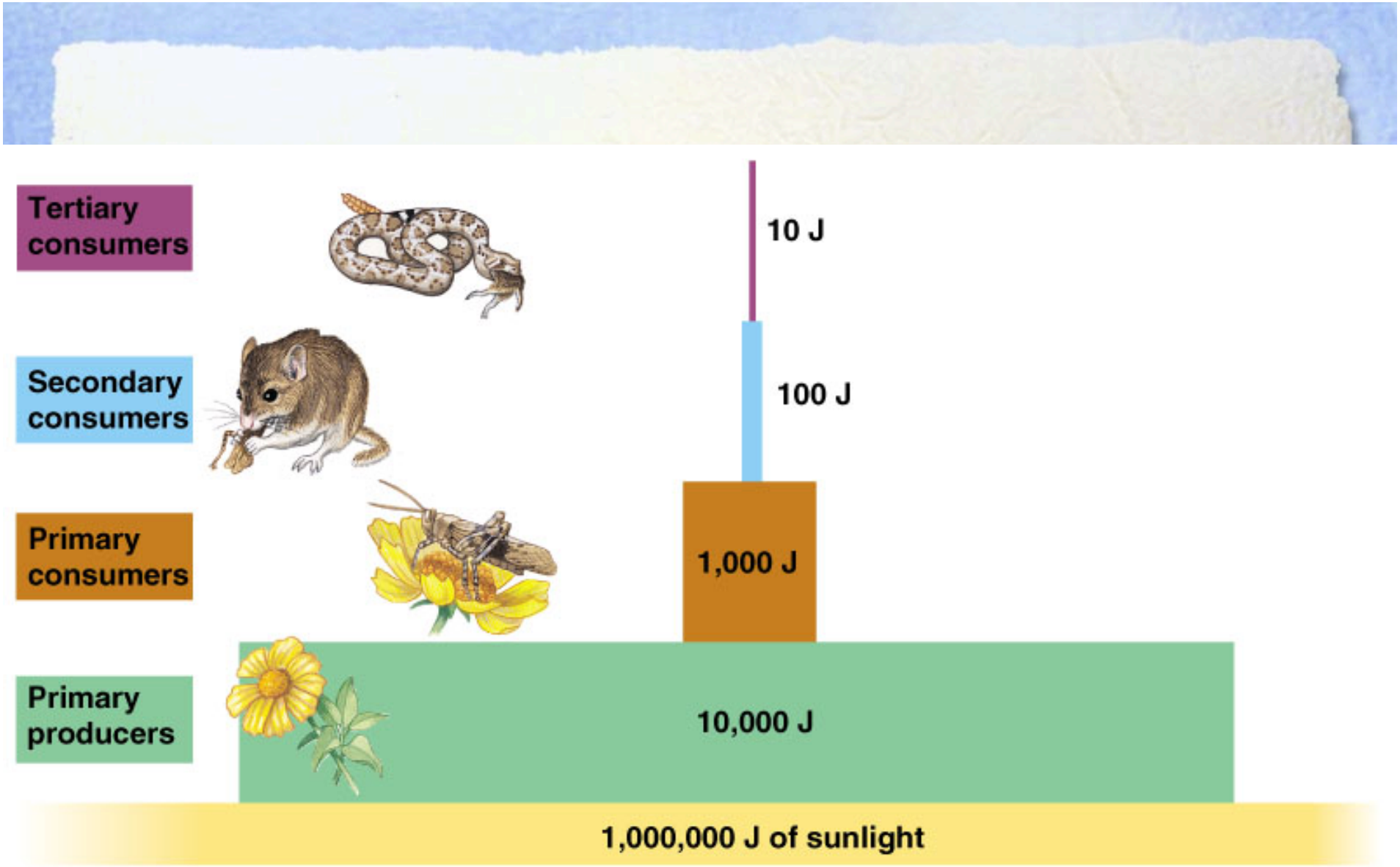

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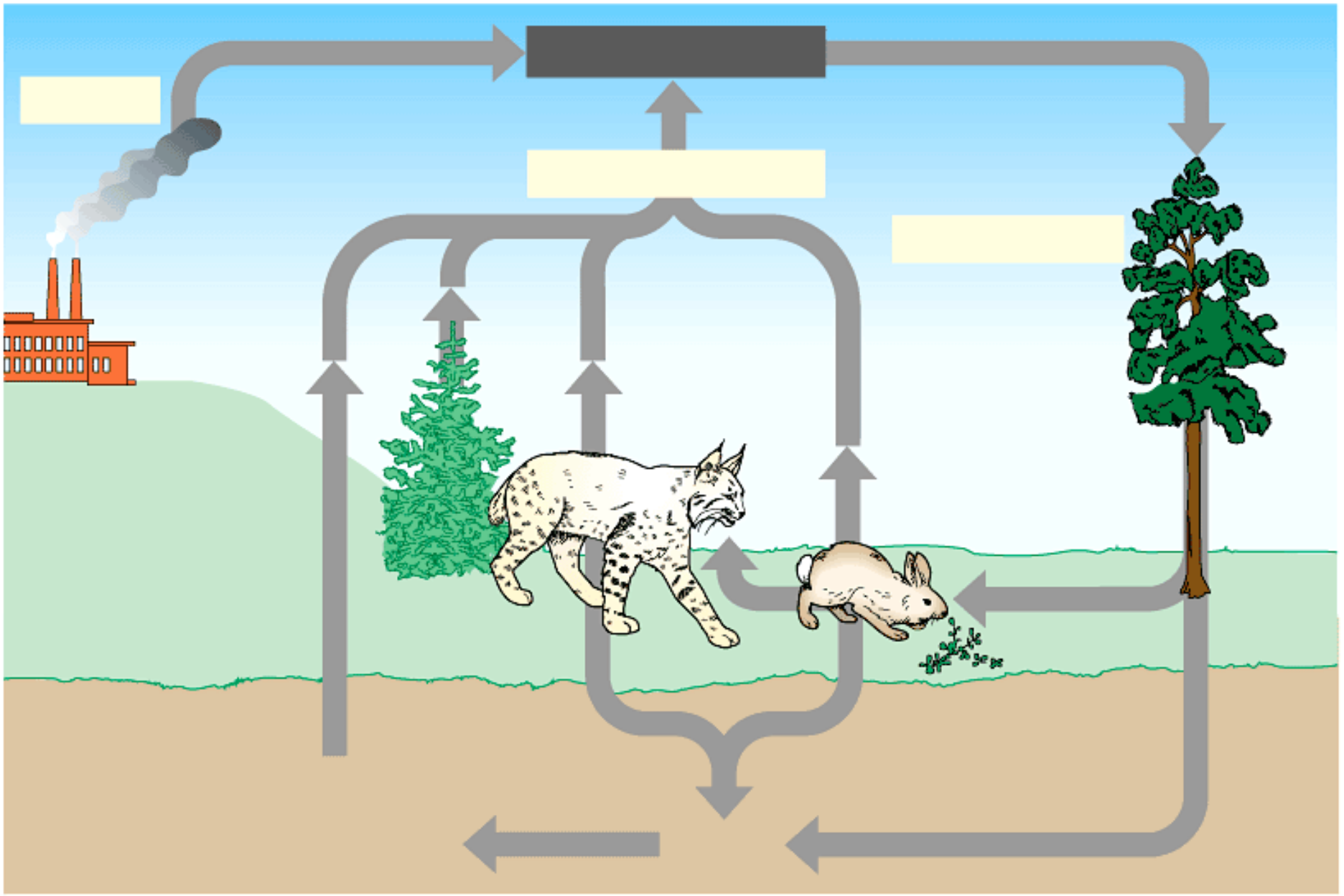

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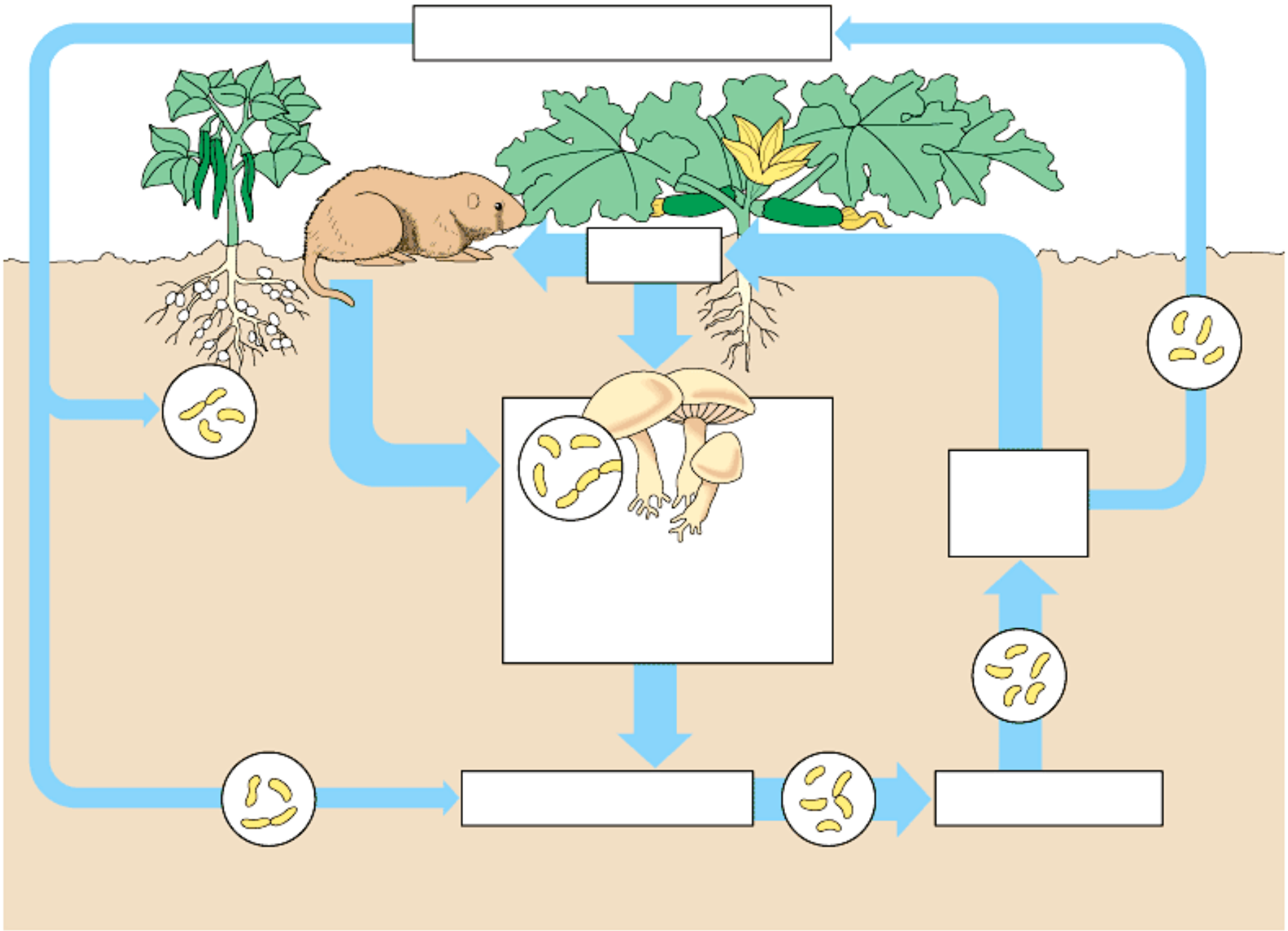

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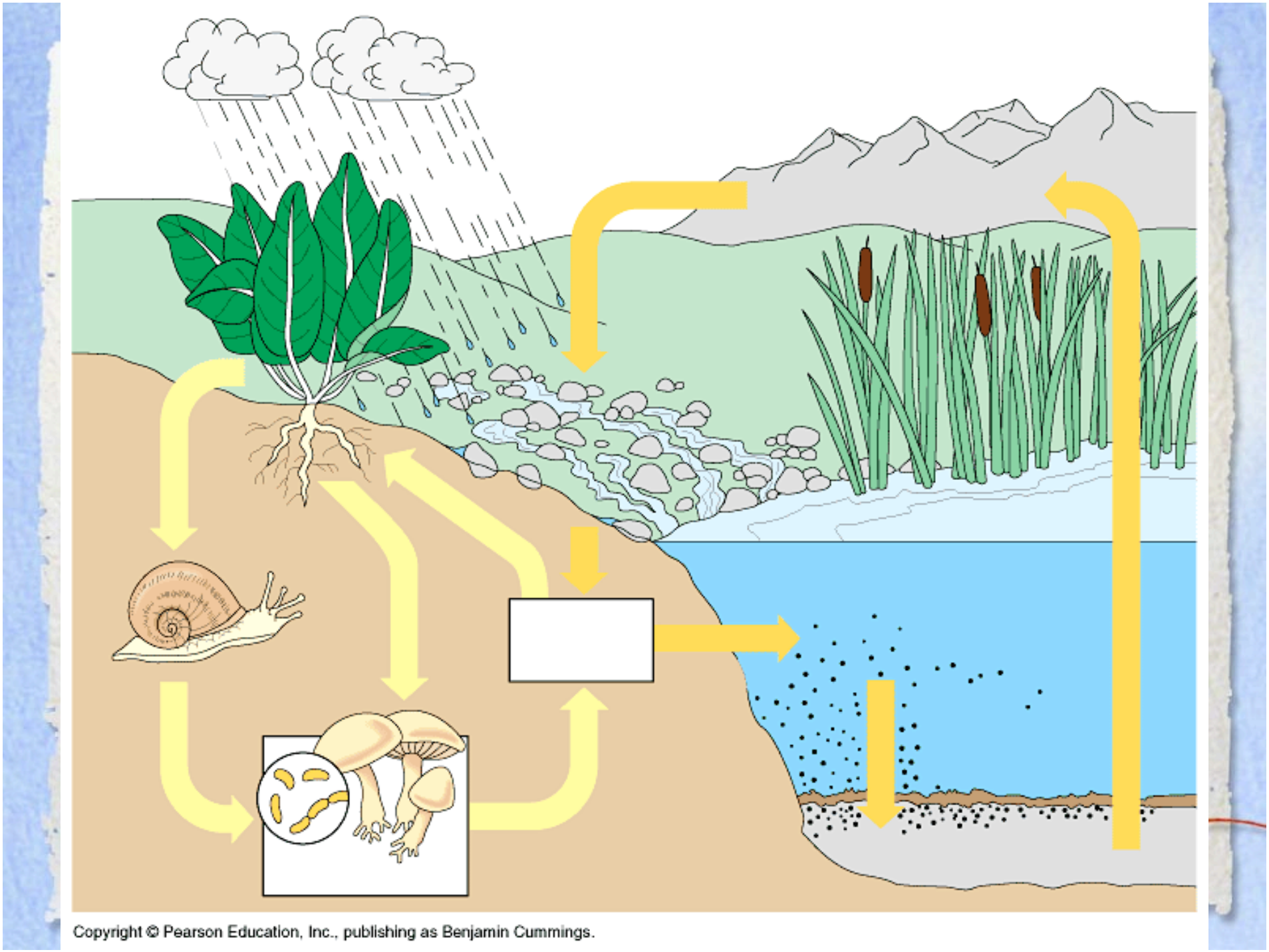

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3. Which of the following is *true* about imprinting?
   a. It may be triggered by visual or chemical stimuli.
   b. It happens to many adult animals, but not to their young.
   c. It is a type of learning involving no innate behavior.
   d. It occurs only in birds.
   e. It causes behaviors that last for only a short time (the critical period).

4. Every morning at the same time John went into the den to feed his new tropical fish. After a few weeks John noticed that the fish would rise to the top of the tank as soon as he would enter the room. This is a good example of
    1. habituation.
    2. imprinting.
    3. classical conditioning.
    4. operant conditioning.
    5. maturation.

5. A dog learns that it will get a treat when it barks. Which of the following might you use to describe this behavior?
    1. The dog is displaying an instinctive fixed action pattern.
    2. The dog is performing a social behavior.
    3. The dog is trying to protect its territory.
    4. The dog has been classically conditioned.
    5. The dog's behavior is a result of operant conditioning.

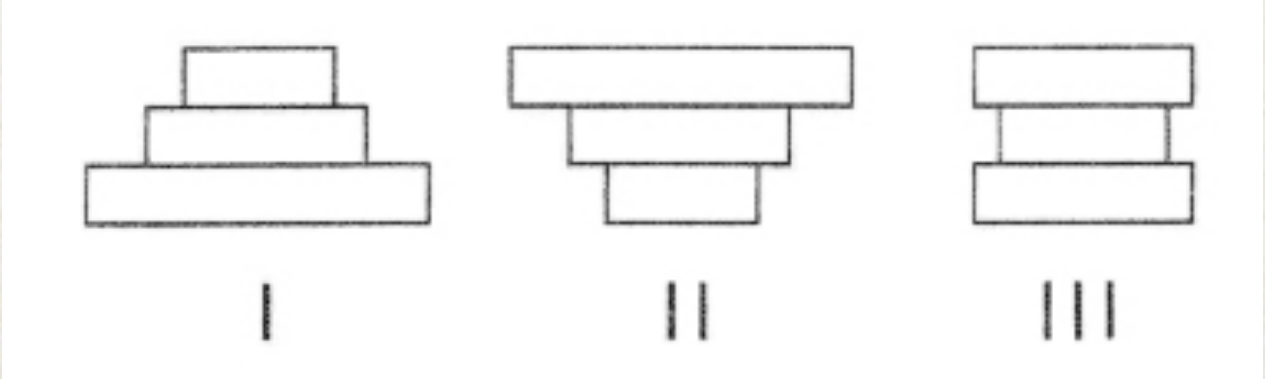
6. The presence of altruistic behavior in animals is most likely due to kin selection, a theory that maintains that
    1. aggression between sexes promotes the survival of the fittest individuals.
    2. genes enhance survival of copies of themselves by directing organisms to assist others who share those genes.
    3. companionship is advantageous to animals because in the future they can help each other.
    4. critical thinking abilities are normal traits for animals and they have arisen, like other traits, through natural selection.
    5. natural selection has generally favored the evolution of exaggerated aggressive and submissive behaviors to resolve conflict without grave harm to participants.

2. As *N* approaches *K* for a certain population, which of the following is predicted by the logistic equation?
   a. The growth rate will not change.
   b. The growth rate will approach zero.
   c. The population will show an Allee effect.
   d. The population will increase exponentially.
   e. The carrying capacity of the environment will increase.

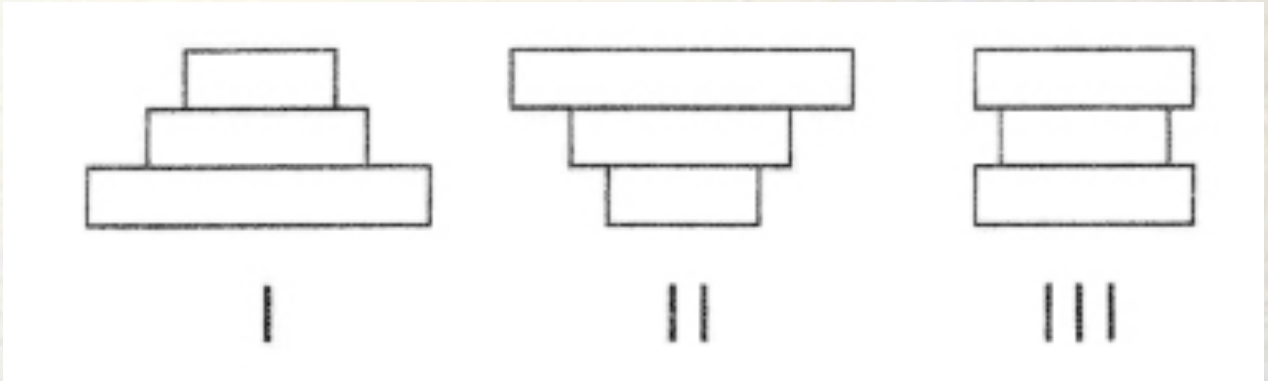
3. In which of the following habitats would you expect to find the largest number of *K*-selected individuals?

   a. an abandoned field in Ohio
   b. the sand dunes south of Lake Michigan
   c. the rain forests of Brazil
   d. south Florida after a hurricane
   e. a newly emergent volcanic island

The following question refers to the figure below, which depicts the age structure of three populations



4. Assuming these age structure diagrams describe human populations, in which population is unemployment likely to be most severe in the future?



a. I
b. II
c. III
d. No differences in the magnitude of future unemployment would be expected among these populations.
e. It is not possible to infer anything about future social conditions from age structure diagrams.

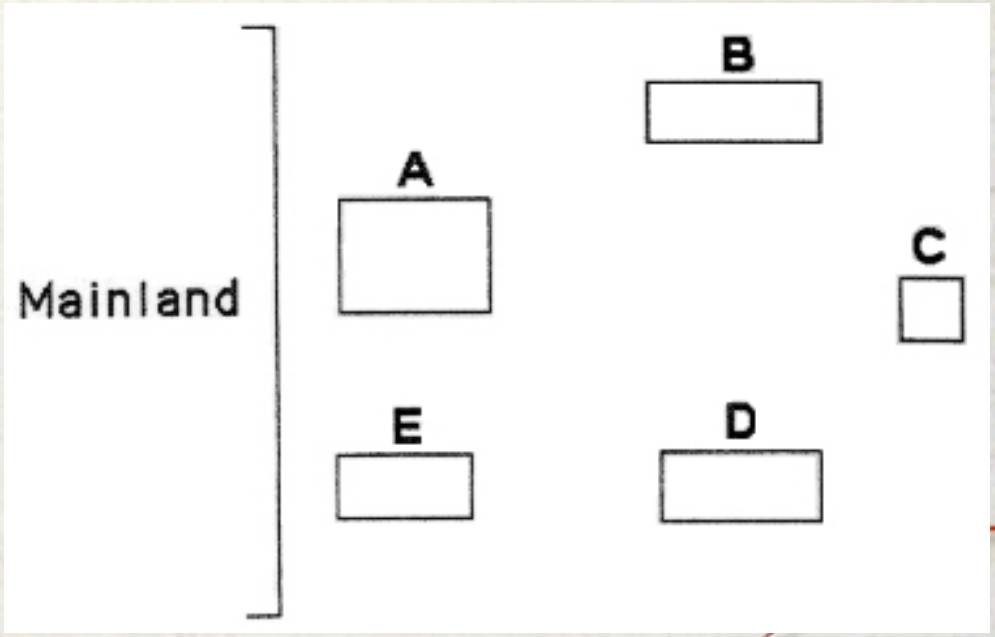
- Why do most food chains consist of only three to five links? *

1. There are only five trophic levels: producers; primary, secondary, and tertiary consumers; and decomposers.
2. Most communities are controlled bottom-up by mineral nutrient supply, and few communities have enough nutrients to support more links.
3. The dominant species in most communities consumes the majority of prey; thus, not enough food is left to support higher predators.
4. According to the energetic hypothesis, the inefficiency of energy transfer from one trophic level to the next limits the number of links that can exist.
5. According to the trophic cascade model, increasing the biomass of top trophic levels causes a decrease in the biomass of lower levels, so that the top levels can no longer be supported.

3. Two barnacles, *Balanus* and *Chthamalus,* can both survive on the lower rocks just above the low tide line on the Scottish coast, but only *Balanus* actually does so, with *Chthamalus* adopting a higher zone. Which of the following best accounts for this niche separation?
    1. competitive exclusion
    2. predation of *Chthamalus* by *Balanus*
    3. cooperative displacement
    4. primary succession
    5. mutualism

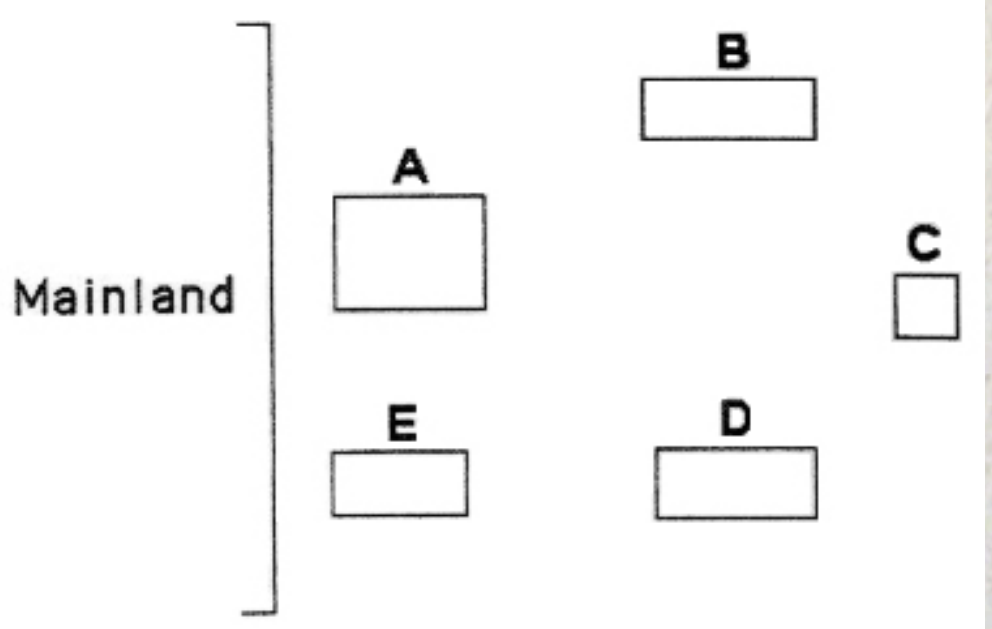
The following questions refer to the diagram in Figure 53.2 of five islands formed at about the same time near a particular mainland.

6. Island with the greatest number of species
   - A
   - B
   - C
   - D
   - E



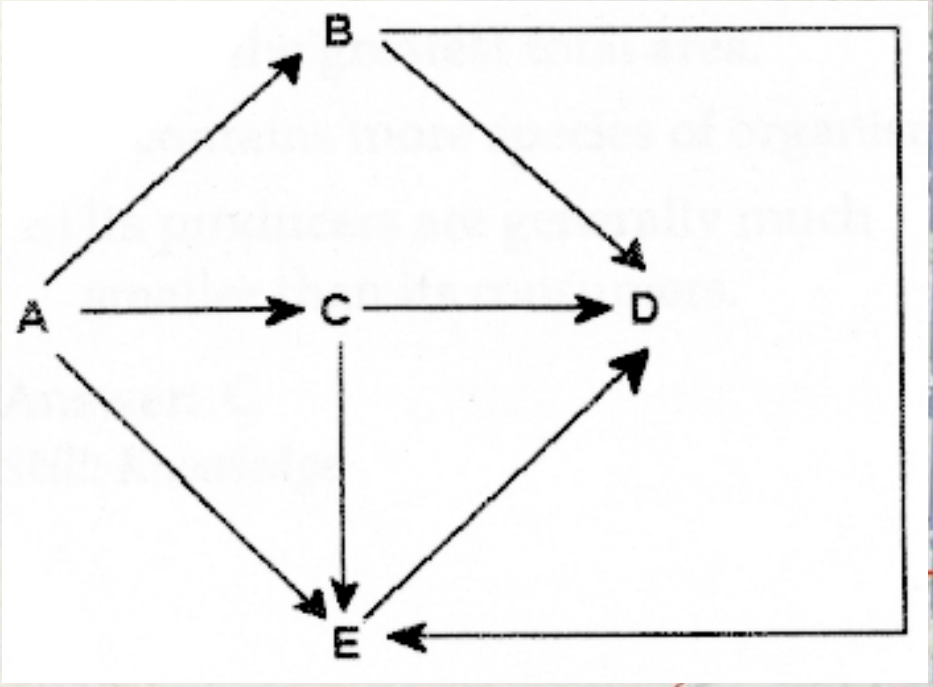
7. Island with the lowest extinction rate

- A
- B
- C
- D
- E

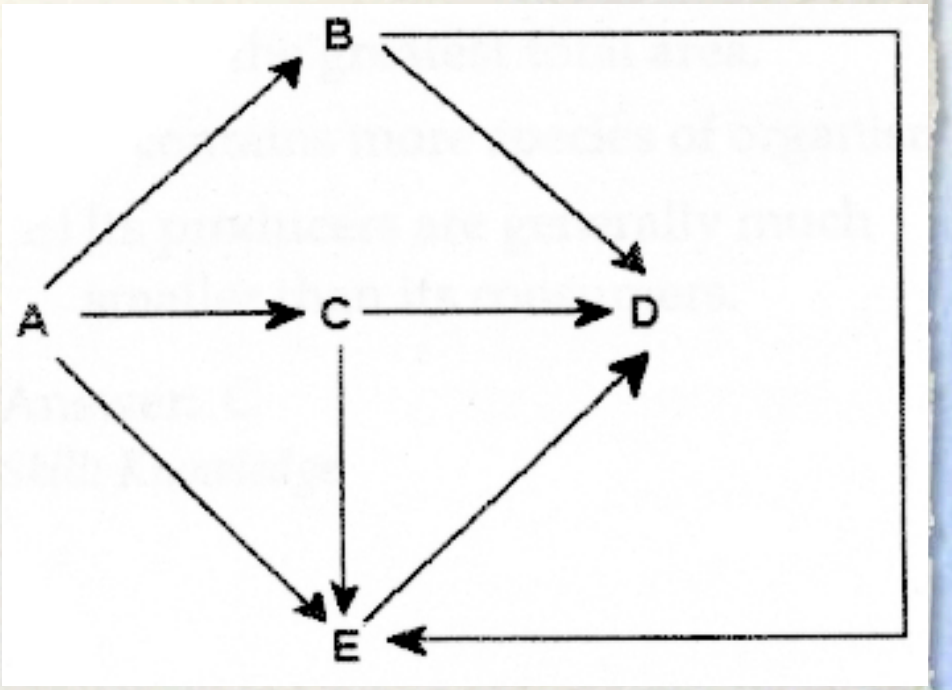


Use the figure below to answer the following questions (2 and 3). Examine this food web for a particular terrestrial ecosystem. Each letter is a species. The arrows represent energy flow.

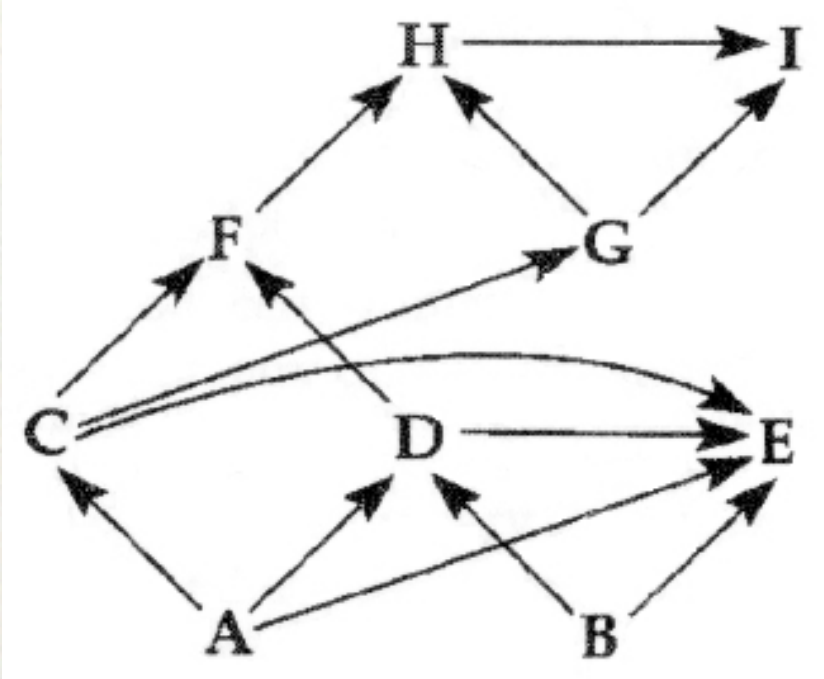
2. Which species is autotrophic?
   - A
   - B
   - C
   - D
   - E



3. Species C makes its predators sick. Which species is most likely to benefit from being a mimic of C? *
   - A
   - B
   - C
   - D
   - E



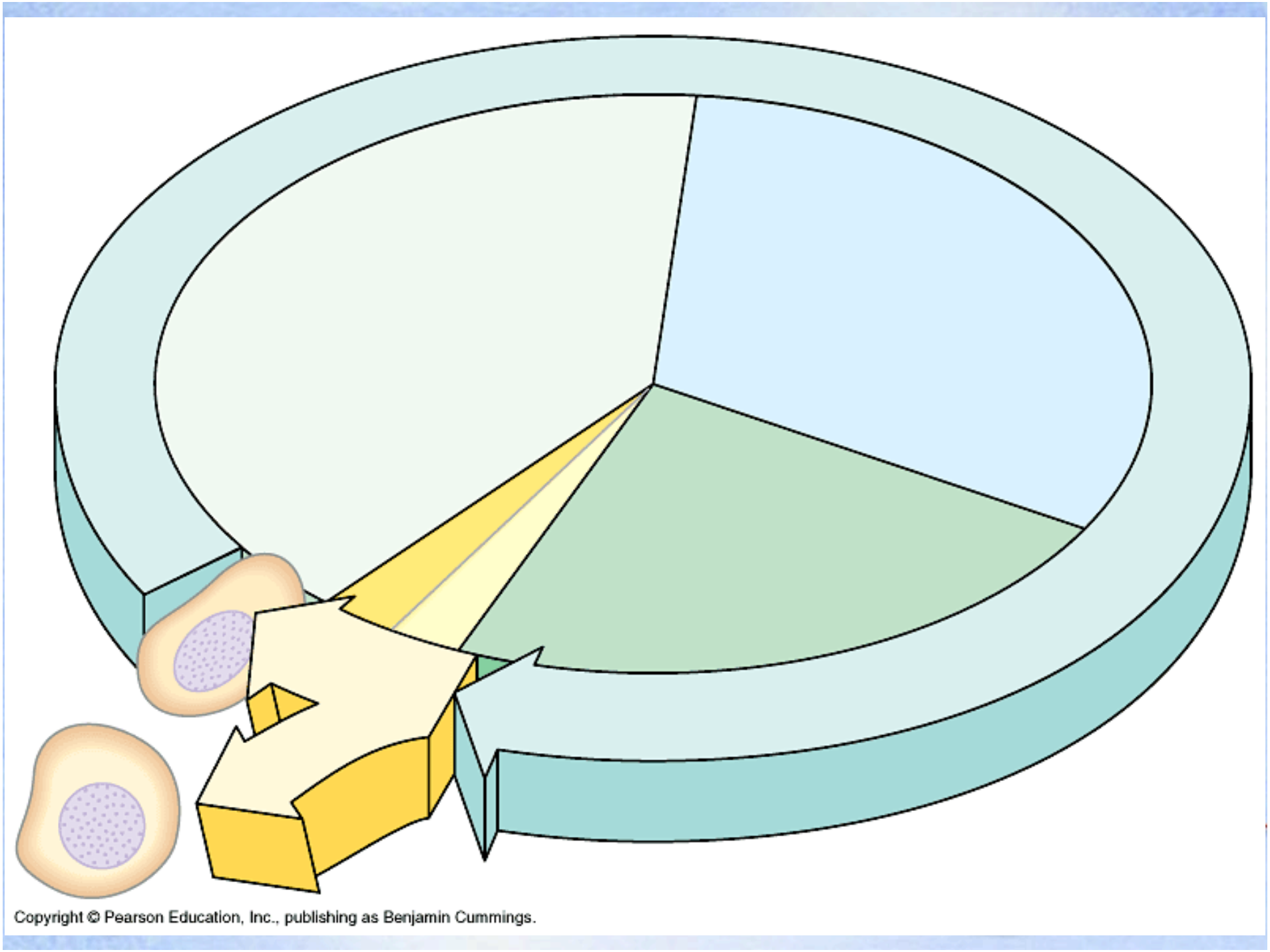
Refer to the figure below,, a diagram of a food web, for the following questions (4 and 5). Arrows represent energy flow and letters represent species.



6. If the flow of energy in an Arctic ecosystem goes through a simple food chain from seaweeds to fish to seals to polar bears, then which of the following is *true*?

   a. Polar bears can provide more food for Eskimos than seals can.
   b. The total energy content of the seaweeds is lower than that of the seals.
   c. Polar bear meat probably contains the highest concentrations of fat-soluble toxins.
   d. Seals are more numerous than fish.
   e. The carnivores can provide more food for the Eskimos than the herbivores can.

Mitosis and Meiosis



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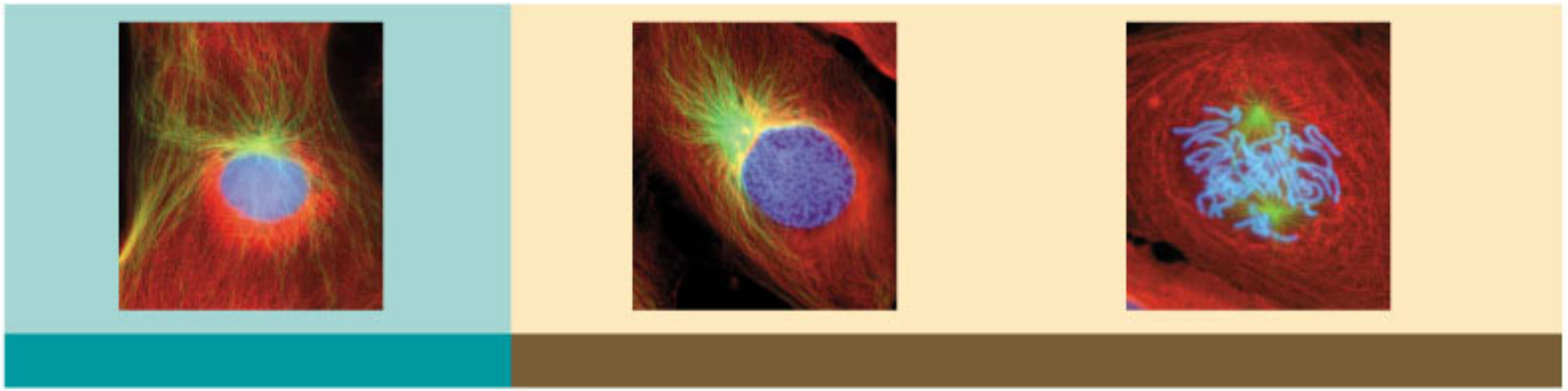

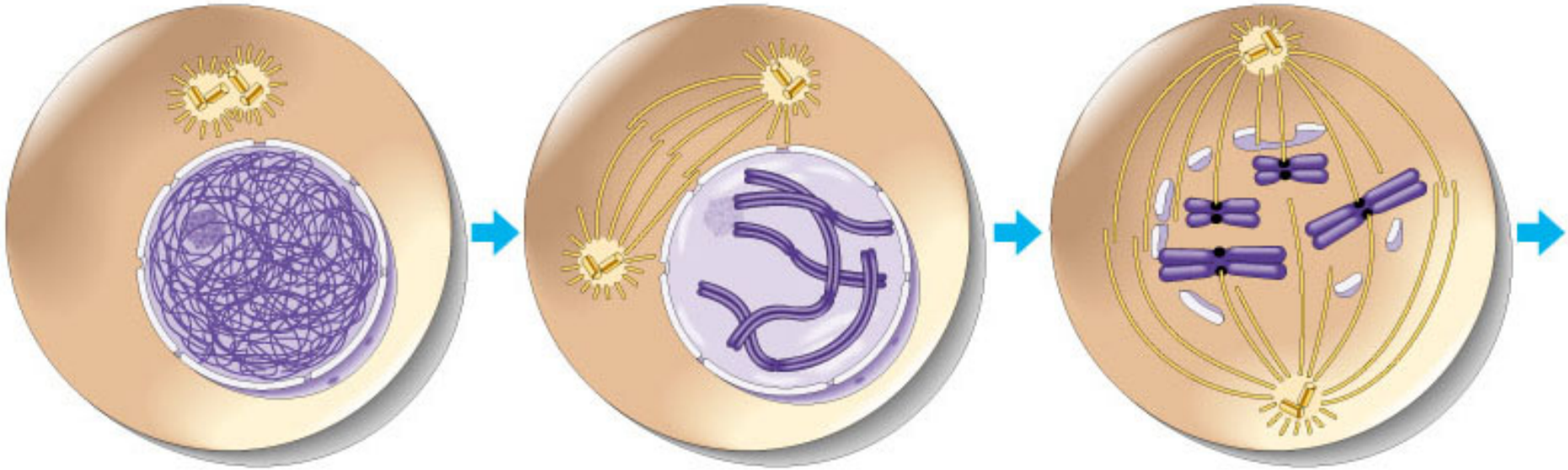

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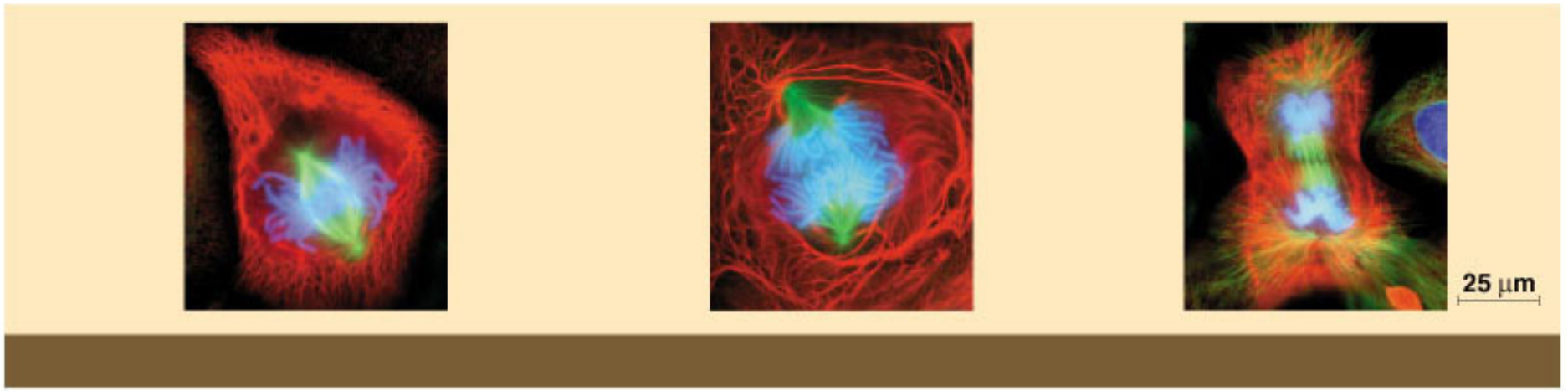

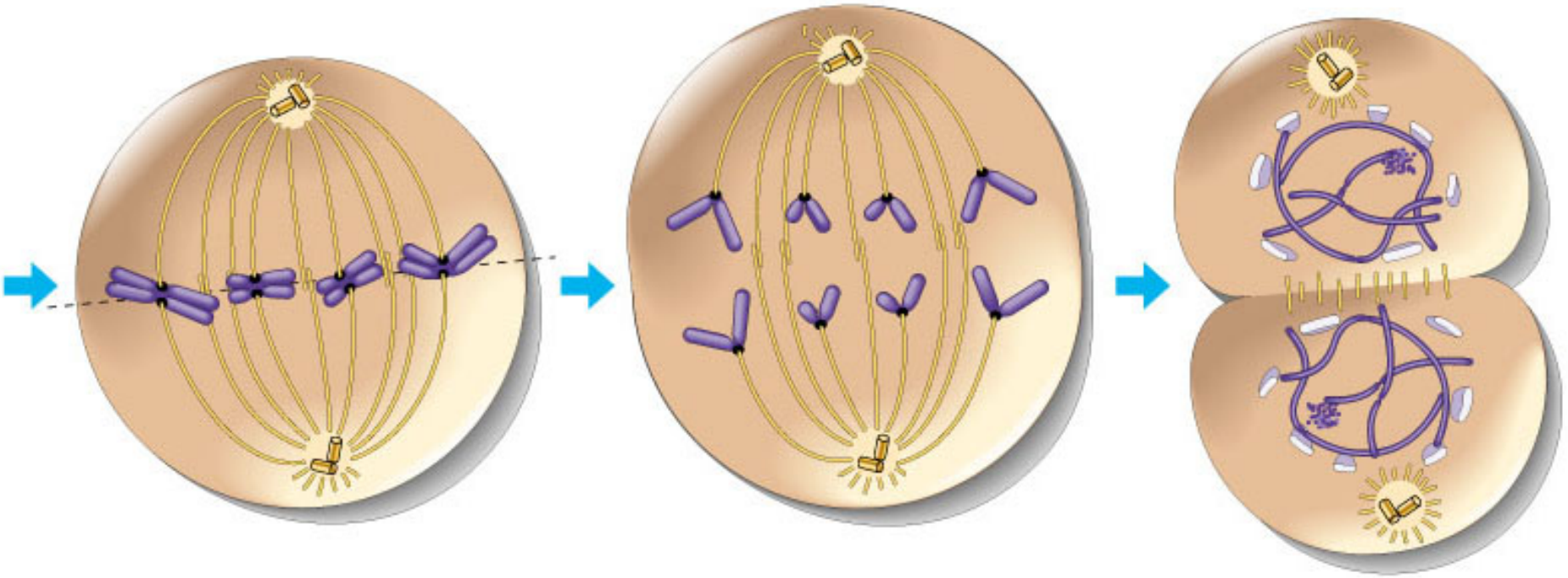

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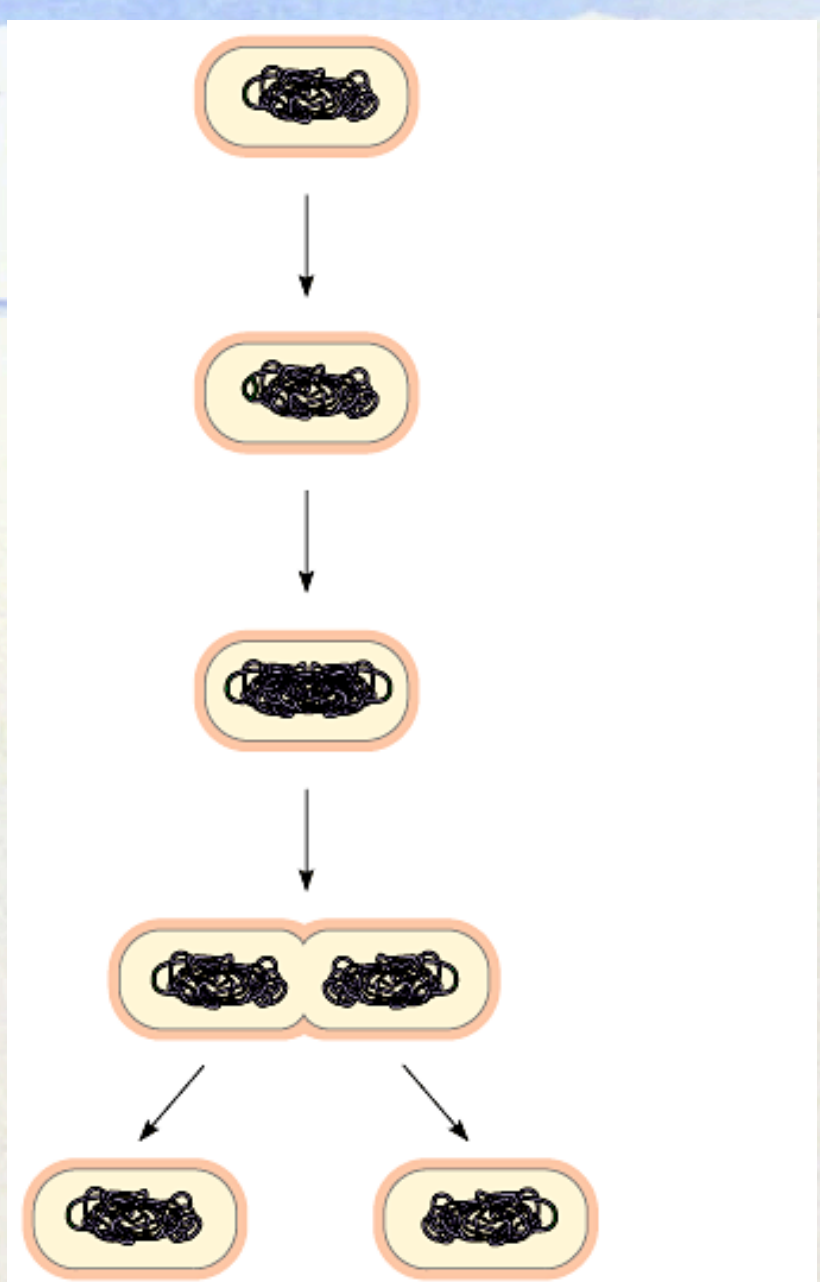

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- Using the data in the table below, the best conclusion concerning the difference between the S phases for beta and gamma is that

Minutes Spent in Cell Cycle Phases

Cell Type	G_1	S	G_2	M
Beta	18	24	12	16
Delta	100	0	0	0
Gamma	18	48	14	20

a. gamma contains more DNA than beta.
b. beta and gamma contain the same amount of DNA.
c. beta contains more RNA than gamma.
d. gamma contains 48 times more DNA and RNA than beta.
e. beta is a plant cell and gamma is an animal cell.

- Taxol is an anticancer drug extracted from the Pacific yew tree. In animal cells, taxol disrupts microtubule formation by binding to microtubules and accelerating their assembly from the protein precursor, tubulin. Surprisingly, this stops mitosis. Specifically, taxol must affect
  1. the fibers of the mitotic spindle.
  2. anaphase.
  3. formation of the centrioles.
  4. chromatid assembly.
  5. the S phase of the cell cycle.

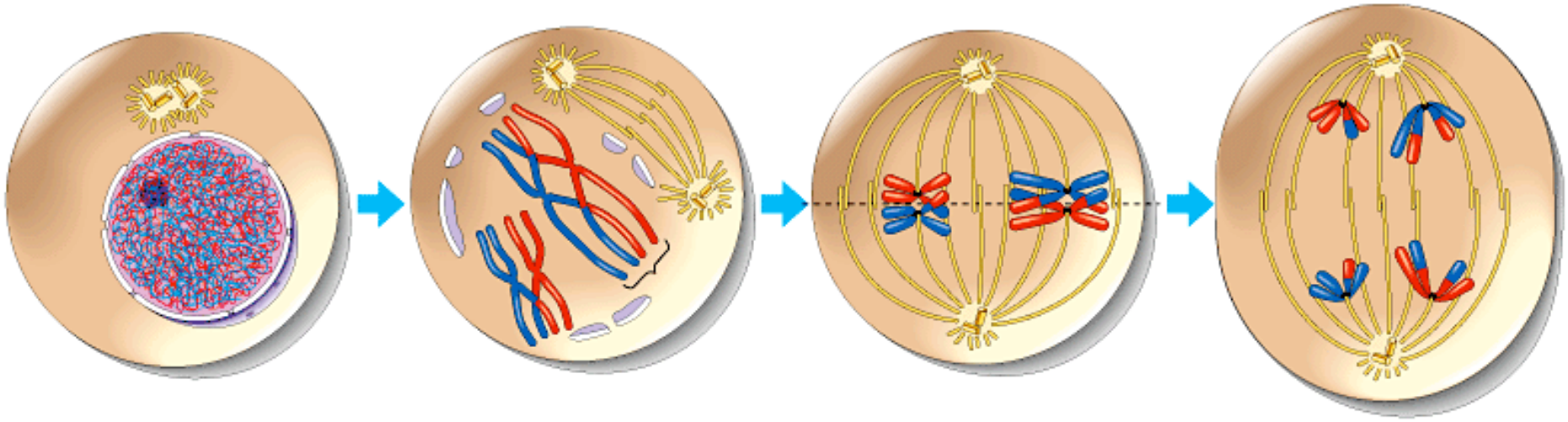
- Movement of the chromosomes during anaphase would be *most* affected by a drug that
  a. reduced cyclin concentrations.
  b. increased cyclin concentrations.
  c. prevented elongation of microtubules.
  d. prevented shortening of microtubules.
  e. prevented attachment of the microtubules to the kinetochore.

- Measurements of the amount of DNA per nucleus were taken on a large number of cells from a growing fungus. The measured DNA levels ranged from 3 to 6 picograms per nucleus. In which stage of the cell cycle was the nucleus with 6 picograms of DNA?
  a. G_0
  b. G_1
  c. S
  d. G_2
  e. M

- A group of cells is assayed for DNA content immediately following mitosis and is found to have an average of 8 picograms of DNA per nucleus. Those cells would have _____ picograms at the end of the S phase and _____ picograms at the end of G_2.

a. 8 ... 8
b. 8 ... 16
c. 16 ... 8
d. 16 ... 16
e. 12 ... 16

- A particular cell has half as much DNA as some of the other cells in a mitotically active tissue. The cell in question is most likely in
  a. G_1.
  b. G_2.
  c. prophase.
  d. metaphase.
  e. anaphase.



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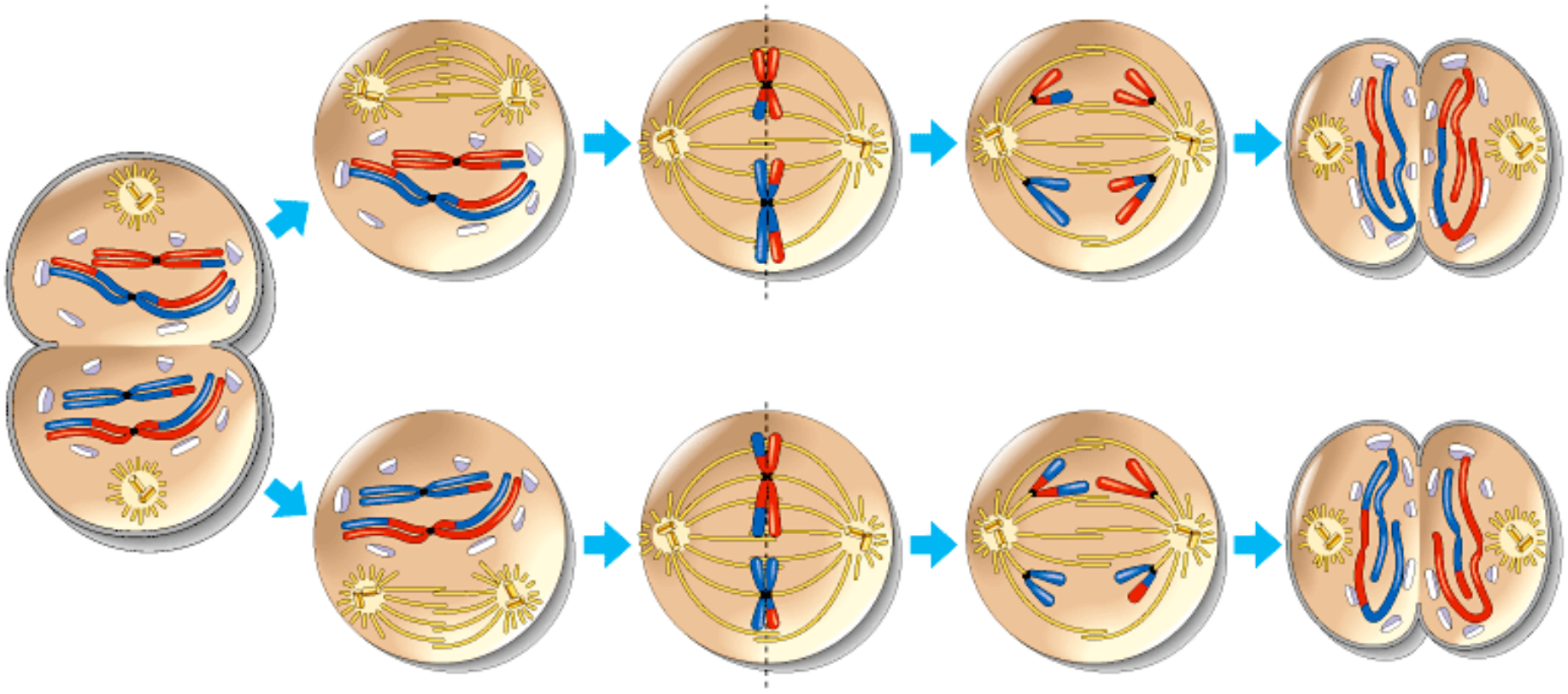

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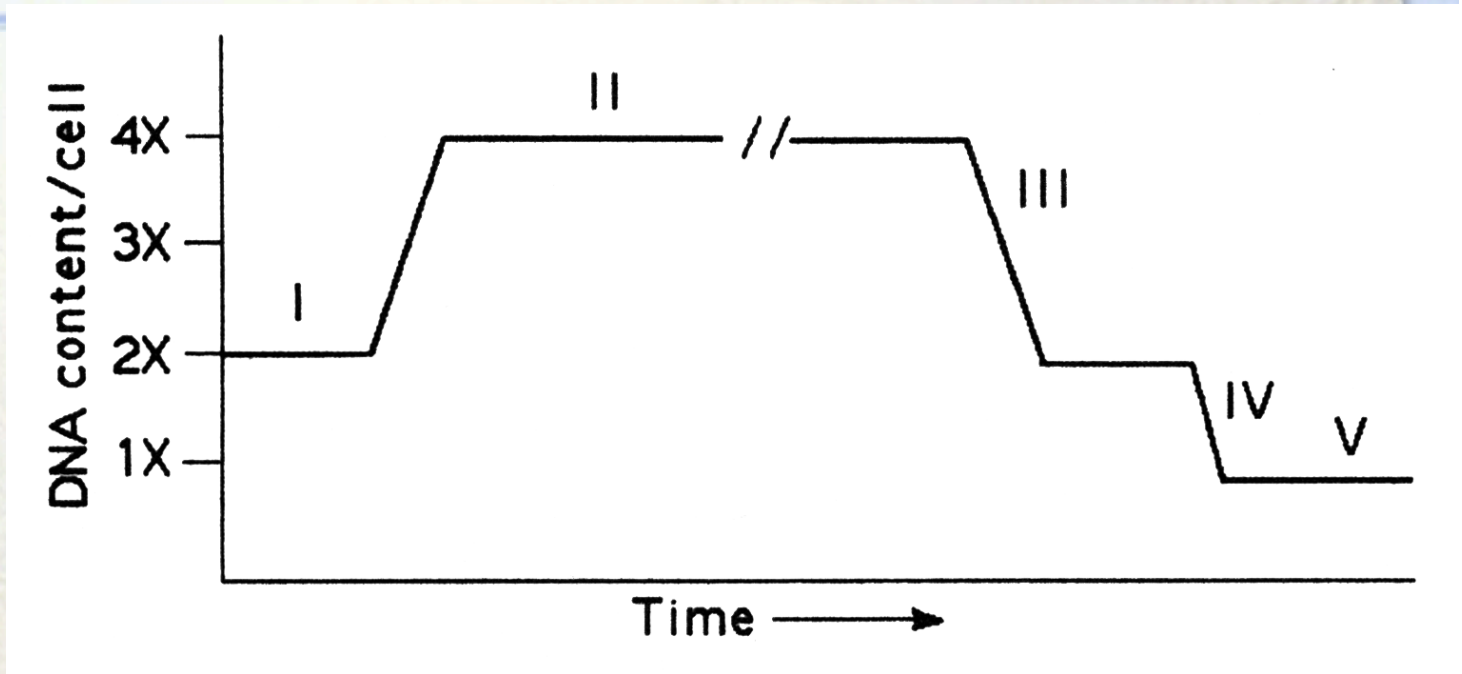
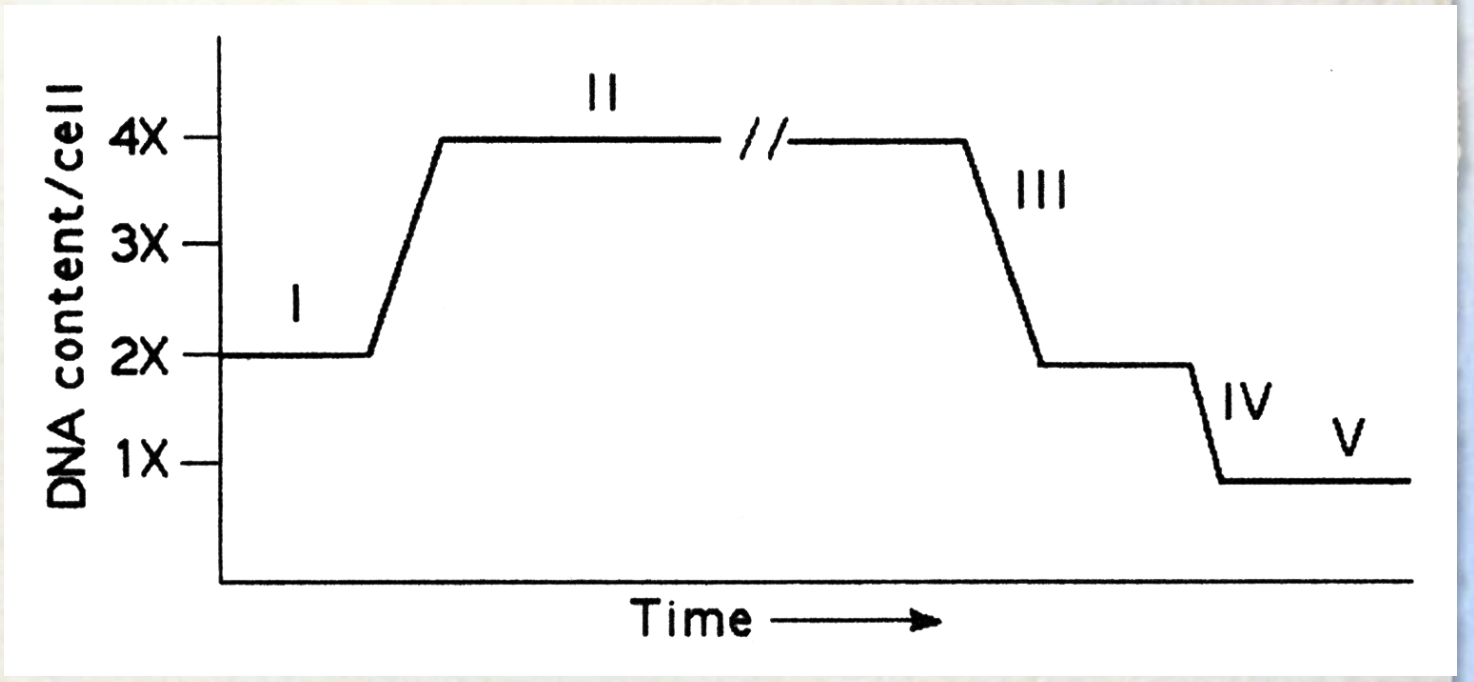
- How do cells at the completion of meiosis compare with cells that have replicated their DNA and are just about to begin meiosis?
  1. They have twice the amount of cytoplasm and half the amount of DNA.
  2. They have half the number of chromosomes and half the amount of DNA.
  3. They have the same number of chromosomes and half the amount of DNA.
  4. They have half the number of chromosomes and one-fourth the amount of DNA.
  5. They have half the amount of cytoplasm and twice the amount of DNA.

- Which number represents G_2? *
  - I
  - II
  - III
  - IV
  - V



- Which number represents the DNA content of a sperm cell?
  - I
  - II
  - III
  - IV
  - V



- The DNA content of a diploid cell in the G_1 phase of the cell cycle is measured. If the DNA content is *x*, then the DNA content of the same cell at metaphase of meiosis I would be

1. 0.25*x*
2. 0.5*x*
3. *x*.
4. 2*x*.
5. 4*x*.

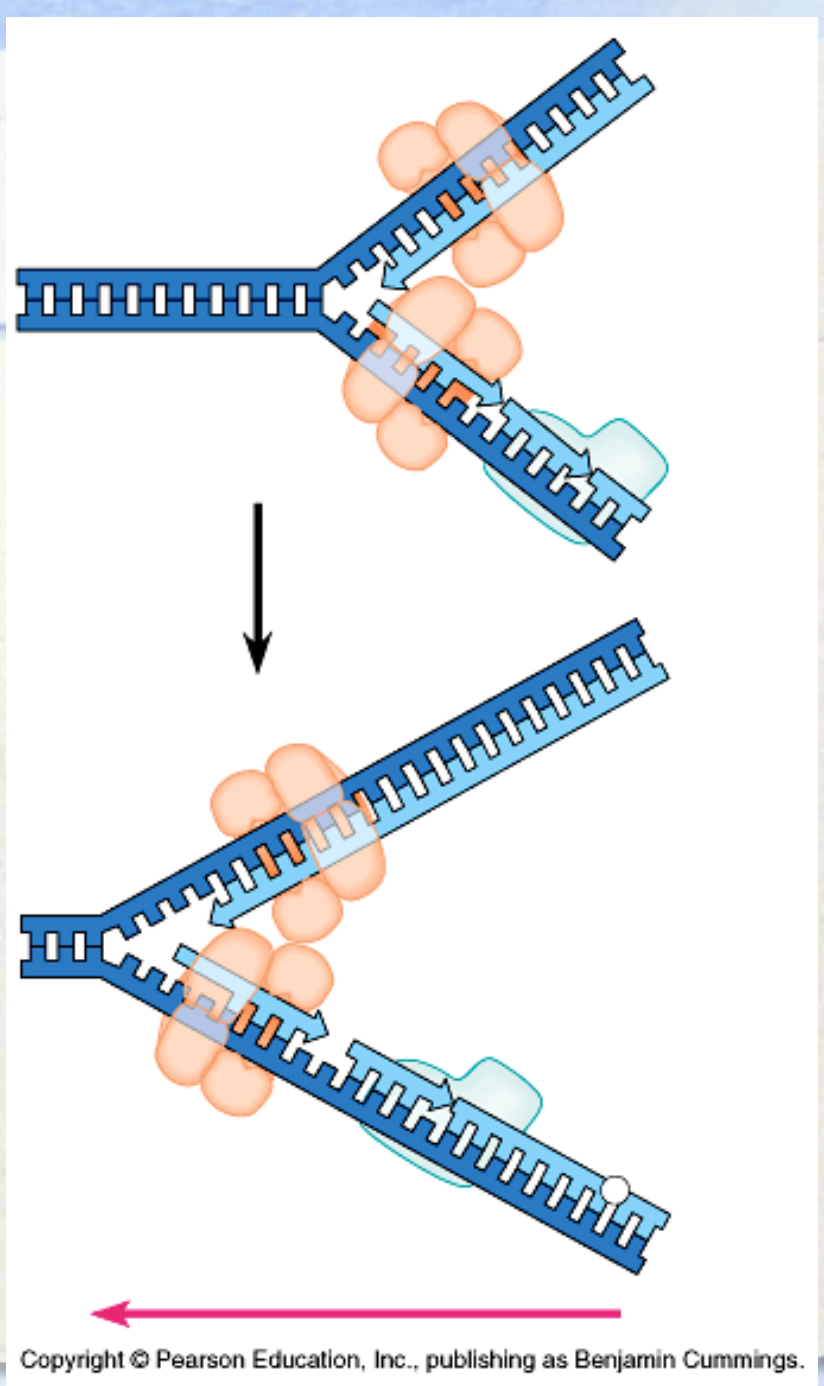
- The DNA content of a diploid cell in the G1 phase of the cell cycle is measured. If the DNA content is *x*, then the DNA content at metaphase of meiosis II would be

1. 0.25*x*.
2. 0.5*x*.
3. *x*.
4. 2*x*.
5. 4*x*.

- The DNA content of a cell is measured in the G_2 phase. After meiosis I, the DNA content of one of the two cells produced would be

1. equal to that of the G_2 cell.
2. twice that of the G_2 cell.
3. one-half that of the G_2 cell.
4. one-fourth that of the G_2 cell.
5. impossible to estimate due to independent assortment of homologous chromosomes.

- Which of the following would not be considered a haploid cell?
  1. daughter cell after meiosis II
  2. gamete
  3. daughter cell after mitosis in gametophyte generation of a plant
  4. cell in prophase I
  5. cell in prophase II



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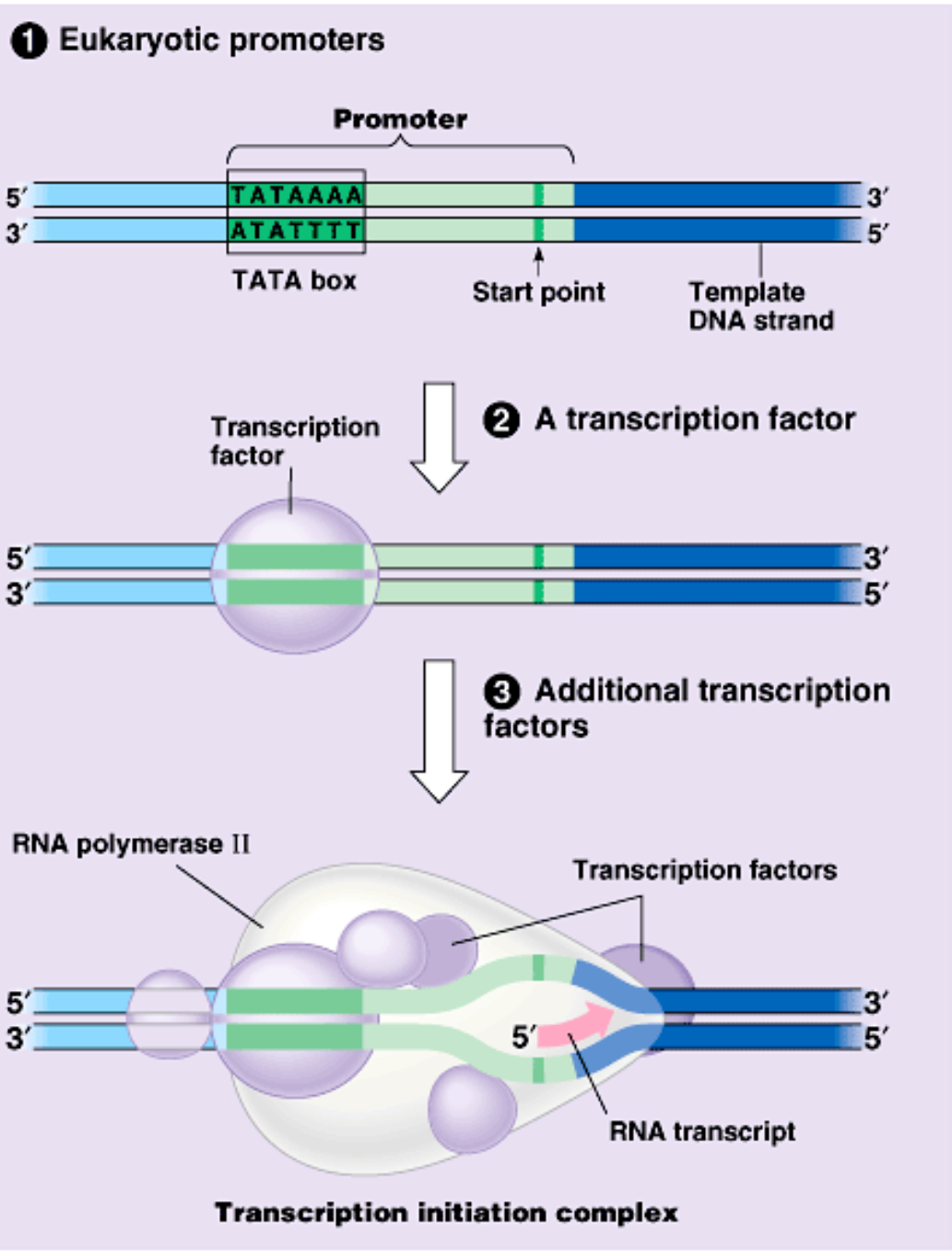

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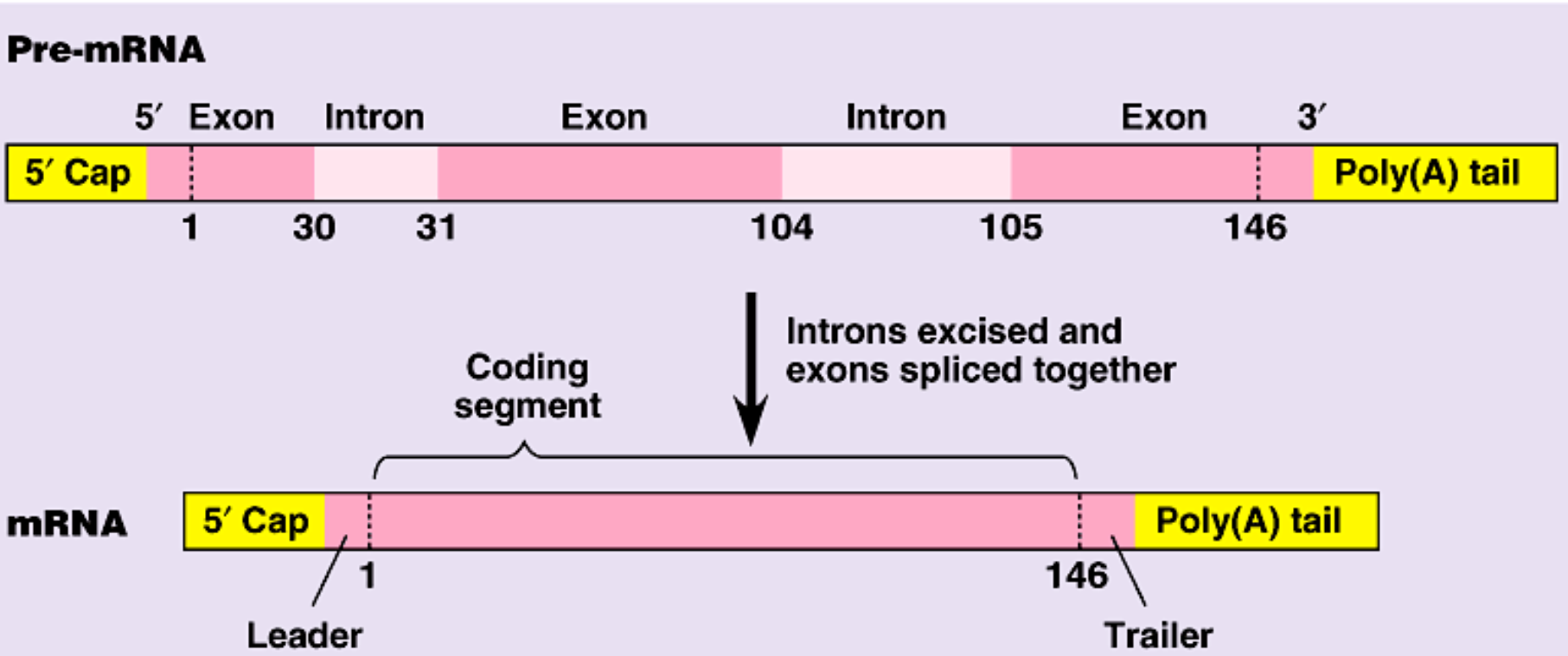

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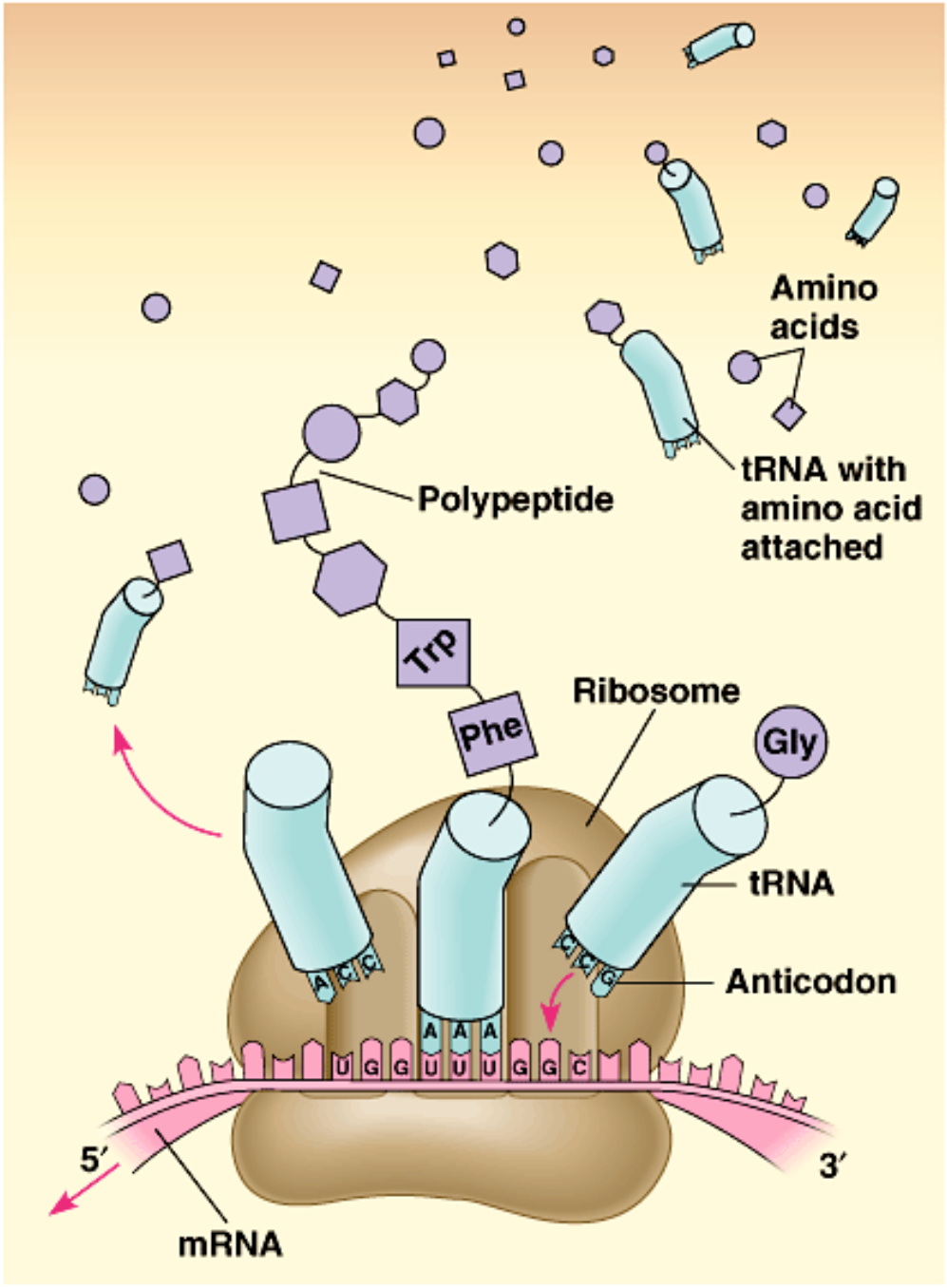

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Chapter 14

Mendel and the Gene Idea

- A couple who are both carriers of the gene for cystic fibrosis have two children who have cystic fibrosis. What is the probability that their next child will have cystic fibrosis?
  a. 0%
  b. 25%
  c. 50%
  d. 75%
  e. 100%

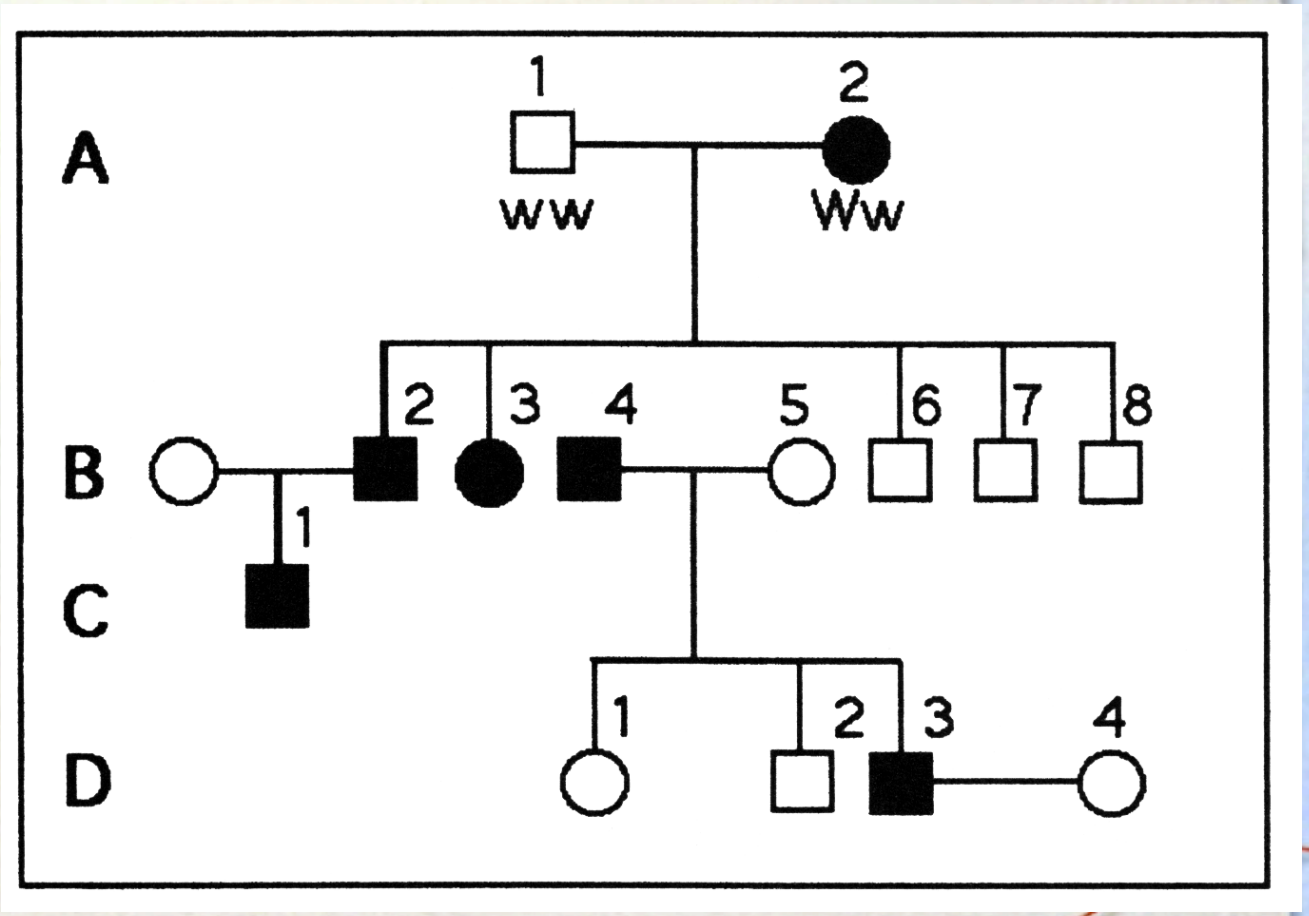
- A couple who are both carriers of the gene for cystic fibrosis have two children who have cystic fibrosis. What is the probability that their next child will be phenotypically normal?
  1. 0%
  2. 25%
  3. 50%
  4. 75%
  5. 100%

- In cattle, roan coat color (mixed red and white hairs) occurs in the heterozygous (*Rr*) offspring of red (*RR*) and white (*rr*) homozygotes. When two roan cattle are crossed, the phenotypes of the progeny are found to be in the ratio of 1 red:2 roan:1 white. Which of the following crosses could produce the highest percentage of roan cattle? *

1. red × white
2. roan × roan
3. white × roan
4. red × roan
5. All of the above crosses would give the same percentage of roan.

- What is the probability that individual C-1 is *Ww*?

1. 3/4
2. 1/4
3. 2/4
4. 2/3
5. 1



- A woman and her spouse both show the normal phenotype for pigmentation, but both had one parent who was an albino. Albinism is an autosomal recessive trait. If their first two children have normal pigmentation, what is the probability that their third child will be an albino?

1. 0
2. 1/4
3. 1/2
4. 3/4
5. 1

- In a cross *AaBbCc* × *AaBbCc*, what is the probability of producing the genotype *AABBCC*?

1. 1/4
2. 1/8
3. 1/16
4. 1/32
5. 1/64

- Feather color in budgies is determined by two different genes that affect the pigmentation of the outer feather and its core. Y_B_ is green; yyB_ is blue; Y_bb is yellow; and yybb is white. A green budgie is crossed with a blue budgie. Which of the following results is *not* possible?
  1. all green offspring
  2. all blue offspring
  3. all white offspring
  4. all yellow offspring
  5. All of the above are possible, but with different probabilities.

- Three babies were recently mixed up in a hospital. After consideration of the data below, which of the following represent the correct baby/parent combinations?

Couple # Blood groups	I A and A	II A and B	III B and O
Baby # Blood groups	1 B	2 O	3 AB

1. I-3, II-1, III-2
2. I-1, II-3, III-2
3. I-2, II-3, III-1
4. I-2, II-1, III-3
5. I-3, II-2, III-1

- A man is brought to court in a paternity case. He has blood type B, Rh positive. The mother has blood type B, Rh negative.

  Which blood type of a child would exclude the accused from paternity?

  1. AB, Rh negative
  2. B, Rh negative
  3. O, Rh negative
  4. B, Rh positive
  5. None of these choices will exclude.

- You are handed a “mystery’’ pea plant with long stems and axial flowers, and asked to determine its genotype as quickly as possible. You know the allele for long stems (*L*) is dominant to that for dwarf stems (*l*) and that the allele for axial flowers (*A*) is dominant to that for terminal flowers (*a*). You cross the “mystery” plant with a dwarf stemmed axial flowered plant. If your mystery plant is heterozygous at both loci, what is/are the expected proportion of offspring?
  1. 100% long stemmed terminal flowered
  2. 100% dwarf stemmed terminal flowered
  3. 100% long stemmed axial flowered
  4. 50% long stemmed axial flowered, 50% dwarf stemmed terminal flowered
  5. 25% long stemmed axial flowered, 25% long stemmed terminal flowered, 25% dwarf stemmed axial flowered, 25% dwarf stemmed terminal flowered

- You think that two alleles for coat color in mice show incomplete dominance. What is the best and simplest cross to perform in order to support your hypothesis?
  1. a testcross of a homozygous recessive mouse with a mouse of unknown genotype
  2. a cross of F_1 mice to look for a 1:2:1 ratio in the offspring
  3. a reciprocal cross in which the sex of the mice of each coat color is reversed
  4. a cross of two true-breeding mice of different colors to look for an intermediate phenotype in the F_1
  5. a cross of F_1 mice to look for a 9:7 ratio in the offspring

- A mother with type B blood has two children, one with type A blood and one with type O blood. Her husband has type O blood. Which of the following could you conclude from this information?
  1. The husband could not have fathered either child.
  2. The husband could have fathered both children.
  3. The husband must be the father of the child with type O blood and could be the father of the type A child.
  4. The husband could be the father of the child with type O blood, but not the type A child.
  5. Neither the mother nor the husband could be the biological parent of the type A child.

Chapter 15

The Chromosomal Basis of Inheritance

- Vermilion eyes is a sex-linked recessive characteristic in fruit flies. If a female having vermilion eyes is crossed with a wild-type male, what percentage of the F_1 males will have vermilion eyes?
  a. 0%
  b. 25%
  c. 50%
  d. 75%
  e. 100%

- Barring in chickens is due to a sex-linked dominant gene (*B*). The sex of chicks at hatching is difficult to determine, but barred chicks can be distinguished from nonbarred at that time. To use this trait so that at hatching all chicks of one sex are barred, what cross would you make?
  a. barred males × barred females
  b. barred males × nonbarred females
  c. nonbarred males × barred females
  d. nonbarred males × nonbarred females

- A recessive allele on the X chromosome is responsible for red-green color blindness in humans. A woman with normal vision whose father is color-blind marries a color-blind male. What is the probability that this couple's son will be color-blind?
  a. 0
  b. 1/4
  c. 1/2
  d. 3/4
  e. 1

- An achondroplastic dwarf man with normal vision marries a color-blind woman of normal height. The man's father was six feet tall, and both the woman's parents were of average height. Achondroplastic dwarfism is autosomal dominant, and red-green color blindness is X-linked recessive.

  How many of their female children might be expected to be color-blind dwarfs? *

  a. all
  b. none
  c. half
  d. one out of four
  e. three out of four

- An achondroplastic dwarf man with normal vision marries a color-blind woman of normal height. The man's father was six feet tall, and both the woman's parents were of average height. Achondroplastic dwarfism is autosomal dominant, and red-green color blindness is X-linked recessive.

  How many of their male children would be color-blind and normal height?

  a. all
  b. none
  c. half
  d. one out of four
  e. three out of four

- In cats, black color is caused by an X-linked allele; the other allele at this locus causes orange color. The heterozygote is tortoiseshell. What kinds of offspring would you expect from the cross of a black female and an orange male?
  a. tortoiseshell female; tortoiseshell male
  b. black female; orange male
  c. orange female; orange male
  d. tortoiseshell female; black male
  e. orange female; black male

- Red-green color blindness is a sex-linked recessive trait in humans. Two people with normal color vision have a color-blind son. What are the genotypes of the parents?
  a. *XcXc* and *XcY*
  b. *XcXc* and *XCY*
  c. *XCXC* and *XcY*
  d. *XCXC* and *XCY*
  e. *XCXc* and *XCY*

- A color-blind son inherited this trait from his

a. mother.
b. father.
c. mother only if she is color-blind.
d. father only if he is color-blind.
e. mother only if she is not color-blind.

Chapter 16

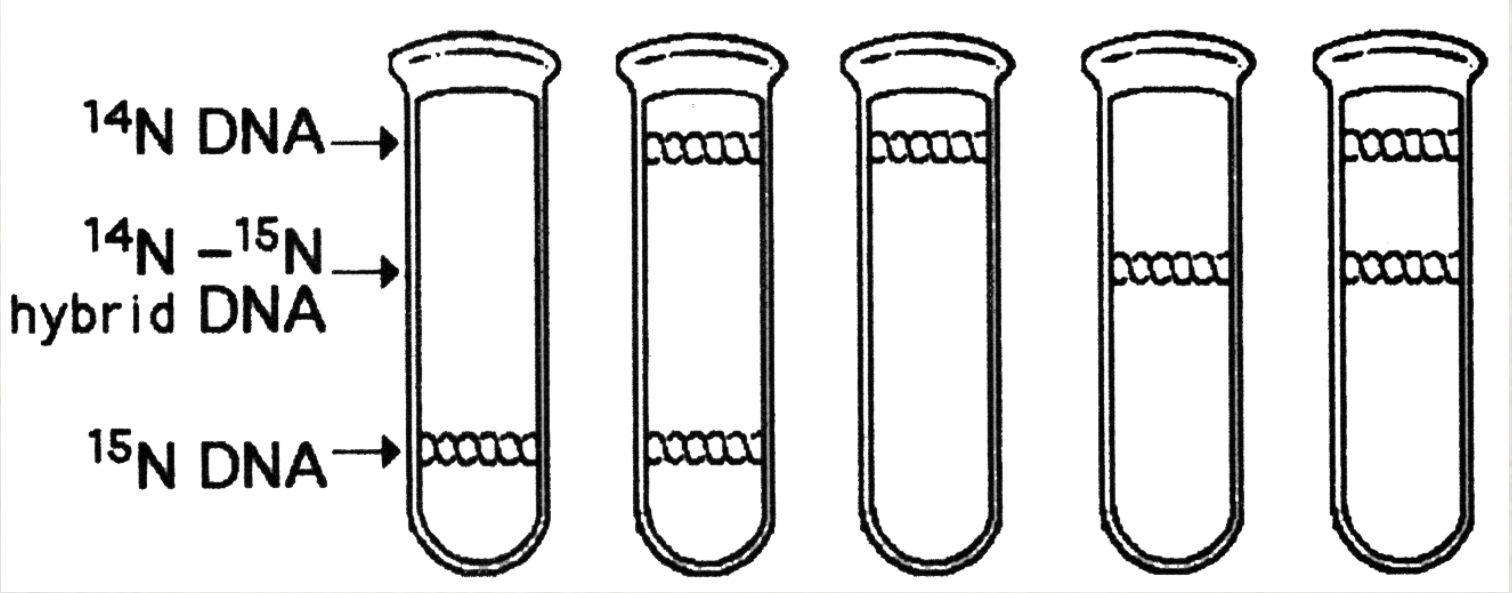
The Molecular Basis of Inheritance

- Tobacco mosaic virus has RNA rather than DNA as its genetic material. In a hypothetical situation where RNA from a tobacco mosaic virus is mixed with proteins from a related DNA virus, the result could be a hybrid virus. If that virus were to infect a cell and reproduce, what would the resulting "offspring" viruses be like?
  1. tobacco mosaic virus
  2. the related DNA virus
  3. a hybrid: tobacco mosaic virus RNA and protein from the DNA virus
  4. a hybrid: tobacco mosaic virus protein and nucleic acid from the DNA virus
  5. a virus with a double helix made up of one strand of DNA complementary to a strand of RNA surrounded by viral protein

- Cytosine makes up 38% of the nucleotides in a sample of DNA from an organism. What percent of the nucleotides in this sample will be thymine?
  1. 12
  2. 24
  3. 31
  4. 38
  5. It cannot be determined from the information provided.

- In an analysis of the nucleotide composition of DNA, which of the following is *true*?
  1. A = C
  2. A = G and C = T
  3. A + C = G + T
  4. A + T = G + C
  5. Both B and C are true

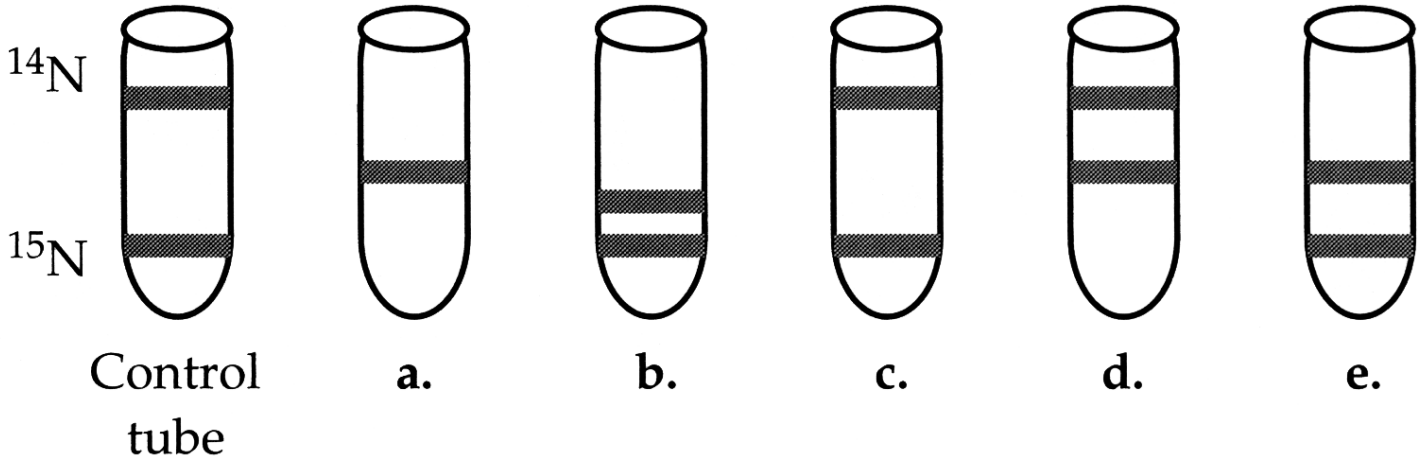
- A space probe returns with a culture of a microorganism found on a distant planet. Analysis shows that it is a carbon-based life form that has DNA. You grow the cells in ^{15}N medium for several generations and then transfer it to ^{14}N medium. Which pattern in this figure would you expect if the DNA were replicated in a conservative manner?



a. b. c. d. e.

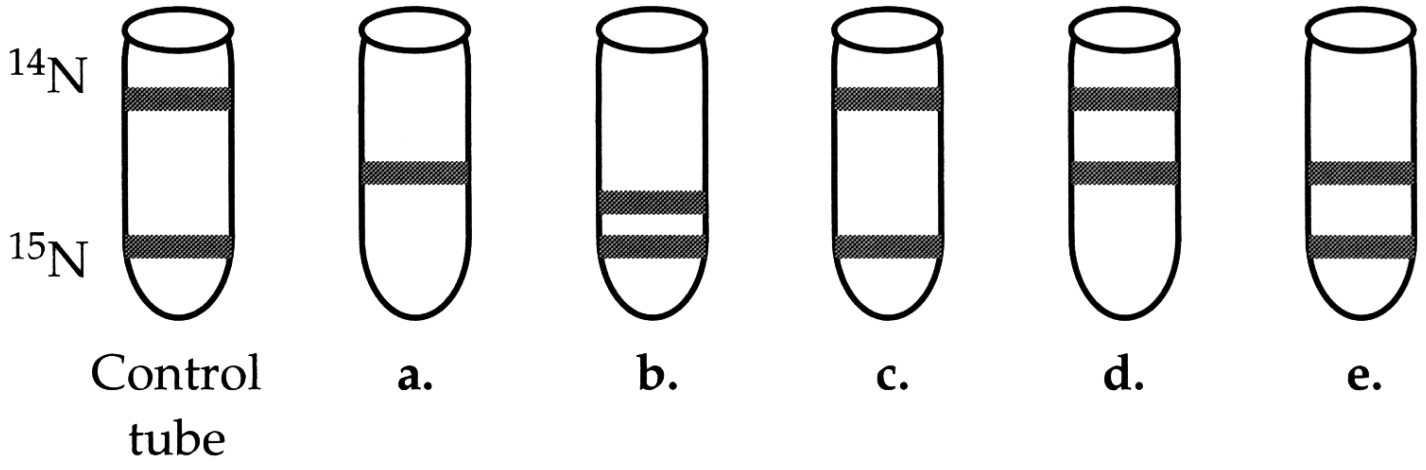
- In analyzing the number of different bases in a DNA sample, which result would be consistent with the base-pairing rules?
  1. A = G
  2. A + G = C + T
  3. A + T = G + T
  4. A = C
  5. G = T

- Imagine the following experiment is done: Bacteria are first grown for several generations in a medium containing the *lighter* isotope of nitrogen, ^{14}N, then switched into a medium containing ^{15}N. The rest of the experiment is identical to the Meselson and Stahl experiment. Which of the following represents the band positions you would expect after two generations? *



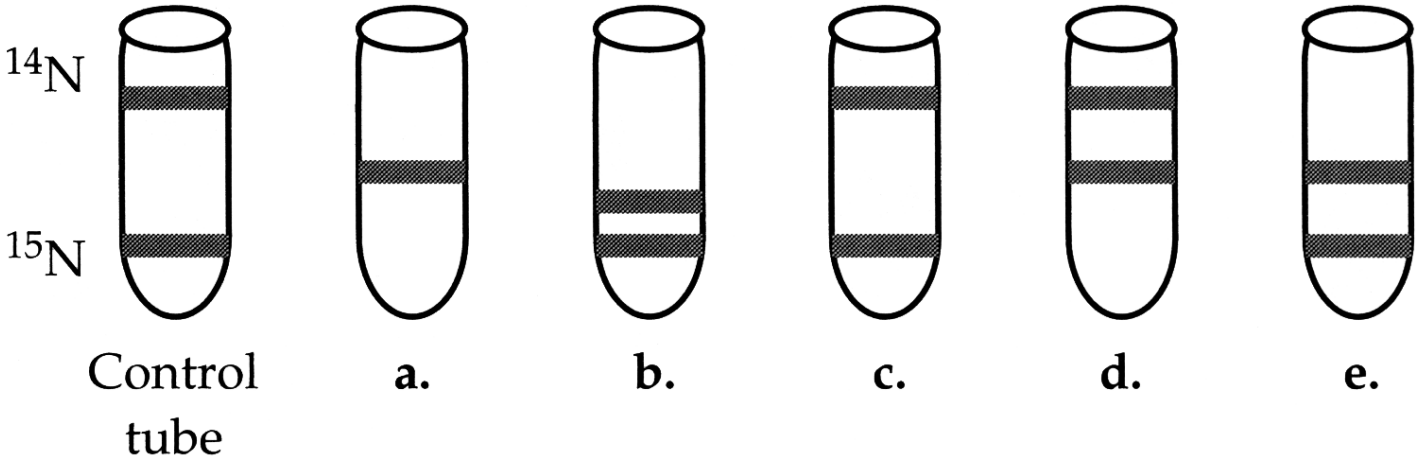
- You are trying to support your hypothesis that DNA replication is conservative; i.e., parental strands separate; complementary strands are made, but these new strands join together to make a new DNA molecule and the parental strands rejoin. You take *E. coli* that had grown in a medium containing only heavy nitrogen (^{15}N) and transfer a sample to a medium containing light nitrogen (^{14}N).

- (cont.) After allowing time for only one DNA replication, you centrifuge a sample and compare the density band(s) formed with control bands for bacteria grown on either normal ^{14}N or ^{15}N medium. Which band location would support your hypothesis of conservative DNA replication?

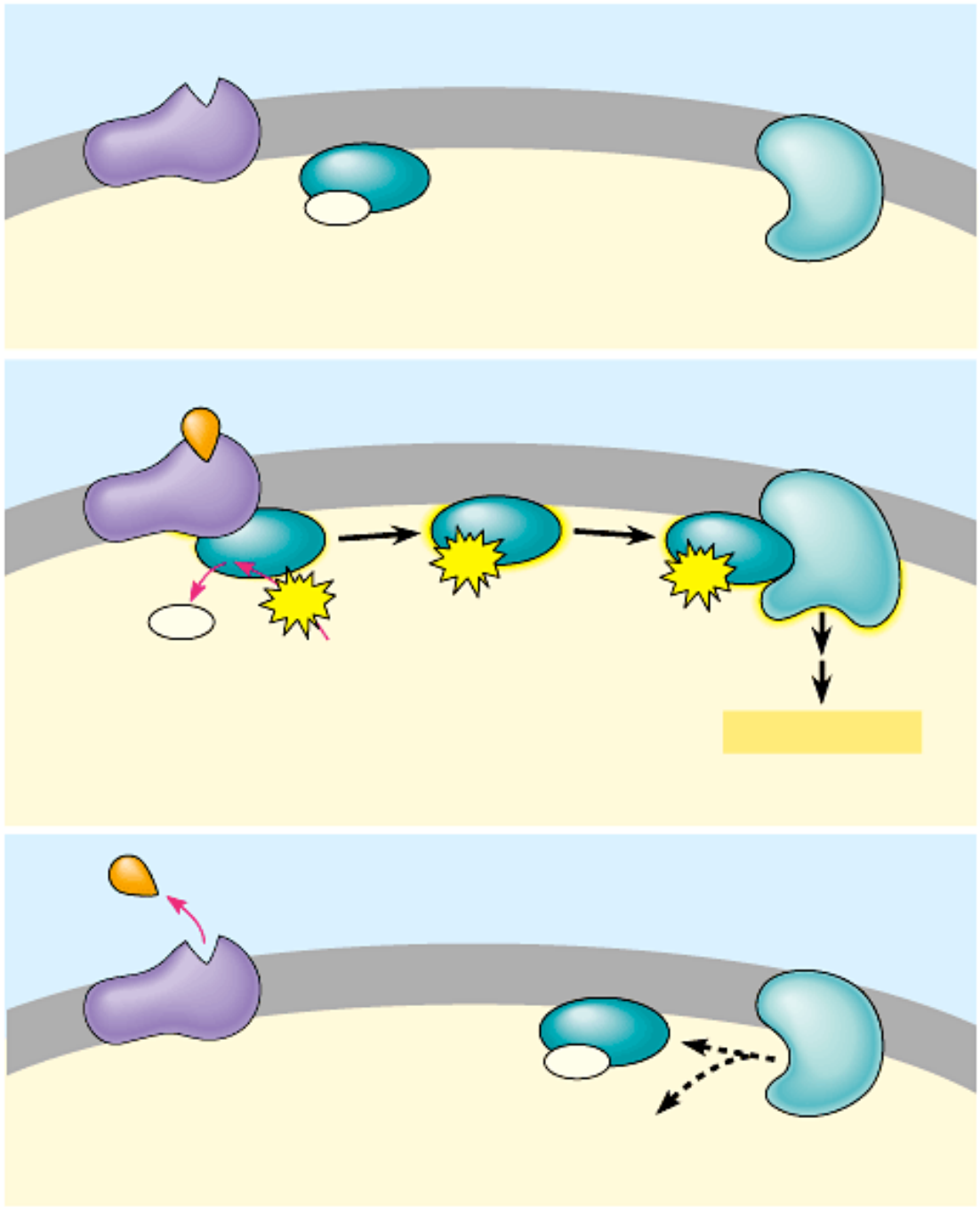


Bands after one replication on ^{14}N

- Using the experiment explained in the previous question, which centrifuge tube would represent the band distribution



Bands after one replication on ^{14}N



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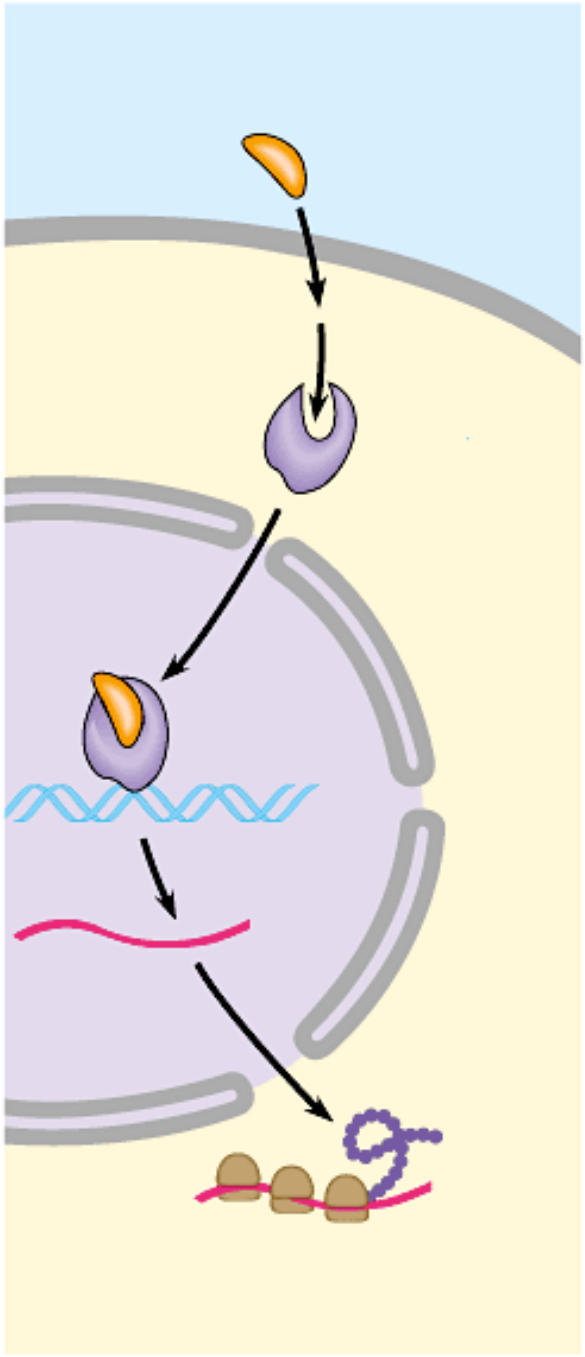

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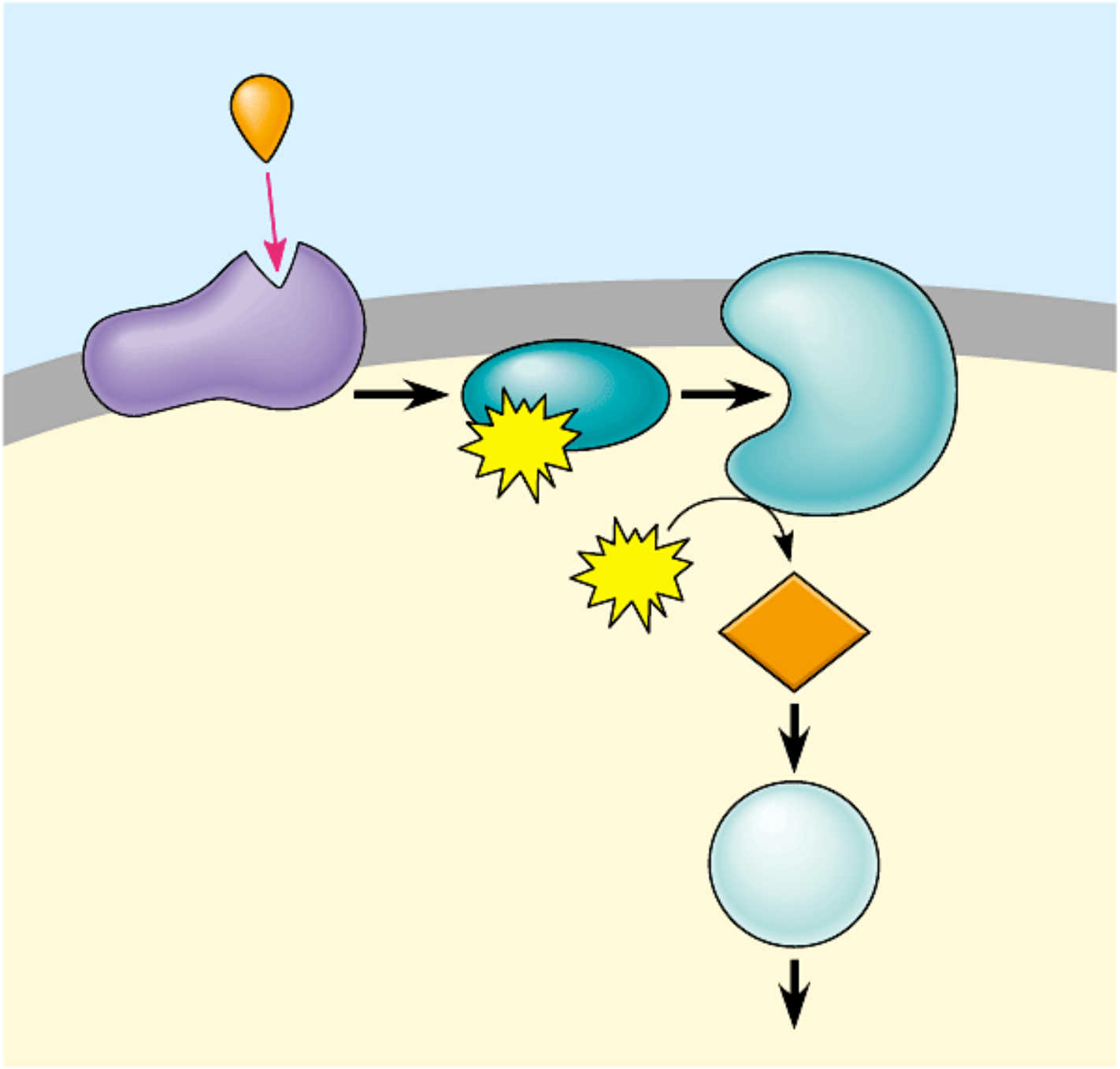

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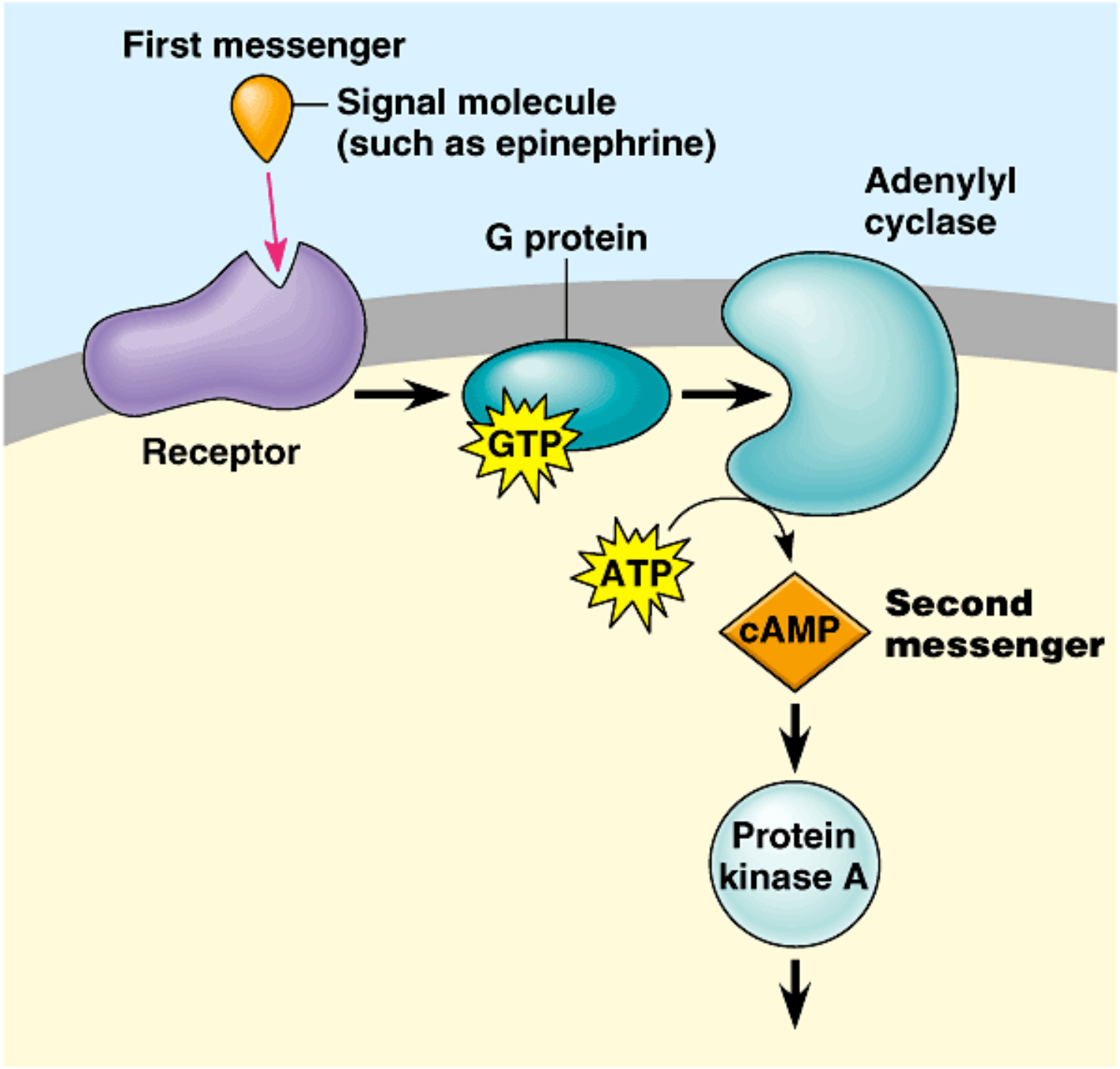

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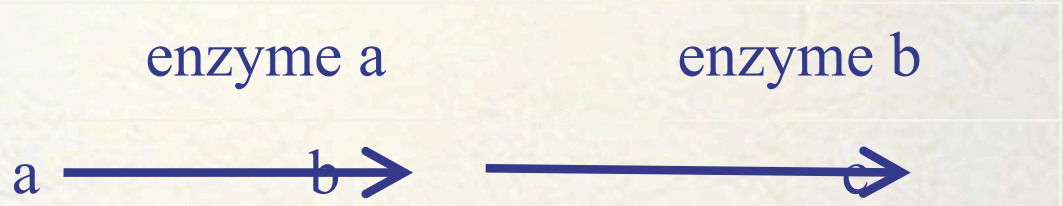
Chapter 17

From Gene to Protein

- A mutation results in a defective enzyme *a*. In the following simple metabolic pathway, what would be a consequence of that mutation?



1. an accumulation of A and no production of B and C
2. an accumulation of A and B and no production of C
3. an accumulation of B and no production of A and C
4. an accumulation of B and C and no production of A
5. an accumulation of C and no production of A and B

- If proteins were composed of only 12 different kinds of amino acids, what would be the small-est possible codon size in a genetic system with four different nucleotides?

1. 1
2. 2
3. 3
4. 4
5. 12

- A portion of the genetic code is UUU = phenylalanine, GCC = alanine, AAA = lysine, and CCC = proline. Assume the correct code places the amino acids phenylalanine, alanine, and lysine in a protein (in that order). Which of the following DNA sequences would substitute proline for alanine?
  1. AAA-CGG-TTA
  2. AAT-CGG-TTT
  3. AAA-CCG-TTT
  4. AAA-GGG-TTT
  5. AAA-CCC-TTT

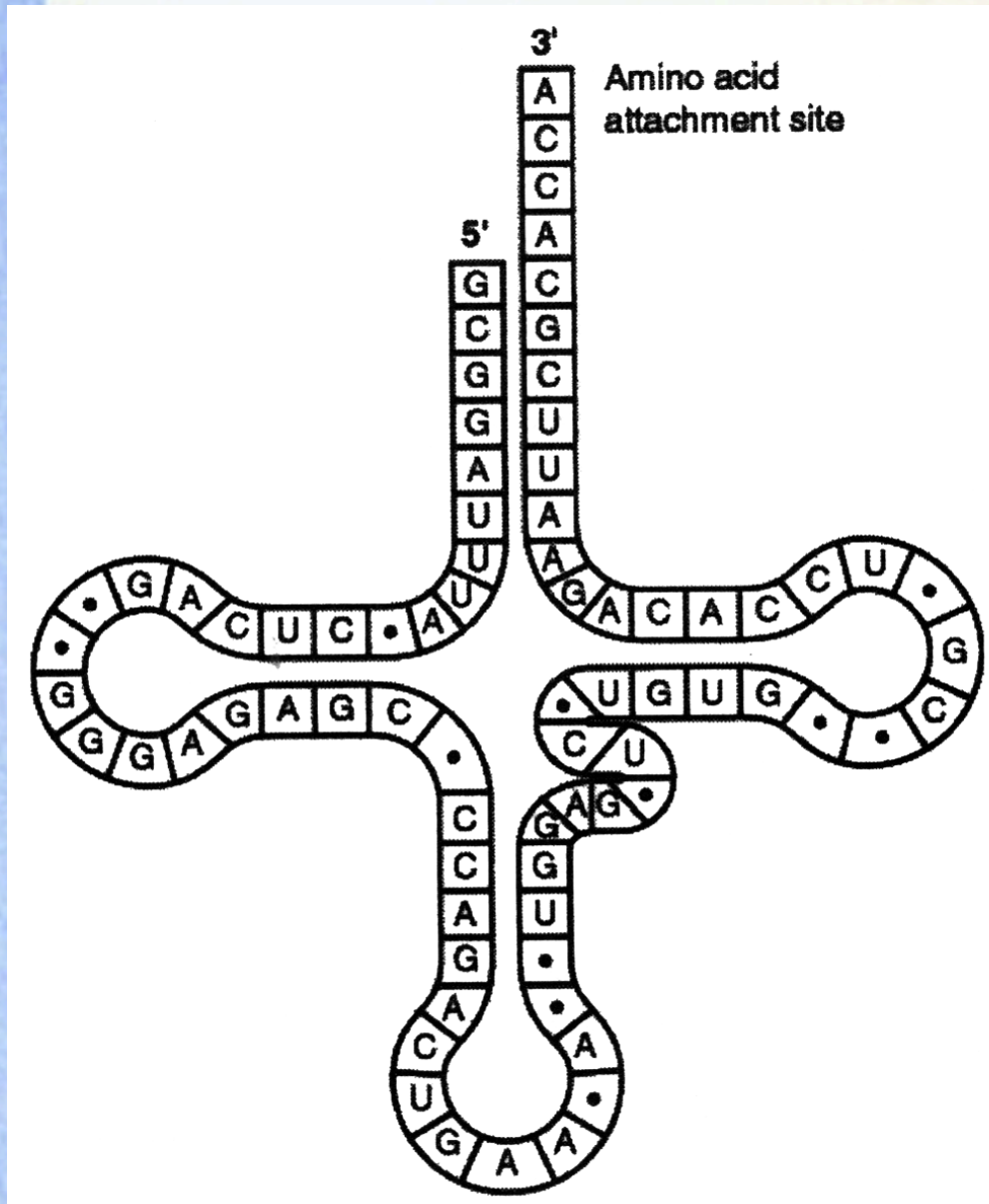
- A particular triplet of bases in the coding sequence of DNA is AAA. The anticodon on the tRNA that binds the mRNA codon is
  1. TTT.
  2. UUA.
  3. UUU.
  4. AAA.
  5. either UAA or TAA, depending on wobble in the first base.

- A part of an mRNA molecule with the following sequence is being read by a ribosome: 5' CCG-ACG 3' (mRNA). The following activated transfer RNA molecules are available. Two of them can correctly match the mRNA so that a dipeptide can form.

tRNA Anticodon	Amino Acid
GGC	Proline
CGU	Alanine
UGC	Threonine
CCG	Glycine
ACG	Cysteine
CGG	Alanine

The dipeptide that will form will be

1. cysteine-alanine.
2. proline-threonine.
3. glycine-cysteine.
4. alanine-alanine.
5. threonine-glycine.



- This figure represents tRNA that recognizes and binds a particular amino acid (in this instance, phenylalanine). Which of the following triplets of bases on the mRNA strand codes for this amino acid?
  1. UGG
  2. GUG
  3. GUA
  4. UUC
  5. CAU

- Each of the following is a modification of the sentence THECATATETHERAT.

A. THERATATETHECAT
B. THETACATETHERAT
C. THECATARETHERAT
D. THECATATTHERAT
E. CATATETHERAT

Which of the above is analogous to a frameshift mutation?

- A
- B
- C
- D
- E

- Each of the following is a modification of the sentence THECATATETHERAT.

A. THERATATETHECAT
B. THETACATETHERAT
C. THECATARETHERAT
D. THECATATTHERAT
E. CATATETHERAT

Which of the above is analogous to a single substitution mutation?

- A
- B
- C
- D
- E

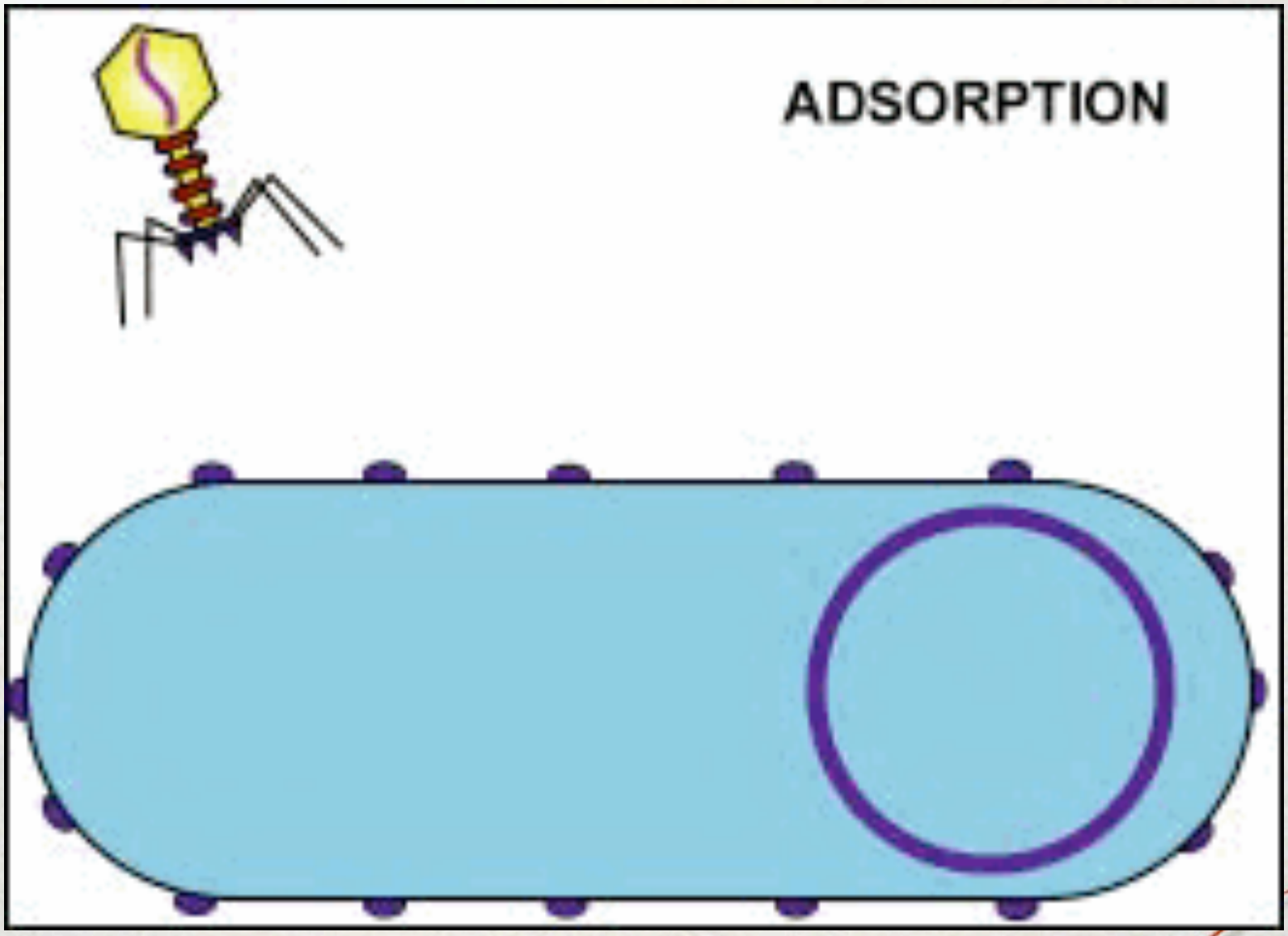
- What is the relationship among DNA, a gene, and a chromosome?
  1. A chromosome contains hundreds of genes, which are composed of protein.
  2. A chromosome contains hundreds of genes, which are composed of DNA.
  3. A gene contains hundreds of chromosomes, which are composed of protein.
  4. A gene is composed of DNA, but there is no relationship to a chromosome.
  5. A gene contains hundreds of chromosomes, which are composed of DNA.

- A biologist inserts a gene from a human liver cell into the chromosome of a bacterium. The bacterium then transcribes this gene into mRNA and translates the mRNA into protein. The protein produced is useless. The biologist extracts the protein and mature mRNA that codes for it. When analyzed you would expect which of the following results? *
  1. the protein and the mature mRNA are longer than in human cells
  2. the protein and mature mRNA are shorter than expected
  3. the protein is longer and the mRNA is shorter than expected
  4. the protein is shorter and the mRNA is longer than expected

- How is the template strand for a particular gene determined?
  1. It is the DNA strand that runs from the 5' → 3' direction.
  2. It is the DNA strand that runs from the 3' → 5' direction.
  3. It depends on the orientation of RNA polymerase, whose position is determined by particular sequences of nucleotides within the promoter.
  4. It doesn't matter which strand is the template because they are complementary and will produce the same mRNA.
  5. The template strand always contains the TATA box.

Bacterial Genetic Recombination:

- Transduction
- Transformation
- Conjugation
- Mutation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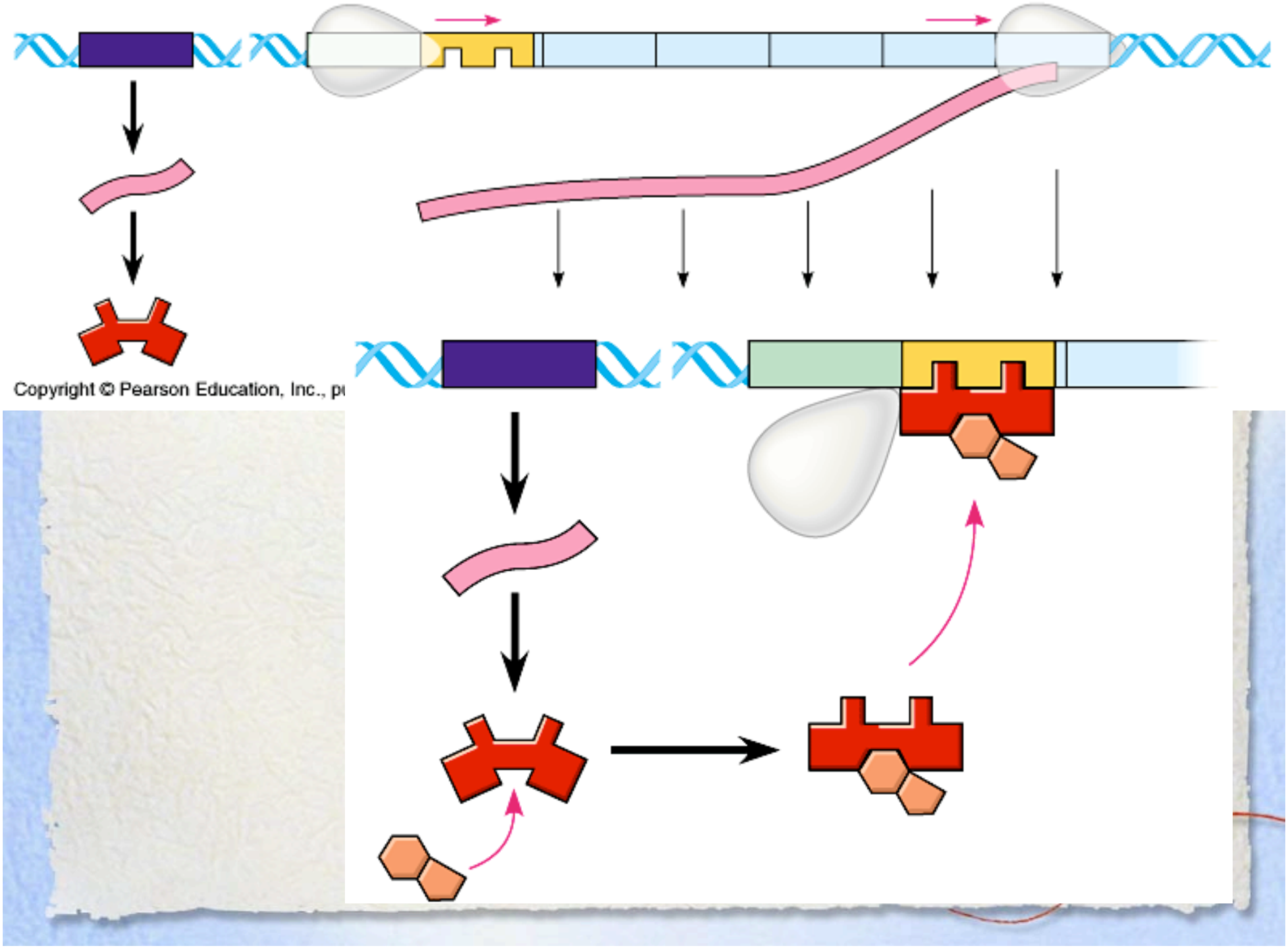
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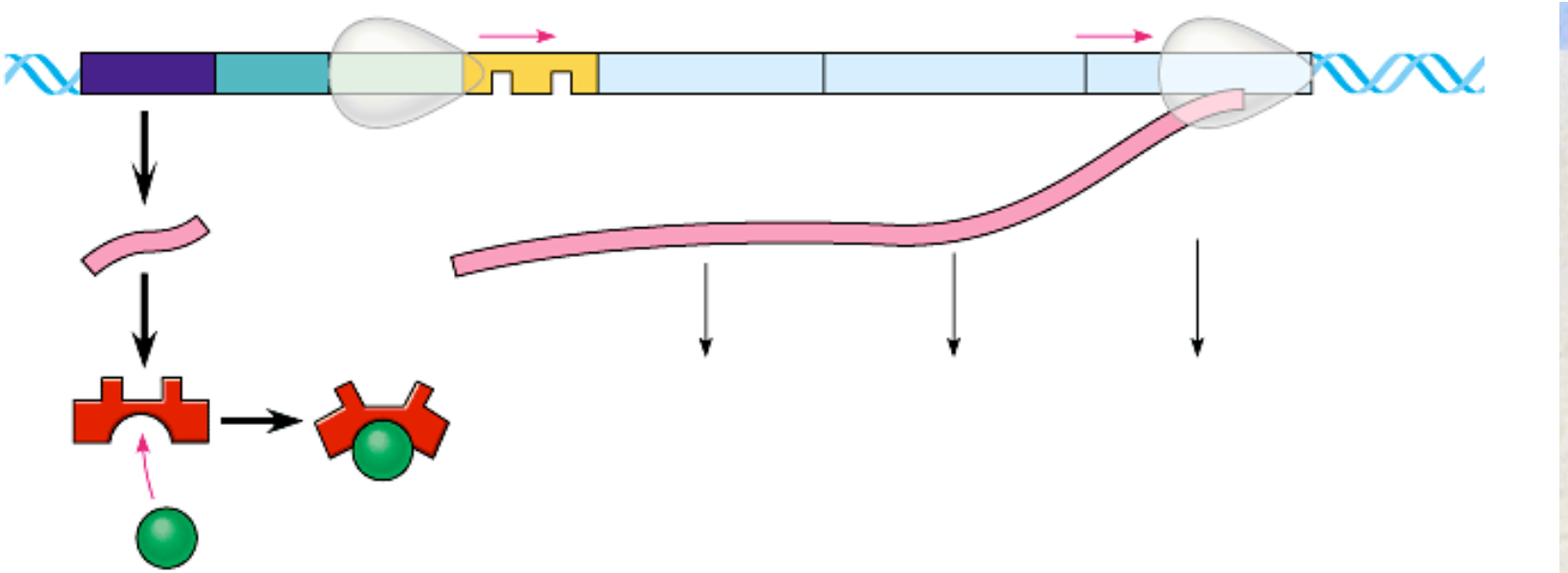

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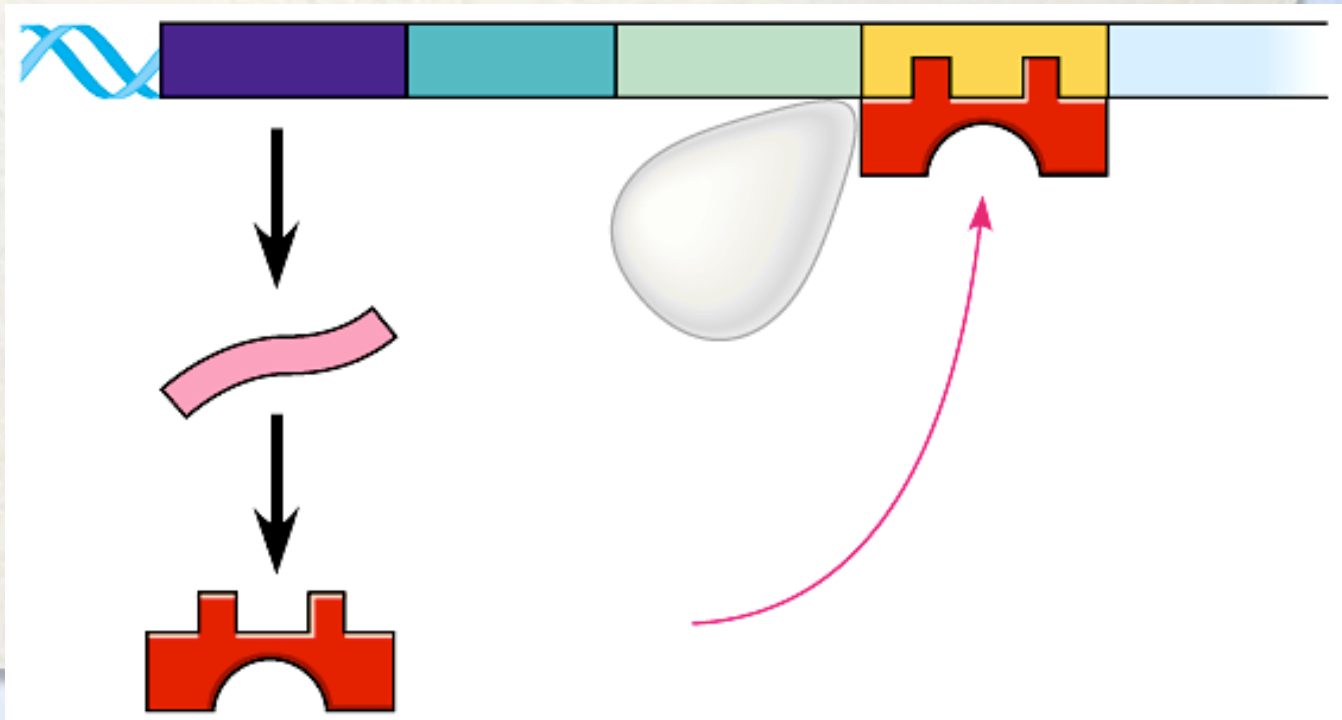
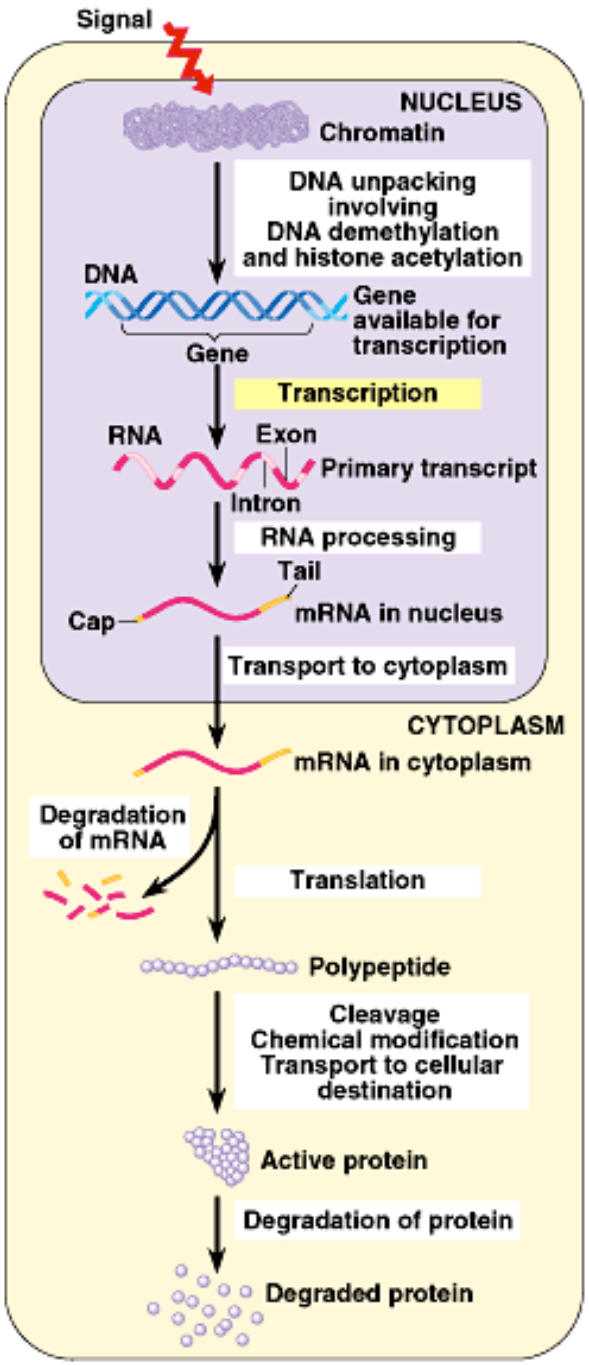


- A researcher lyses a cell that contains nucleic acid molecules and capsid units of tobacco mosaic virus (TMV). The cell contents are left in a covered test tube overnight. The next day this mixture is sprayed on tobacco plants. Which of the following would be expected to occur?
  1. The plants would develop some but not all of the symptoms of the TMV infection.
  2. The plants would develop symptoms typically produced by viroids.
  3. The plants would develop the typical symptoms of TMV infection.
  4. The plants would not show any disease symptoms.
  5. The plants would become infected, but the sap from these plants would be unable to infect other plants.

- A mutation that inactivates the regulator gene of a repressible operon in an *E. coli* cell would result in
  1. continuous transcription of the structural gene controlled by that regulator.
  2. complete inhibition of transcription of the structural gene controlled by that regulator.
  3. irreversible binding of the repressor to the operator.
  4. inactivation of RNA polymerase.
  5. both B and C.

- A mutation that makes the regulatory gene of an inducible operon nonfunctional would result in
  1. continuous transcription of the operon's genes.
  2. reduced transcription of the operon's genes.
  3. accumulation of large quantities of a substrate for the catabolic pathway controlled by the operon.
  4. irreversible binding of the repressor to the promoter.
  5. overproduction of cAMP receptor protein.

- A mutation that renders nonfunctional the product of a regulatory gene for an inducible operon would result in *
  1. continuous transcription of the genes of the operon.
  2. complete blocking of the attachment of RNA polymerase to the promoter.
  3. irreversible binding of the repressor to the operator.
  4. no difference in transcription rate when an activator protein was present.
  5. negative control of transcription.



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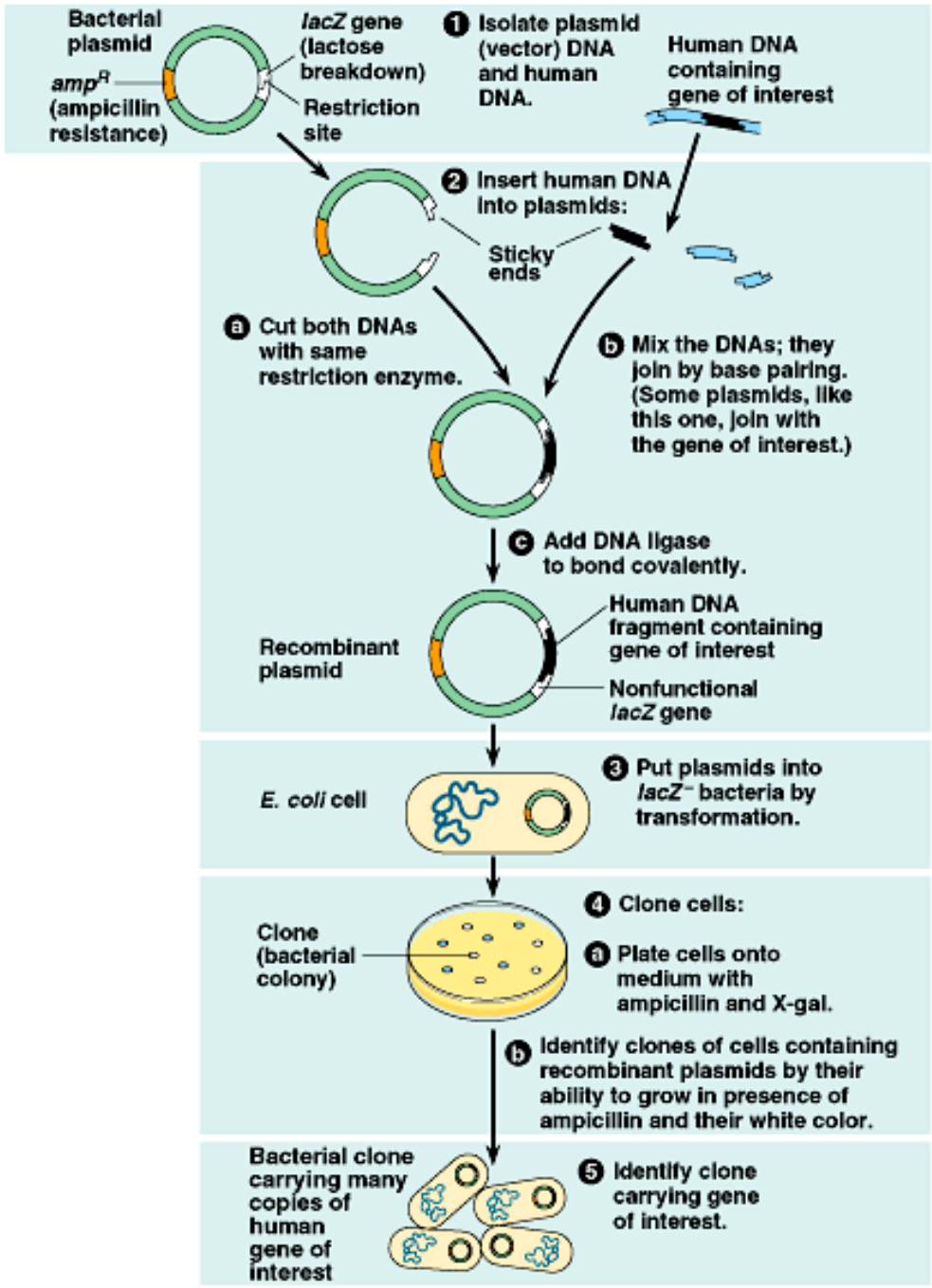

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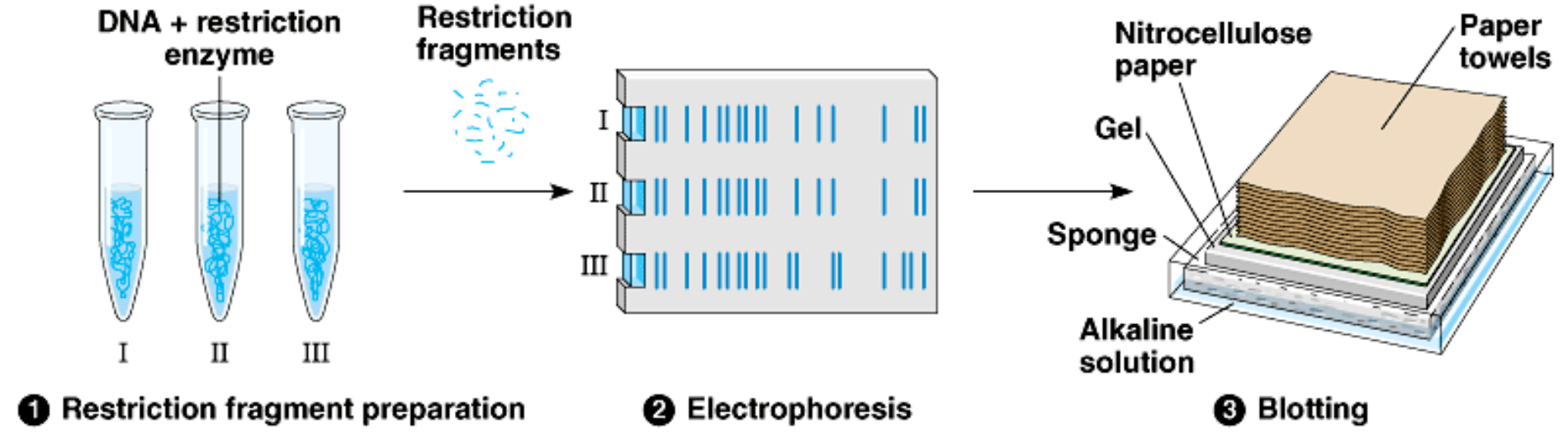

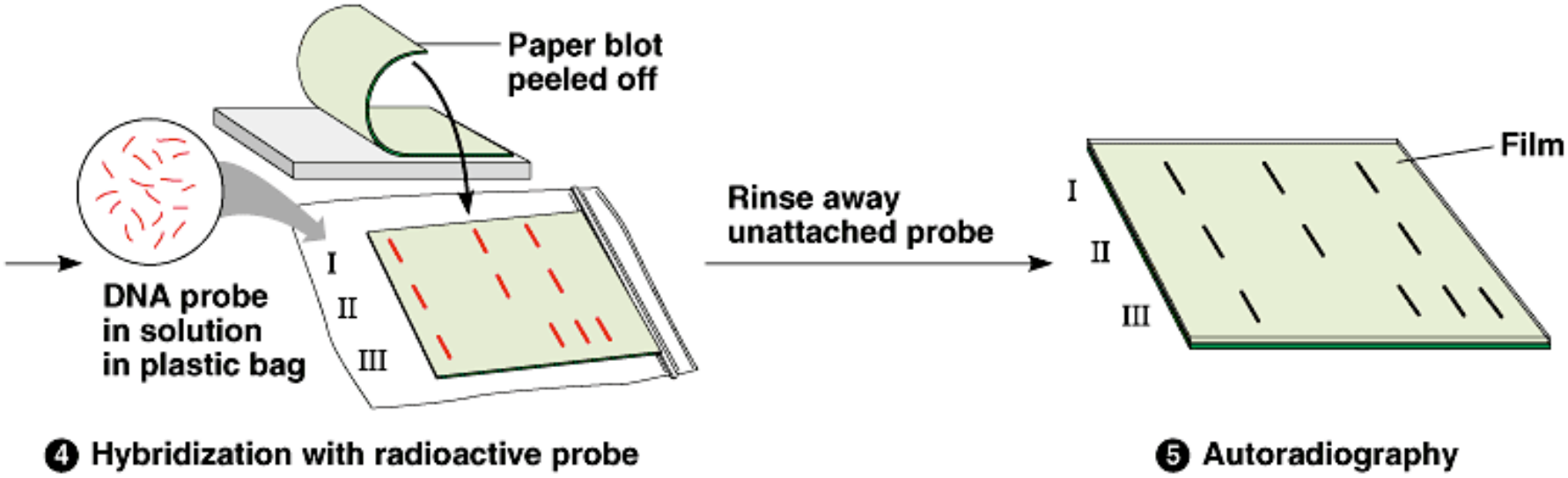

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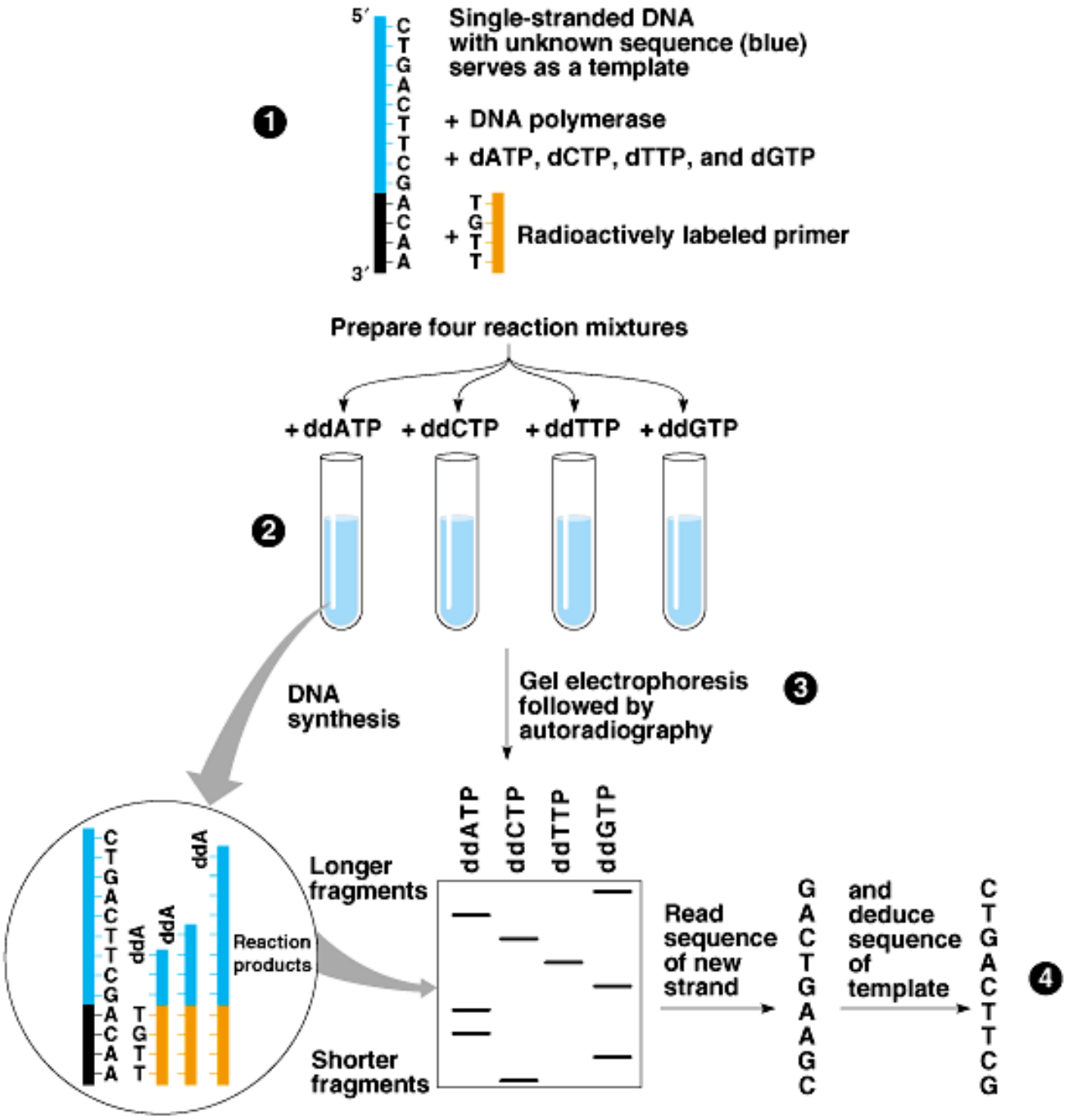
- PCR
- Southern Hybridization



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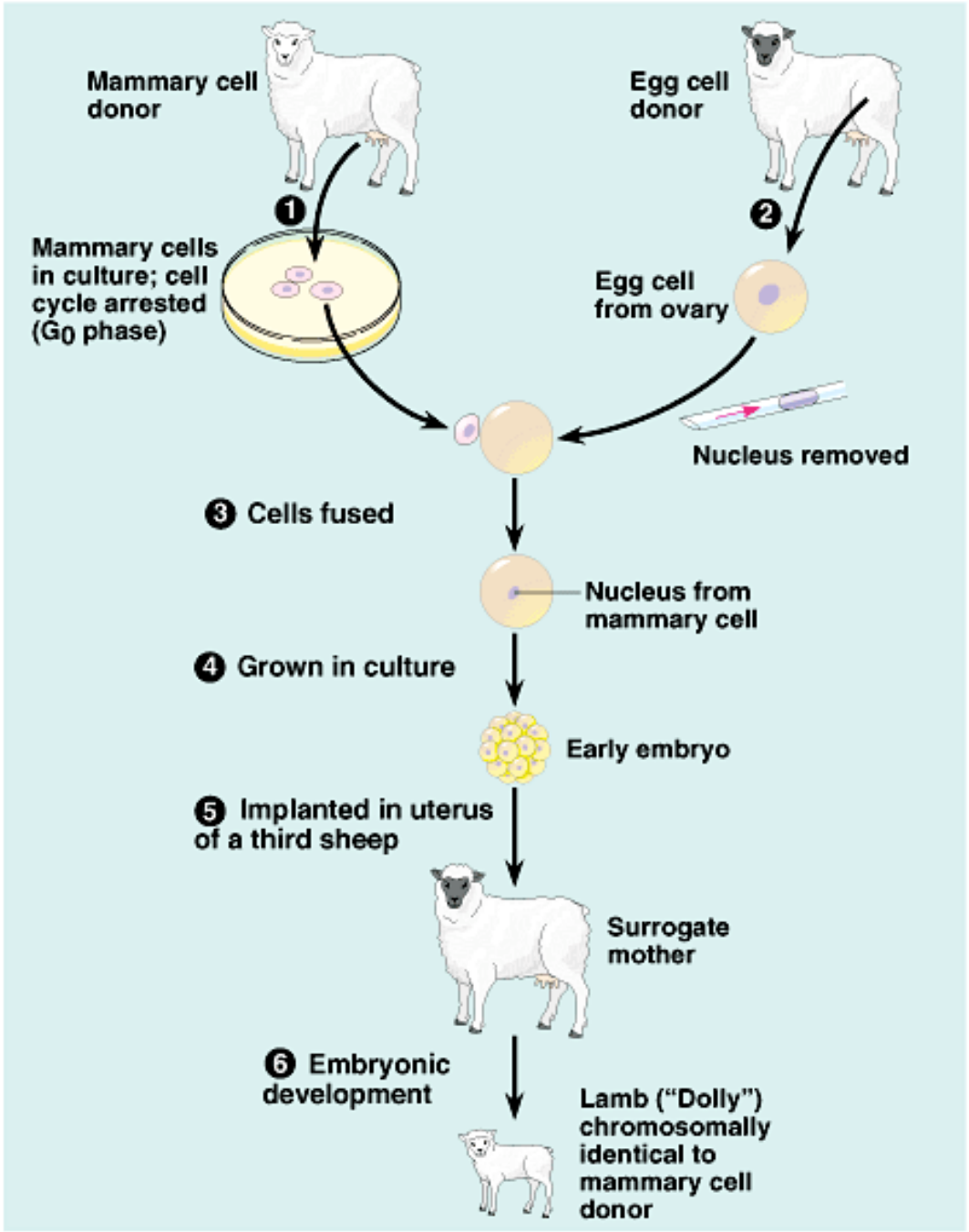

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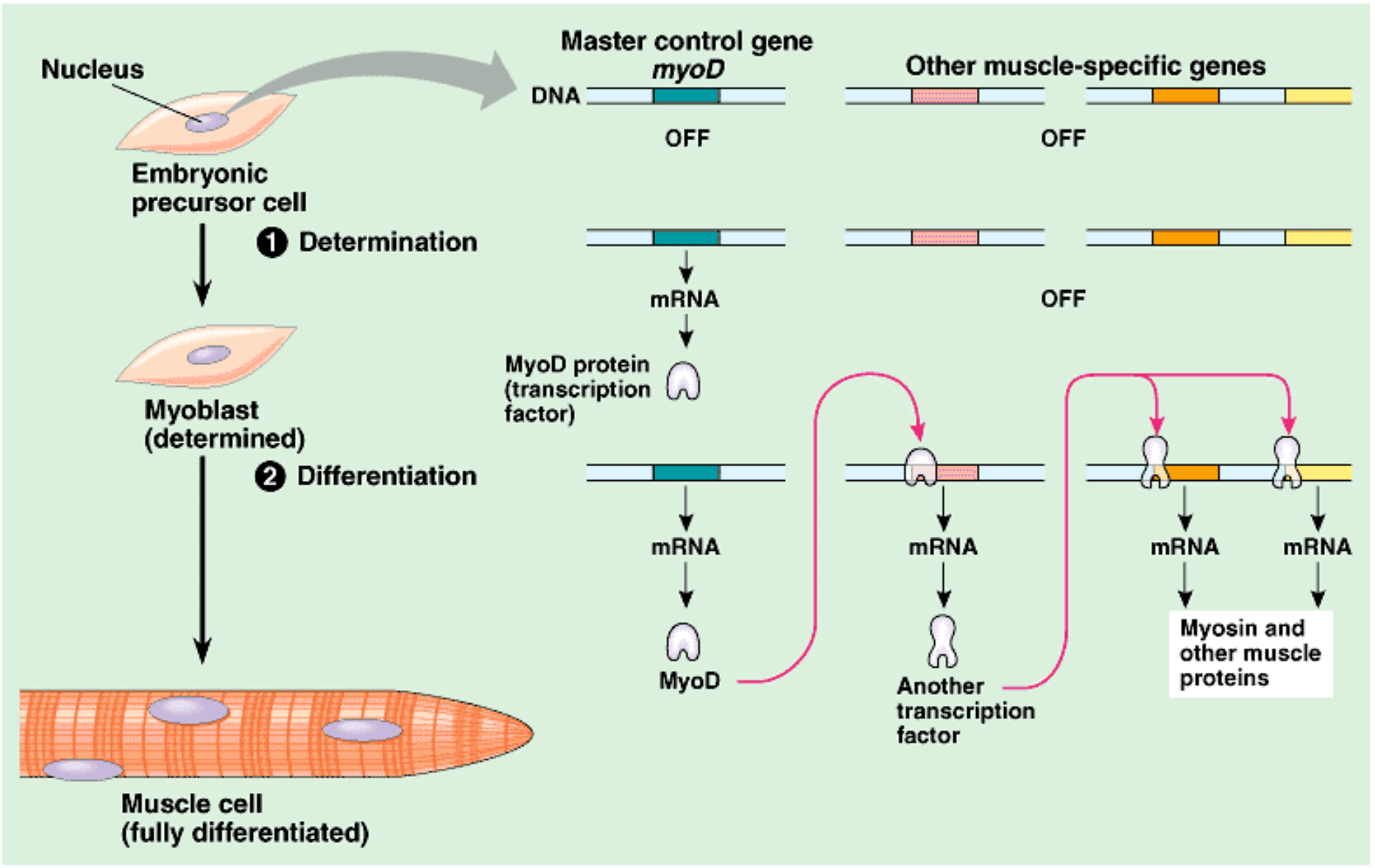

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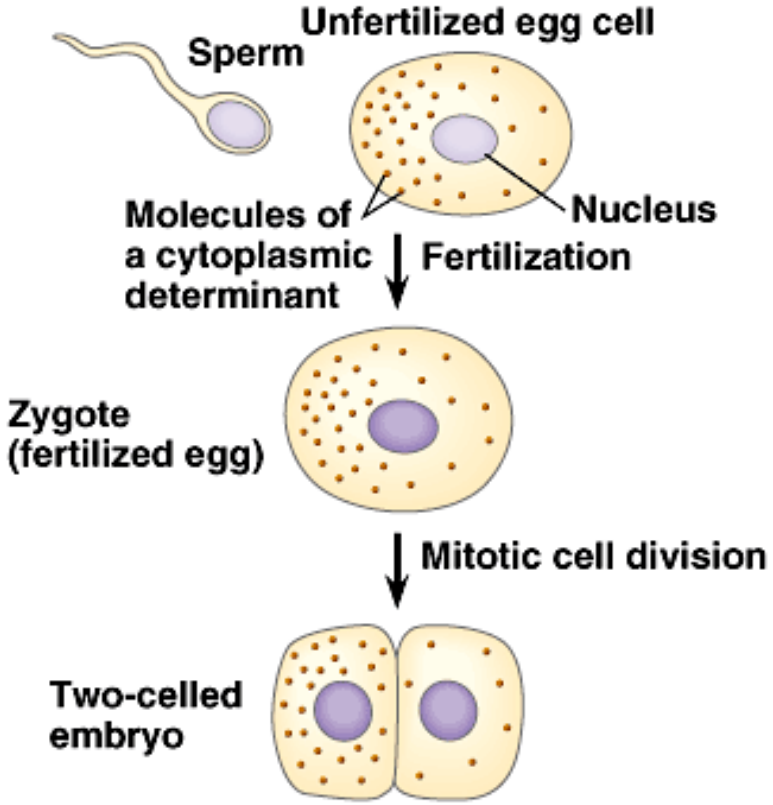
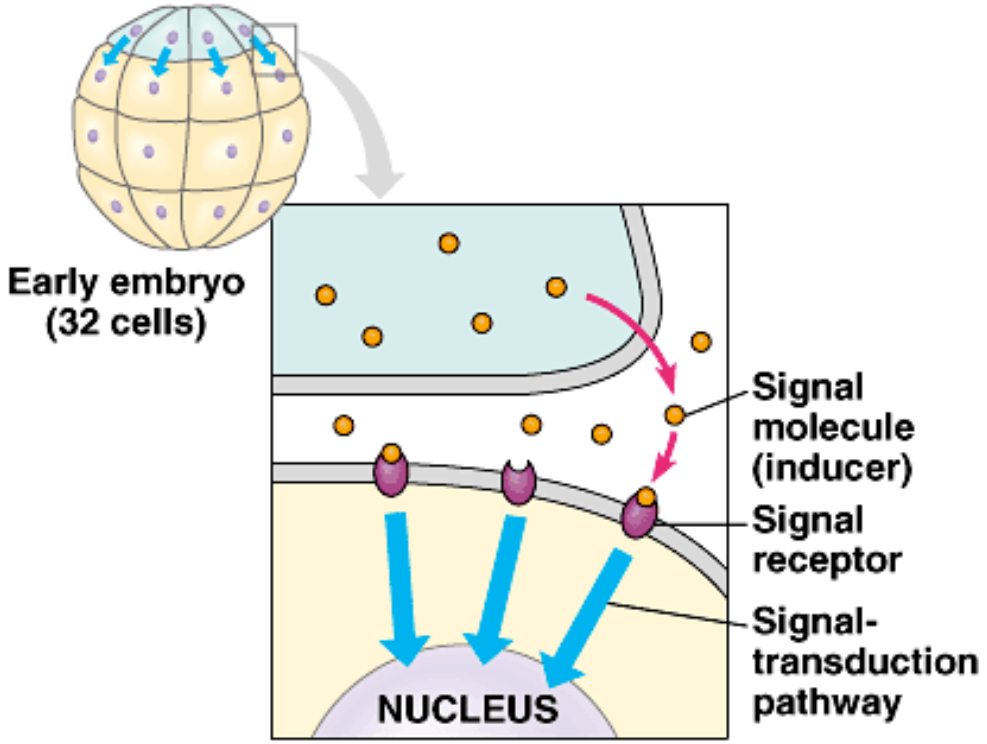


(a) Cytoplasmic determinants in the egg



(b) Induction by nearby cells

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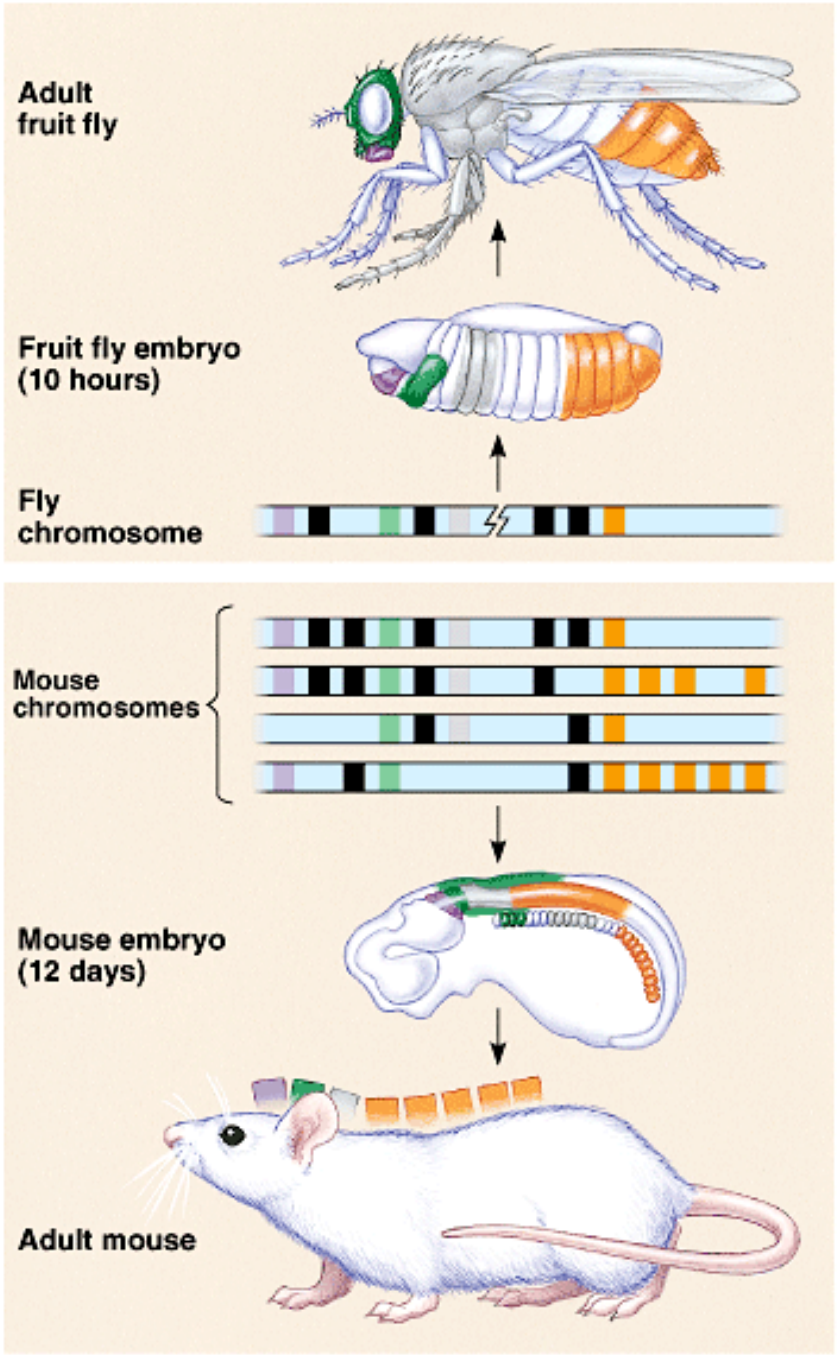

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