

# Structure of proteins

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# OBJECTIVES:

- Tertiary Structure
- Domains
- Stabilizing interactions.
- Chaperones in Protein folding
- Quaternary Structure

# Tertiary Structure:

- **Three dimensional** structure of the whole protein.
- Amino Acids are far apart from each other in the linear sequences.
- But Amino Acids are close in the three dimension.
  
- The tertiary structure acquired by native protein ,is always thermodynamically most stable.

# Flavodoxin Protein Structure

## Structure Consist of

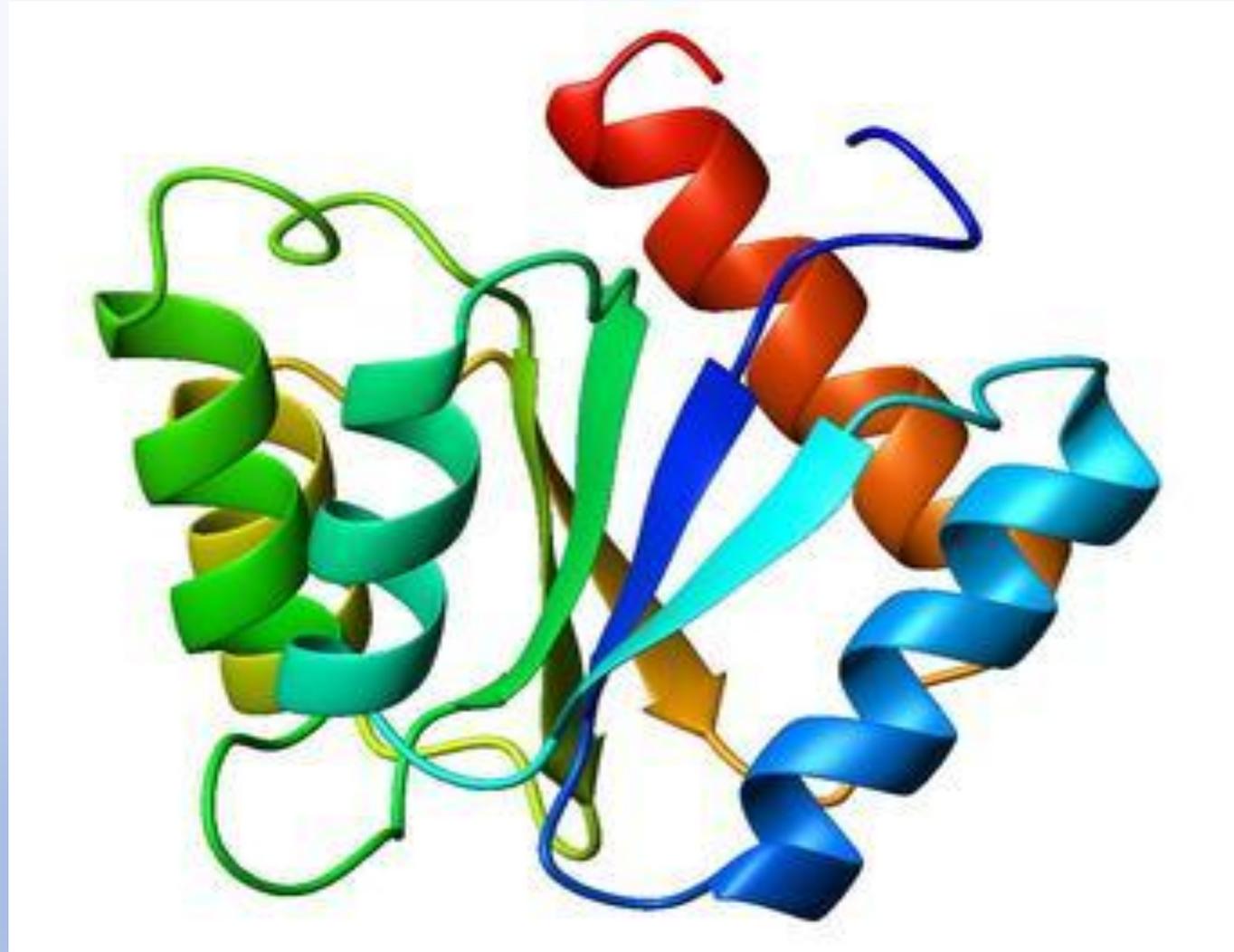
- 140-180 Amino Acid structure.
- 5 alpha Helix
- 4 Beta Plated sheet
- One chain
- One protein present.

## Question :

- Where is 1st AA and Last AA ?
- Are they near to each other ?
- Are they near i sequence ?

## Conclusion :

Amino Acid far apart in linear Sequence ,But close in three dimension structure.



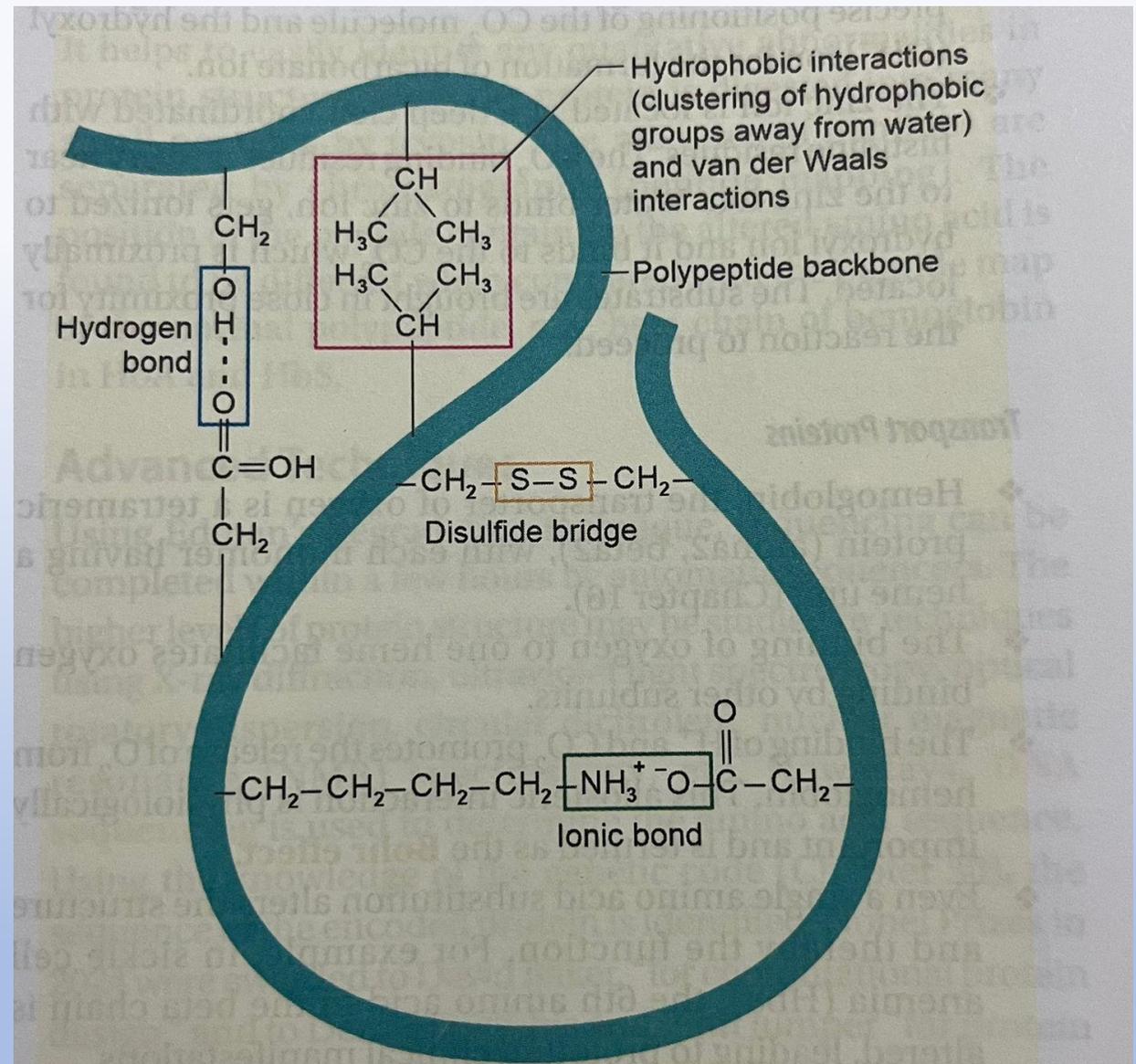
# Domain:

- Compact Globular Functional Unit of a protein.
- ( For Bike drive/ Computer typing , shoulder –Hand make structure =Domain)
- Each domain forms a compact three dimensional structure.
- Polypeptide chains that are >200 amino acids in length ,consist of two or more domains.
- Core of a domain is built from combinations of motifs(supersecondary structural elements)
- Folding of the peptide chain within a domain usually occurs independently of folding in other domains..

# Stabilizing Interactions:

The following four types of interactions cooperate in stabilizing the tertiary structure of globular protein.

- A) Disulfide bonds
- B) Hydrophobic interactions.
- C) Hydrogen bonds.
- D) Ionic interactions.



# Chaperones in Protein Folding:

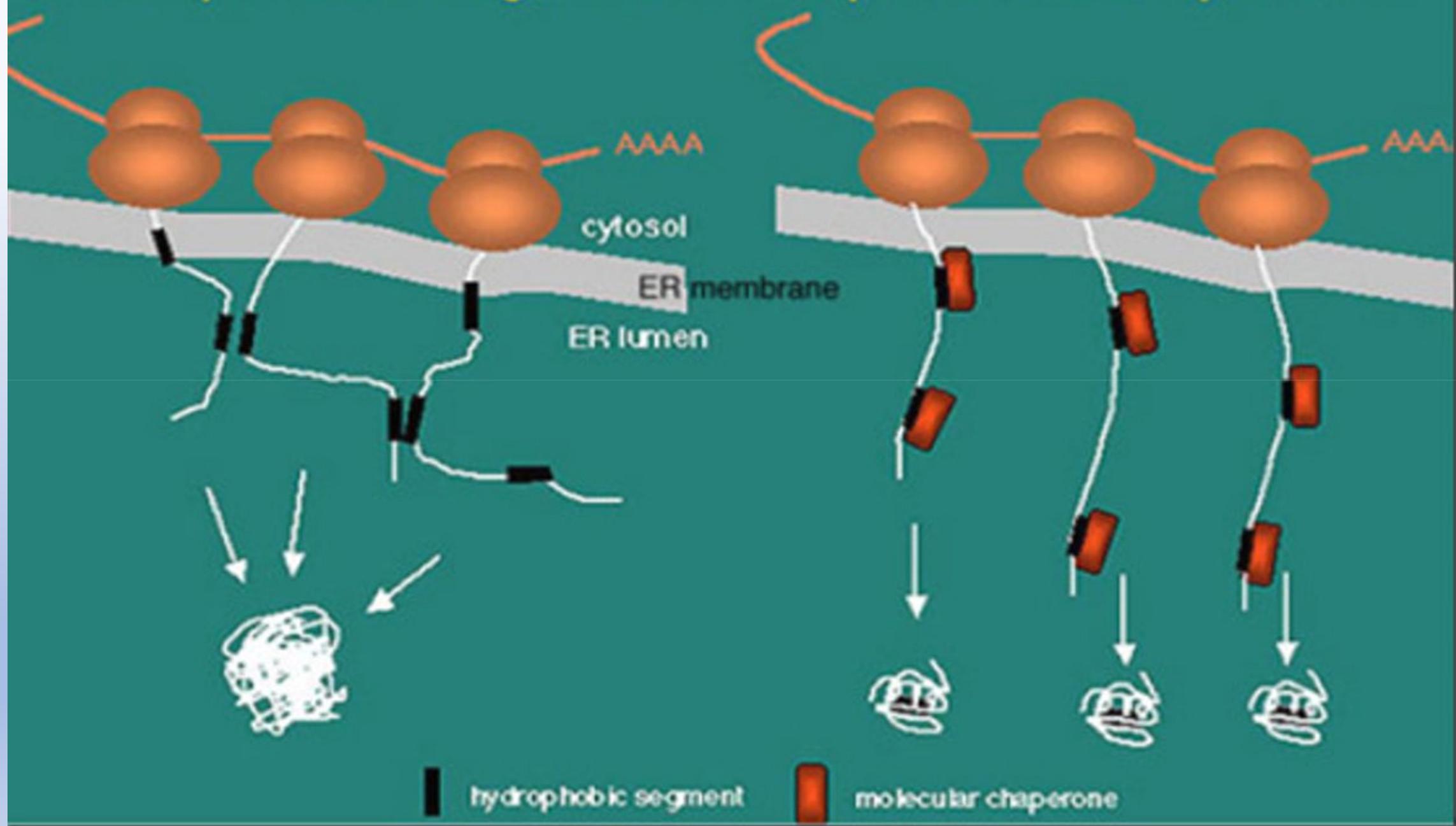
- **What is Chaperones**

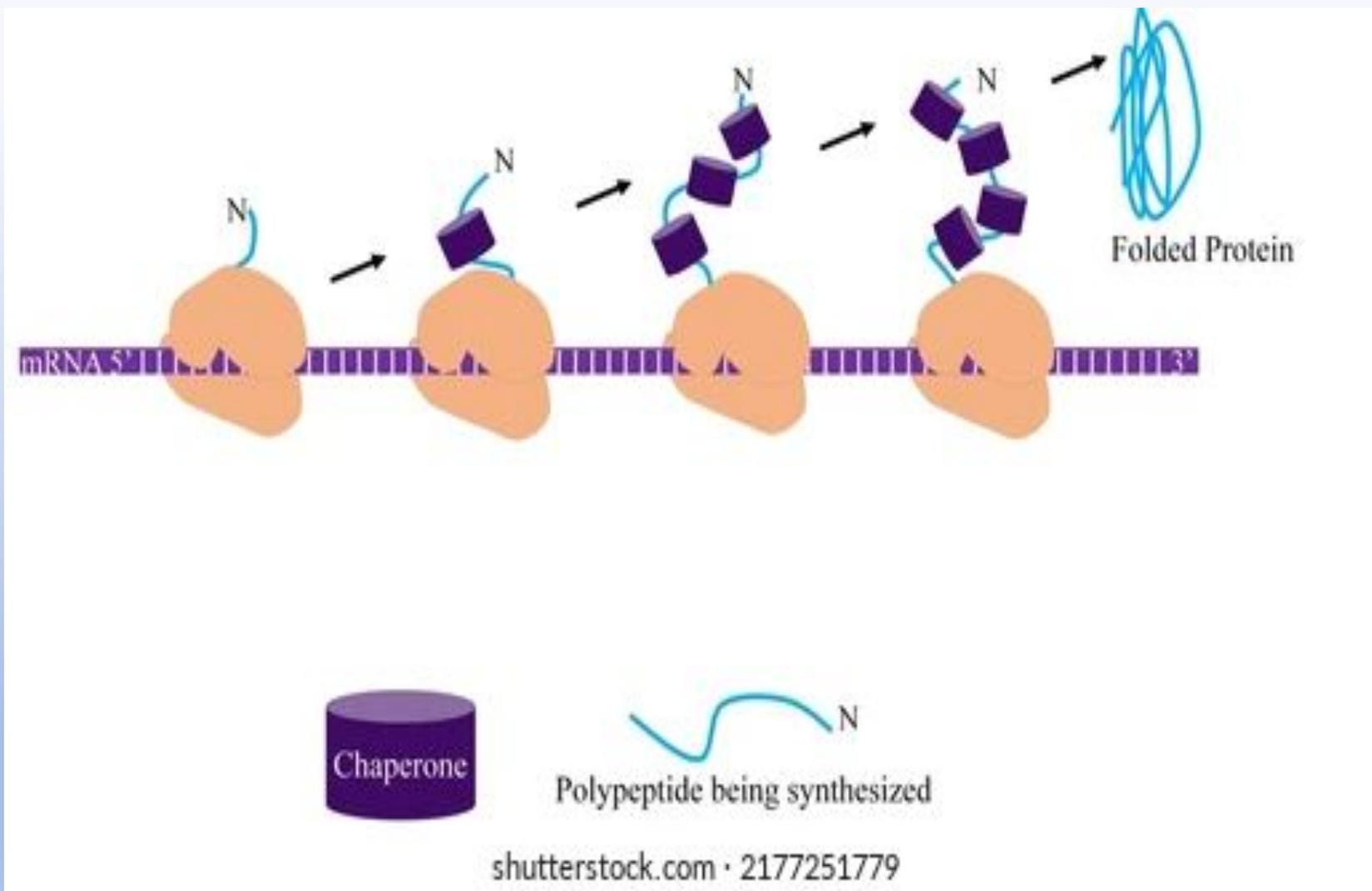
- ✓ group of proteins
- ✓ also known as **Heat Shock Protein(HSP)**
- ✓ helps in proper folding of proteins.(newborn to first year)

- **What is function of Chaperones**

- ✓ Protein folding starts with stages its synthesis.
- ✓ Folding does not wait for synthesis be totally completed.
- ✓ Chaperones ,interact with the polypeptide at various stages during the folding process.
- ✓ Some chaperones keeps protein unfolded until its syntesis is finished
- ✓ Some denatured protein can not be re-folded properly,
- ✓ (Second year UG students. Normal to CRF )

# In vivo protein folding in absence or presence of chaperones







CHAPERONS : 1. De bourgeois (xive s.) ; 2. De noble (xve s.) ;  
3. De noble (xvii<sup>e</sup> s.) ; 4. De veuve (xive s.) ; 5. Moderne  
(de magistrat).

# Quaternary Structure:

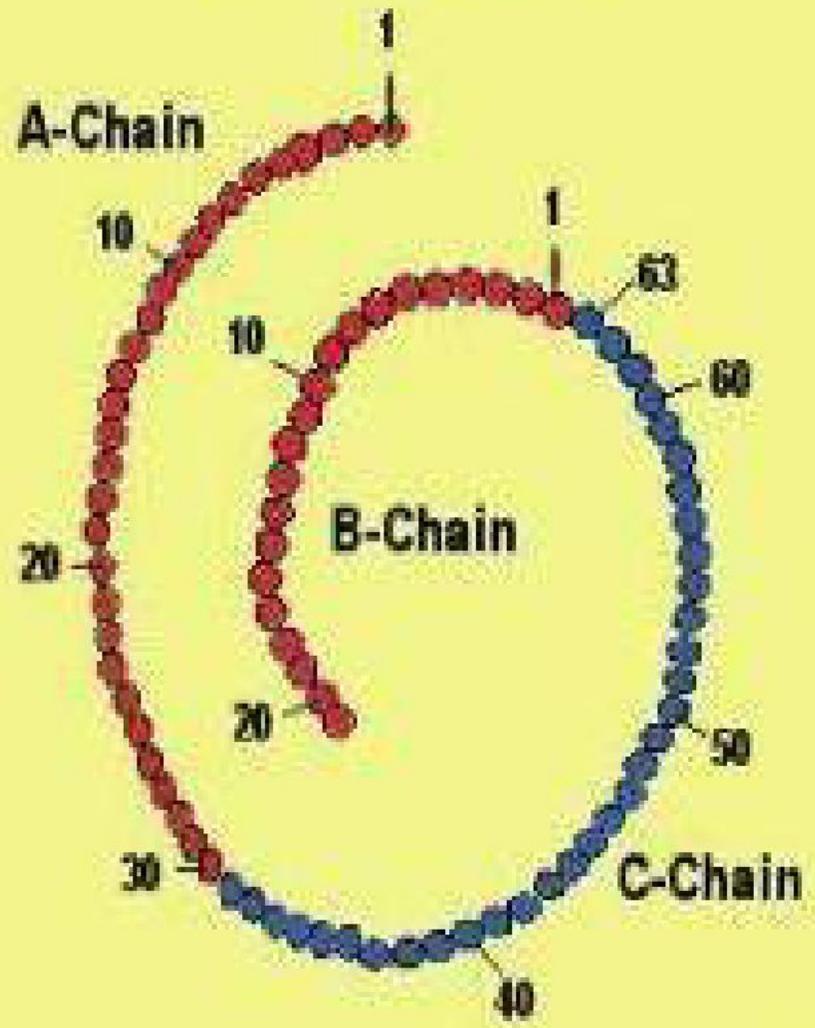
- 2 or more than 2 polypeptide chain will aggregate to form one functional protein
- Depending on the number of the polypeptide chain , the protein may be termed as a dimer(2 chain), tetramer(4 chain)
- HOMODIMER = Two copies of the same polypeptide chains.
- HETERODIMER = Two different types of polypeptides as a functional unit.
- For example: Hemoglobin = 2 alpha and 2 beta chains

Immunoglobulin G = 2 heavy & 2 light chains

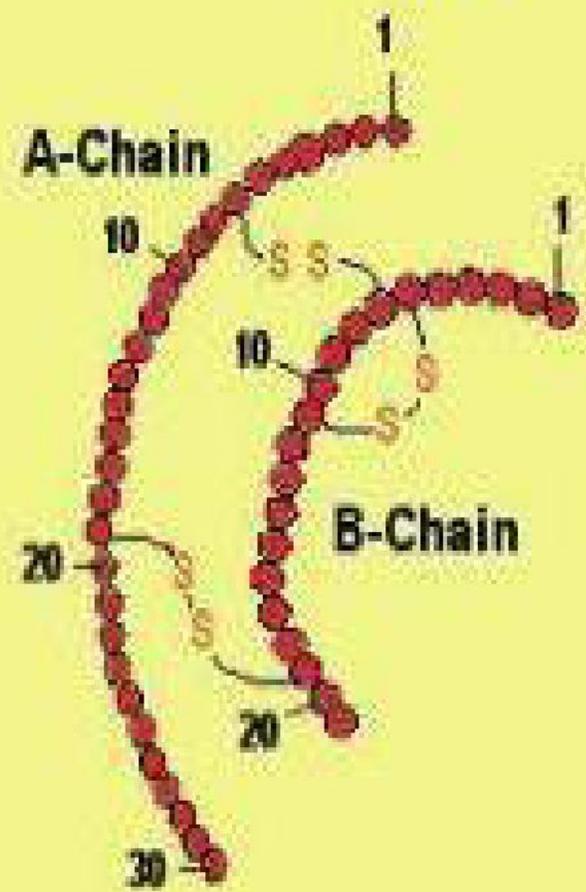
Creatine kinase is dimer & Lactate dehydrogenase is a tetramer.

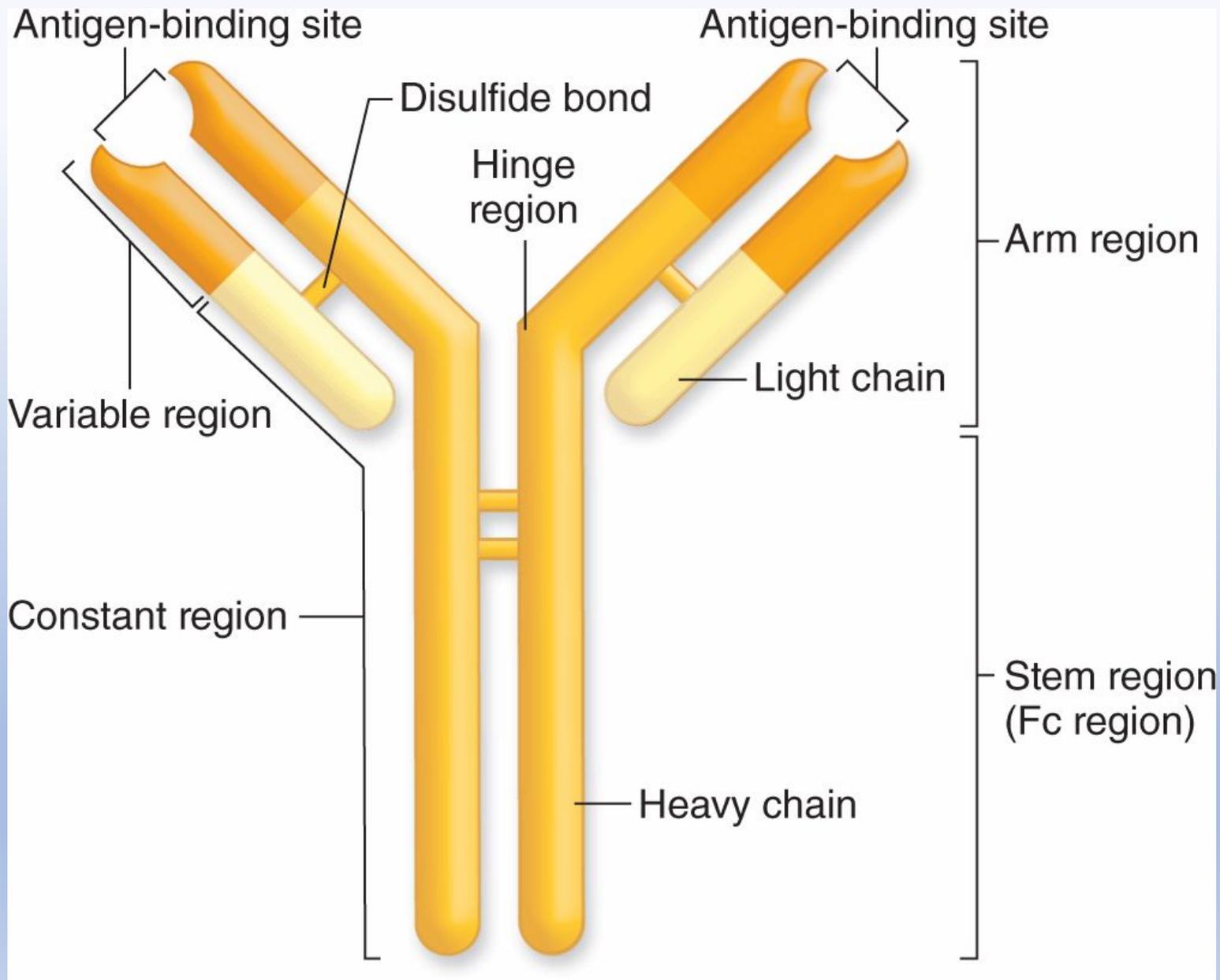
- The forces that stabilizes quaternary structures
  - ✓ hydrogen bonds,
  - ✓ electrostatic bonds,
  - ✓ hydrophobic bonds and
  - ✓ van der waals forces.

# Pro-Insulin



# Insulin





**1) The tertiary structure of a protein is primarily stabilized by which of the following interactions?**

a) Ester bonds

b) Hydrogen bonds only

c) Disulfide bonds, hydrophobic interactions, Hydrogen bonds ,ionic bonds

d) Glycosidic bond

**2) Which Amino Acid is involved in disulfide bond formation ?**

a) Methionine

b) Serine

c) Cysteine

d) Tyrosine

### **3) What is primary role of chaperons in protein structure?**

- a) To Synthesize amino acids.
- b) To make polypeptide chain.
- c) To assist newly synthesized polypeptides in proper folding.
- d) To transport proteins across the cell membrane.

**4) Denaturation of a protein usually results in loss of :**

- a) Primary and Secondary Structures
- b) Secondary and Tertiary Structures
- c) Tertiary structure only
- d) Quarternary structure only

## 5) what is correct about myoglobin & hemoglobin from below given option?

- a) Myoglobin has tertiary structure while hemoglobin has quaternary structure
- b) Myoglobin has quaternary structure while hemoglobin has tertiary structure
- c) Both have tertiary structure
- d) Both have quaternary structure



**THANK YOU**