Protein Denaturation

SOME IMPORTANT POINTS TO PONDER UPON

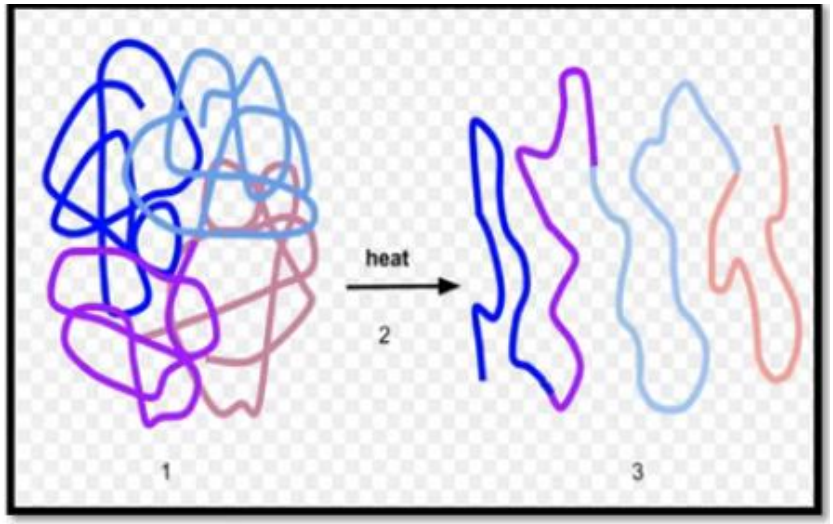
- Denaturation is the process in which protein lost its native confirmation.
- It basically involves the disruption & possible destruction of both secondary & tertiary structures.
- Denaturation mainly breaks covalent & non-covalent bonds, but they are not strong enough to break peptide bonds.
- So, the primary structure (sequence of amino acid) remains same after the denaturation process.
- The most common observation in the denaturation process is the precipitation or coagulation of the protein.

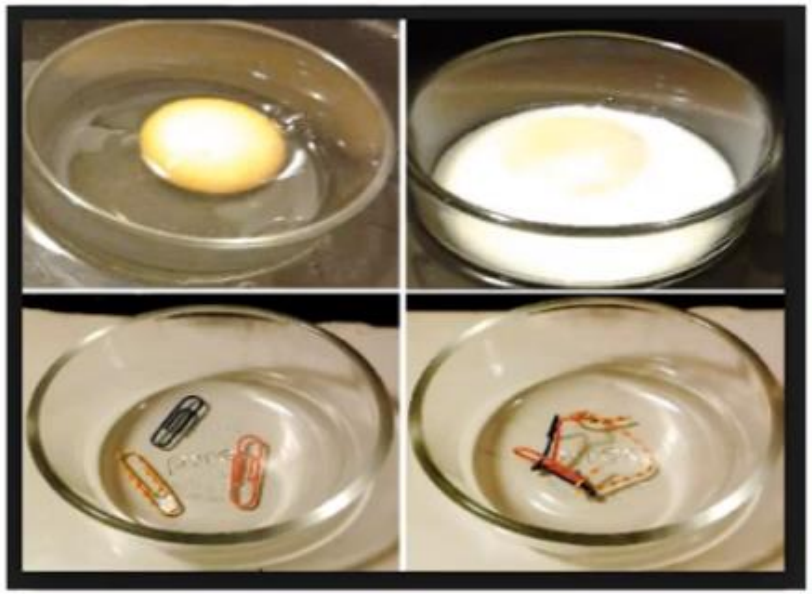
Various Denaturing agents

- HEAT
- STRONG ACIDS
- STRONG BASES
- DETERGENTS
- REDUCING AGENTS
- HEAVY METAL IONS

1. Heat

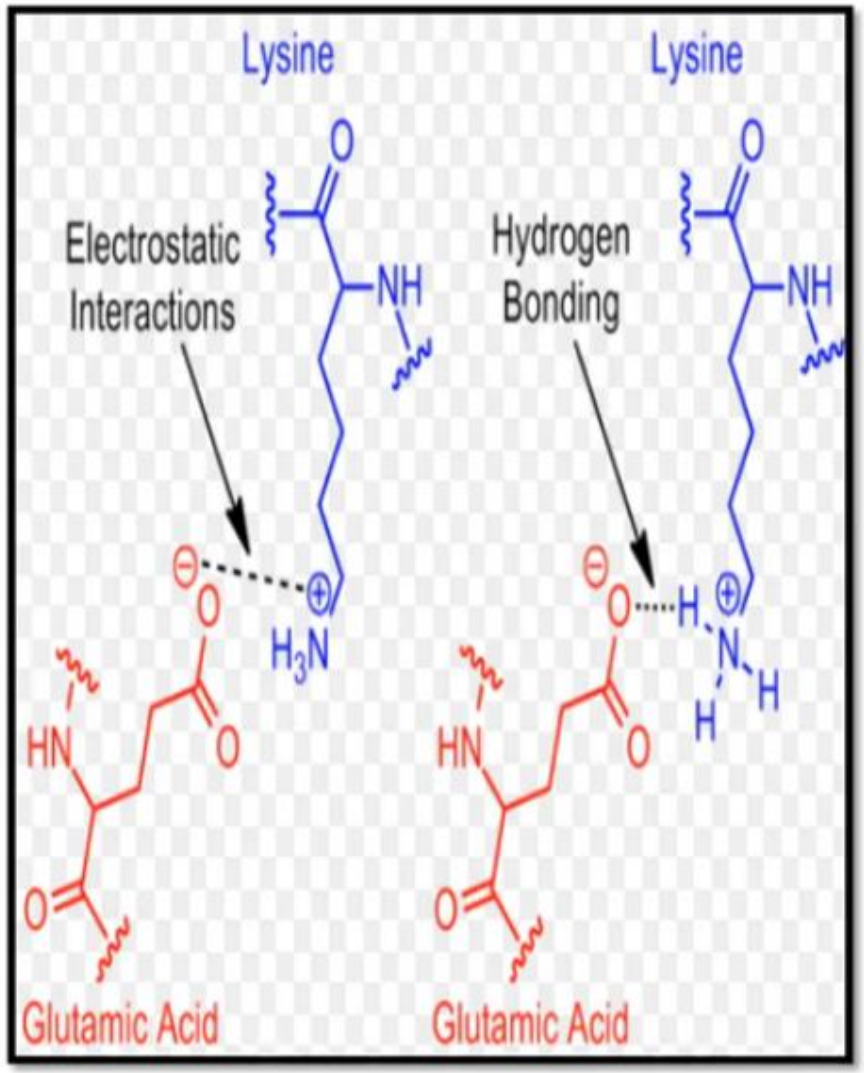
- Heat can be used to disrupt hydrogen bonding & non polar hydrophobic interactions.
- The mechanism behind it is, increase in kinetic energy, which causes molecules to vibrate rapidly & violently because of which bonds/interactions are disrupted.
- Example: the proteins in egg denature & coagulate during cooking.
- Medical instruments are sterilized by heating to denature proteins in bacteria & thus destroy it.



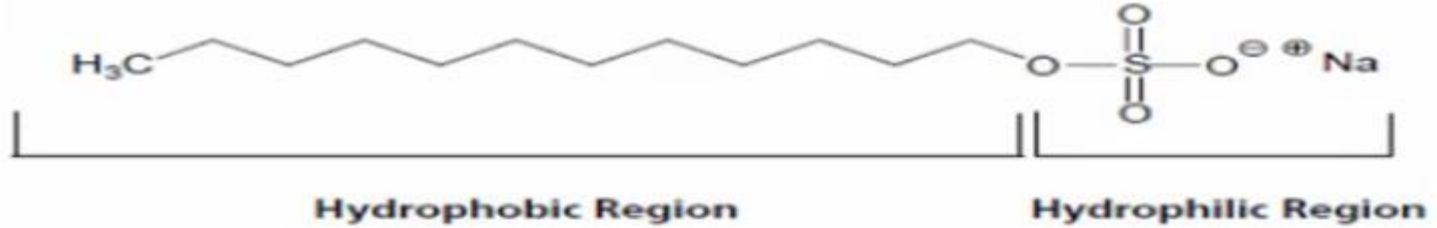


2. Strong Acids & Bases

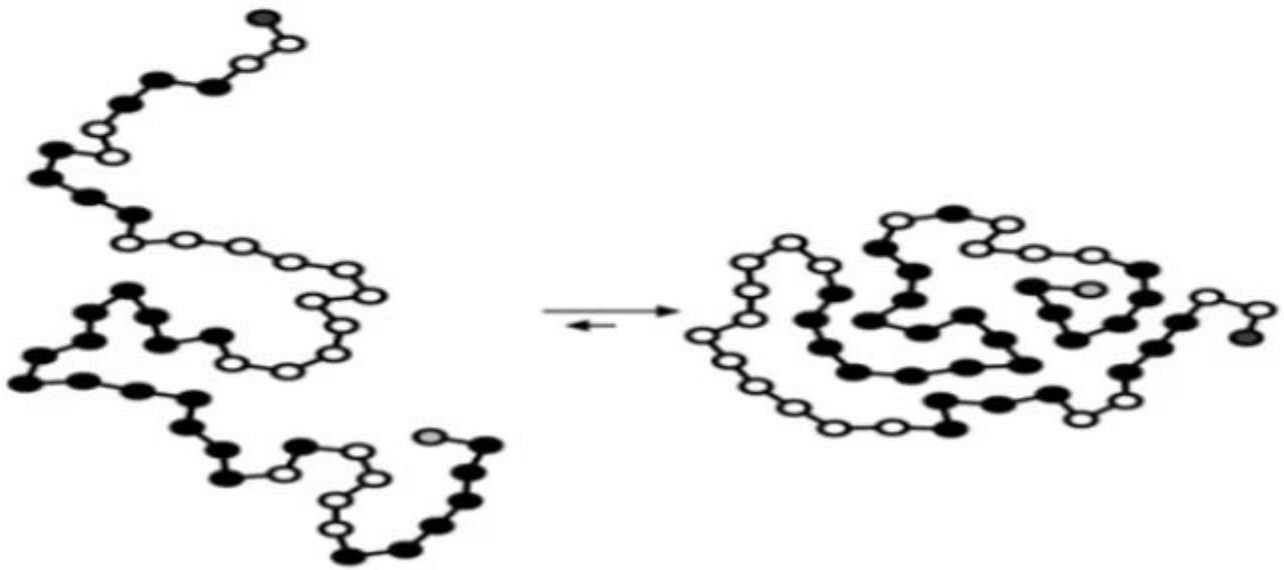
- Acids & Bases basically disrupts the salt bridges formed in a protein structure.
- Mechanism involves the change in pH, which further results in protonation or deprotonation of the side groups of protein.
- It alters the hydrogen bonding & Salt bridge patterns.
- Example: this reaction occurs in the digestive system, where the acidic gastric juices cause the curdling (coagulating) of milk.



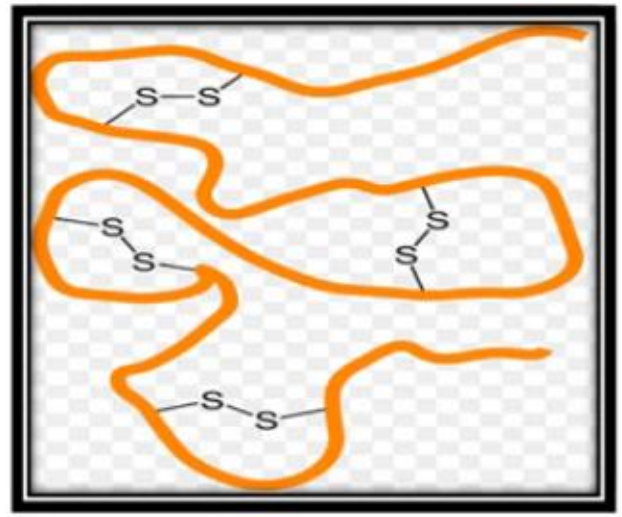
3. Detergents



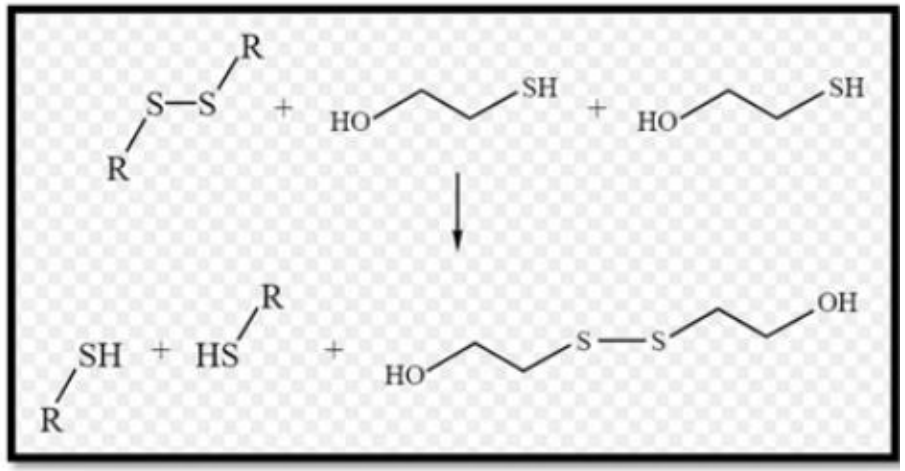
- Detergents are amphipathic molecules which disrupts hydrophobic interactions.
- The result is the unfolded protein structure that turns into extended polypeptide chains.



4.Reducing Agents



- Reducing agents such as β-mercaptoethanol reduces the disulphide bonds to sulfhydryl groups & breaks intra and interchain disulphide bonds.
- Disulphide bonds are formed by oxidation of the sulfhydryl groups on cysteine.
- If oxidizing agents cause formation of a disulphide bonds, then reducing agents of course will spilt it apart.
- Basically, reducing agents add hydrogen atoms to make the thiol group, -SH.



5. Heavy Metal Ions

- Heavy metal salts act to denature proteins in the much same manner as acids & bases.
- Heavy metal usually contain Hg^{+2} , Pb^{+2} & other metals with high atomic weights.
- Since salts are ionic, they disrupt salt bridges in proteins.
- The reaction of a heavy metal salt with a protein usually leads to an insoluble metal salt protein.