Notes

Date

Complex:

1. Latency → Delay b/w stimulus & response.
2. Summation → Response resulting from summing 2 stimuli.
3. Warm Up or Facilitation or Motor Recruitment
4. Inhibition.
5. Feedback control.

Protein Denaturation

The bending and folding of the secondary structure into different shapes like spheres, rods or fibres yields the Tertiary structure of proteins. It brings about stearic relationships b/w amino acids which are far apart in linear sequence. The active sites (polar side chains) of the protein are brought forward towards the surface while other side chains (hydrophobic) are brought to the interior. The tertiary structure to form requires another Protein, Chaperonin which facilitates the complex folding.

Bonds in Tertiary Structure

1. Covalent Bonds – (i) Peptide Bond (ii) S-S disulphide linkage
2. Ionic Bonds – Attractive forces b/w 2 oppositely charged ionized group.
3. Hydrogen Bond – Sharing of H^+ by electronegative atoms.
4. Vander Walls Interaction – Charge fluctuations b/w 2 closely placed groups.
5. Hydrophobic Bond – 2 non-polar group.

Denaturation of proteins involves the disruption and possible destruction of both secondary & tertiary structure to yield linear random polypeptides. The denaturation reactions are however not strong enough to break peptide bonds hence, the primary structure remains intact. The main target for denaturants (agents causing denaturation) are the bonds that establish the respective secondary & tertiary structure of proteins. There are various types of different ways by which a protein can be denatured.

Notes

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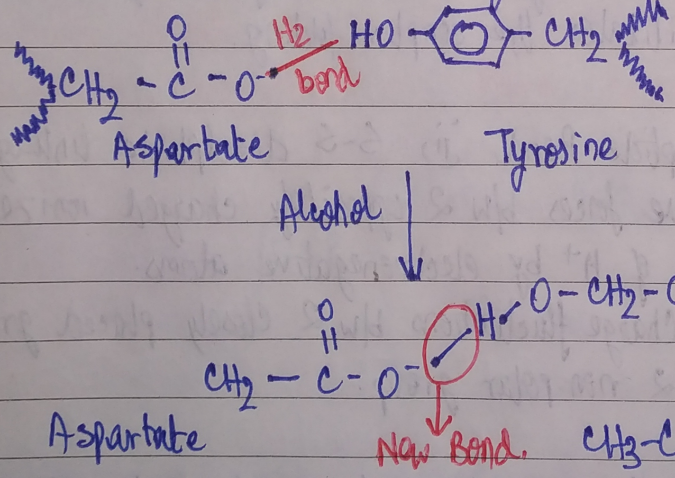
Heat → Disrupts the Hydrogen bonds and nonpolar hydrophobic interactions. Heat increases the kinetic energy and causes the molecules to vibrate so quickly and violently that the bonds are broken.
eg. Coagulation of Albumin in Egg during Cooking.
Sterilization to denature proteins of pathogens.

Alcohol → H_2 bonds between the amide groups in secondary structure and between the side chains in the tertiary structure are disrupted by adding another alcohol. 70% alcohol used as a disinfectant penetrates bacterial cell wall & denatures cellular proteins & enzymes. 95% alcohol coagulates protein on the outer surface of cell wall. The disruption of the existing H_2 bonds in the side chain and further establishment of new H_2 bonds b/w the alcohol & side-chains of the protein is the mechanism of alcohol induced denaturation.



pH - Acids & Bases → Salt bridges result from the neutralization of an acid and amine on side chains. The final interaction is ionic b/w the positive ammonium group and the negative acid group. Any combination of various acidic or amine amino acid will have this effect.
Acids & Bases disrupts salt bridges held together by ionic charges. A type of double replacement reaction occurs where positive and negative ions in the salt change partner with anions and cations in the new base or acid respectively.

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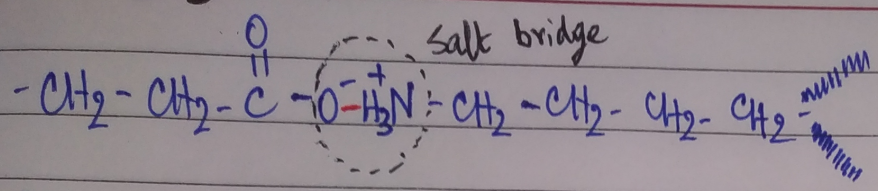
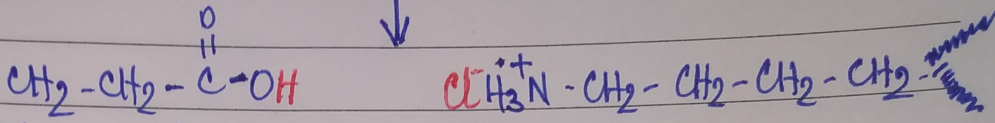
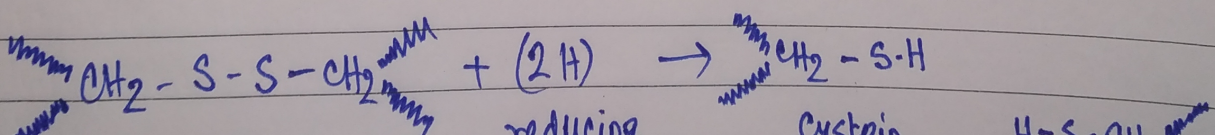


Glutamic Acid Lysine

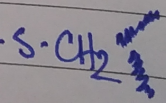


Glutamic Acid Lysine.

Heavy Metals → Heavy metal salts disrupts salt bridges in the same manner as Acids & Bases. Heavy metal salts usually contain Hg^{2+}, Pb^{2+}, Ag^{1+}, Cd^{+2} The reaction of a heavy metal salt with a protein usually leads to the formation of an insoluble metal protein salt. This reaction is used in disinfection.
eg. $AgNO_3$ used to prevent nose and throat infections.
Mercurochrome (Mercury salts) prevents infections in wounds.
In case of poisoning by a heavy metal, the person is made to eat milk or egg whites containing proteins which can precipitate the heavy metal salt. Once formed the precipitate can be removed by inducing vomitting by medicines. Heavy metals may also disrupt the S-S bonds because of their high affinity and attraction for sulphur. Oxidizing agents induce the formation of the S-S bonds while reducing agents disrupts these bonds.



Cystein reducing agent Cystein



Cystein.