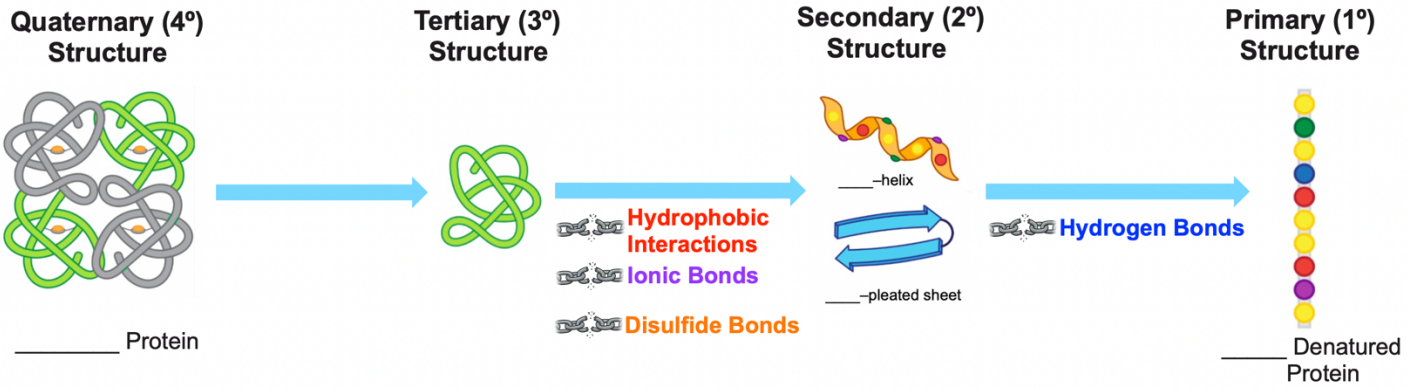
CONCEPT: PROTEIN DENATURATION

- A protein's structure and shape are critical to its _____ function.
  - □ **Denaturation:** Disruption of the ____, ____, or ____ structures of a protein.



  - □ Proteins can be denatured through different methods:

Method of Denaturation	Description	Bonds Disrupted
Heat	Temperatures above _____ can irreversibly disrupt nonpolar residue interactions.	□ _____ Interactions. □ Hydrogen Bonds.
Mechanical Agitation	Physical stress through kinetic action that stretches polypeptide chains.	□ Hydrophobic Interactions. □ Hydrogen Bonds. □ _____ Bonds.
pH	Changes in acidity and basicity alter the _____ on side chains.	□ _____ Bonds.
Heavy Metal Ions	Metals of Ag^{+}, Hg^{2+} or Pb^{2+} strongly bond to S atoms.	□ _____ Bonds.

EXAMPLE: Which of the following statements about protein denaturation is true?

a) Losing its overall shape, which is secondary structure, causes the protein to become inactive.

b) Lead poisoning would result in the disruption of glycine residues within a protein.

c) Whisking egg whites into a fluffy meringue is mechanical agitation.

d) Denaturation would disrupt amide bonds of a functional protein.

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PRACTICE: Which of the following would be an example of pH-based protein denaturation?

a) Frying bacon on a skillet.

b) Adding lemon juice to milk.

c) Kneading dough to create bread.

d) Thawing a bag of frozen shrimp.

PRACTICE: Which of the following statements about protein denaturation is true?

a) The amino acid sequence remains intact during and after denaturation.

b) Temperatures above 50ºC are enough to break peptide bonds.

c) All proteins will reform their shape after heat is removed.

d) Covalent bonds within the tertiary structure are strengthened.

PRACTICE: Which of the following statements is false?

a) Preparing a steak to medium rare is heat-induced protein denaturation.

b) Bacteria releasing lactic acid in milk is pH-based protein denaturation.

c) Histidine is susceptible to pH-induced protein denaturation.

d) Heavy metal ions form strong bonds to nonpolar residues.