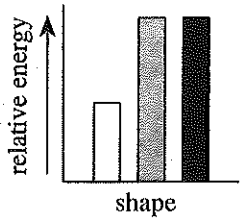
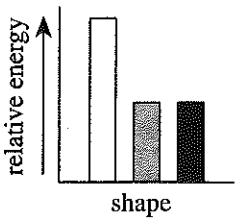
34. Which of the following diagrams showing the relationship between a given protein's shape and its relative energy is consistent with Scientist 2's assertions about the energy of proteins, but is NOT consistent with Scientist 1's assertions about the energy of proteins?

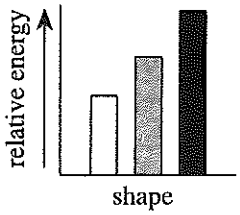
F.



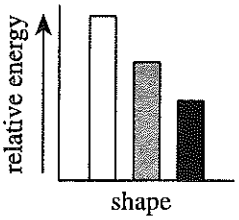
H.



G.



J.



Key
- randomly coiled shape
- active shape
- most stable shape

35. Scientist 2 says that a protein may be trapped in a moderately high-energy shape. Which of the following findings, if true, could be used to *counter* this argument?

A. Once a protein has achieved its tertiary structure, all of the folding patterns at the local level are stable.

B. Enough energy is available in the environment to overcome local energy barriers, driving the protein to its lowest-energy shape.

C. During protein synthesis, the secondary structure of a protein is determined before the tertiary structure is formed.

D. Proteins that lose their tertiary structure or quaternary structure also tend to lose their biological functions.

Passage VI

A *polypeptide* molecule is a chain of amino acids. A *protein* consists of 1 or more polypeptides. A protein's shape is described by 3 or 4 levels of structure.

1. The *primary structure* of a protein is the sequence of amino acids in each polypeptide.
2. The *secondary structure* of a protein is the local folding patterns within short segments of each polypeptide due to *hydrogen bonding* (weak chemical bonds).
3. The *tertiary structure* is the folding patterns that result from interactions between amino acid *side chains* (parts of an amino acid) in each polypeptide. These folding patterns generally occur across greater distances than those associated with the secondary structure.
4. The *quaternary structure* is the result of the clustering between more than 1 folded polypeptide.

A protein can adopt different shapes, and each shape has a relative energy. Lower-energy shapes are more stable than higher-energy shapes, and a protein with a relatively high-energy shape may *denature* (unfold) and then *renature* (refold), adopting a more stable shape. A protein that is almost completely denatured is called a *random coil*. Random coils are unstable because they are high-energy shapes; however, some can renature, adopting more stable shapes.

Two scientists discuss protein shape.

Scientist 1

The *active shape* (the biologically functional shape) of a protein is always identical to the protein's lowest-energy shape. Any other shape would be unstable. Because a protein's lowest-energy shape is determined by its primary structure, its active shape is determined by its primary structure.

Scientist 2

The active shape of a protein is dependent upon its primary structure. However, a protein's active shape may also depend on its *process of synthesis*, the order (in time) in which the amino acids were bonded together. As synthesis occurs, stable, local structures form within short segments of the polypeptide chain due to hydrogen bonding. These local structures may be different than the local structures associated with the protein's lowest-energy shape. After synthesis, these structures persist, trapping the protein in an active shape that has more energy than its lowest-energy shape.

29. According to the passage, protein shapes with relatively low energy tend to:

A. be random coils.
B. lack a primary structure.
C. become denatured.
D. maintain their shape.

30. The information in the passage indicates that when a protein is completely denatured, it still retains its original:

F. primary structure.
G. secondary structure.
H. tertiary structure.
J. quaternary structure.

31. Scientist 2's views differ from Scientist 1's views in that only Scientist 2 believes that a protein's active shape is partially determined by its:

A. quaternary structure.
B. amino acid sequence.
C. process of synthesis.
D. tertiary folding patterns.

32. A student has 100 balls. The balls are various colors. The student chooses 15 balls and aligns them in a row. The spatial order in which the balls were placed corresponds to which of the following levels of structure in a protein?

F. Primary structure
G. Secondary structure
H. Tertiary structure
J. Quaternary structure

33. Suppose proteins are almost completely denatured and then allowed to renature in a way that allows them to have their lowest-energy shapes. Which of the following statements about the proteins is most consistent with the information presented in the passage?

A. If Scientist 1 is correct, all of the proteins will have their active shapes.
B. If Scientist 1 is correct, all of the proteins will have shapes different than their active shapes.
C. If Scientist 2 is correct, all of the proteins will have their active shapes.
D. If Scientist 2 is correct, all of the proteins will have shapes different than their active shapes.

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