Levels of protein structure

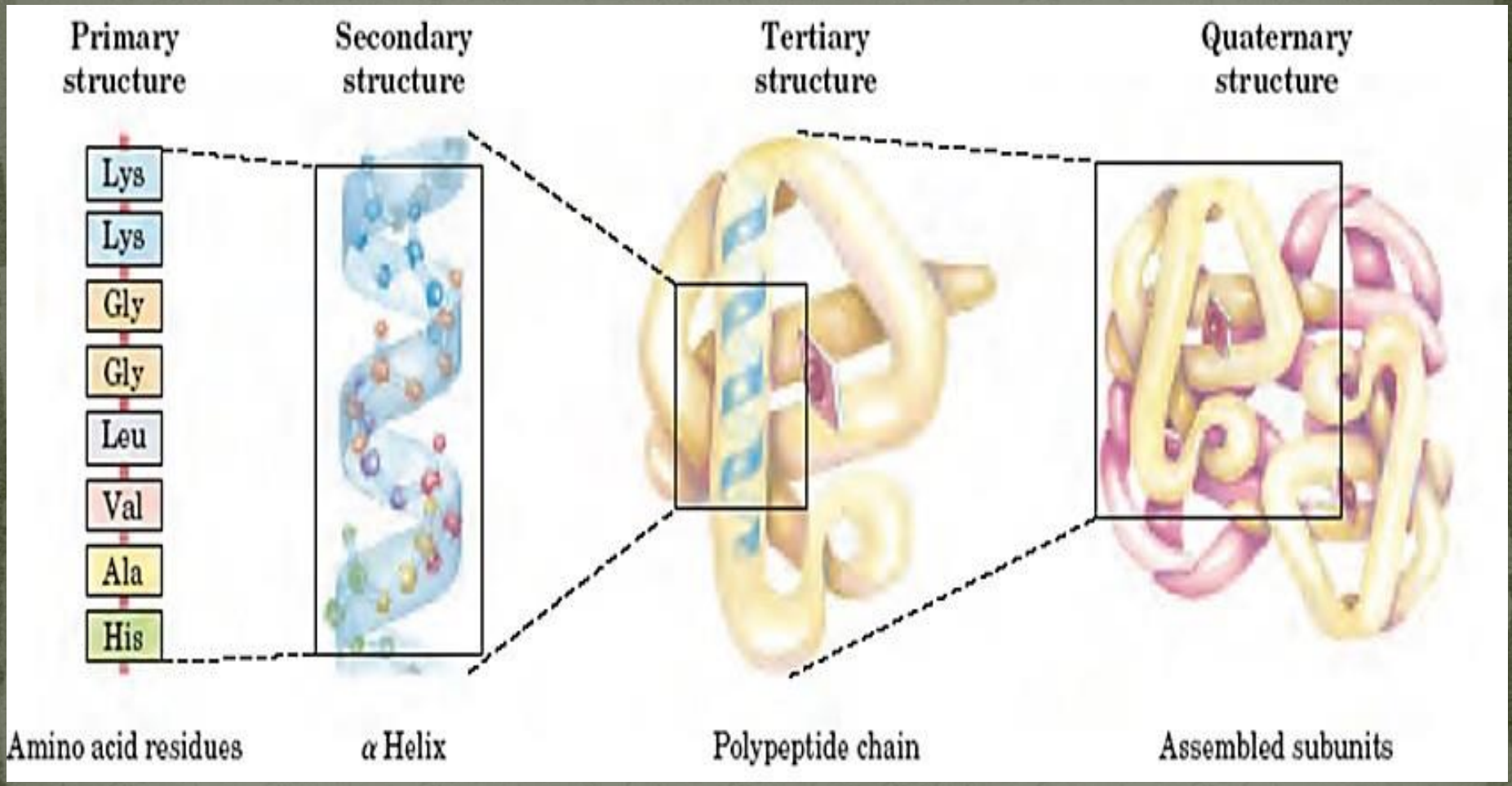
- Primary (1^o)
- Secondary (2^o)
- Tertiary (3^o)

organizes folding within a single polypeptide

- Quaternary (4^o)

interactions between two or more polypeptides that make a protein

Levels of Protein Structure:



Levels of protein structure

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Primary (1°) Structure

- unique sequence of amino acid
- sequence determined by DNA
- a slight change in primary structure can affect a protein's conformation and ability to function

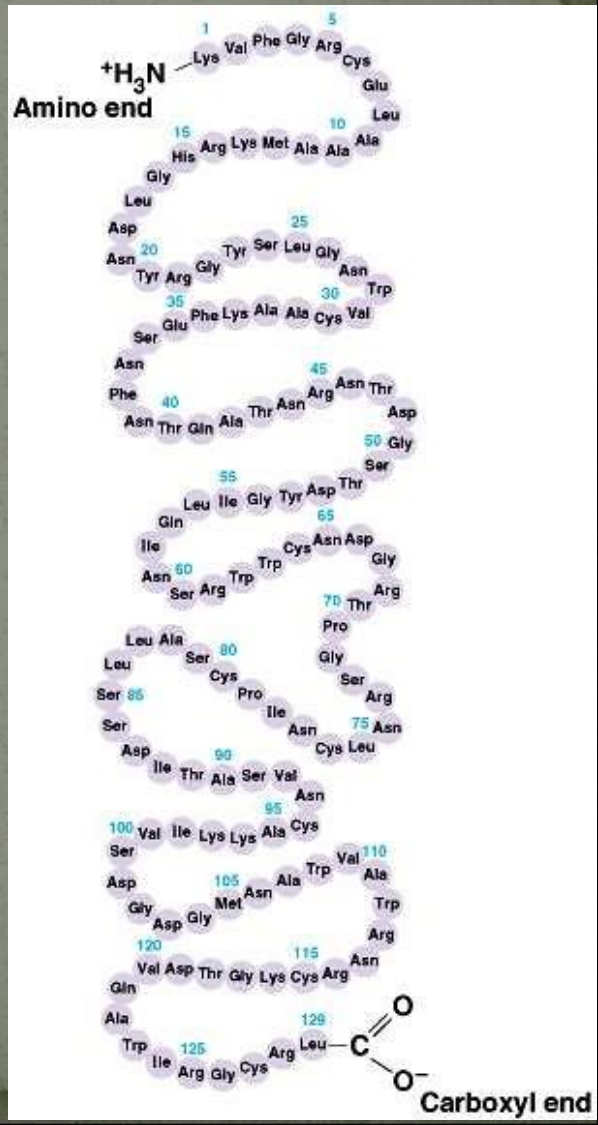
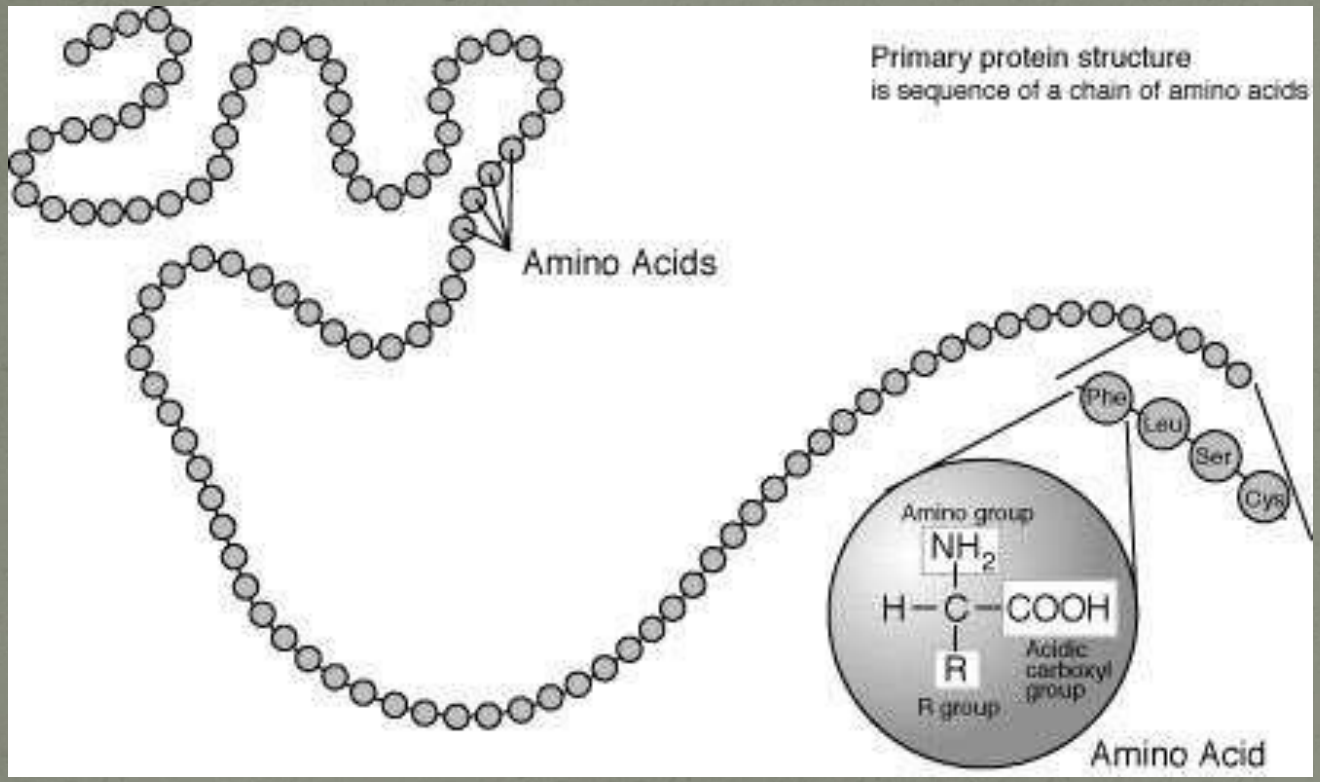


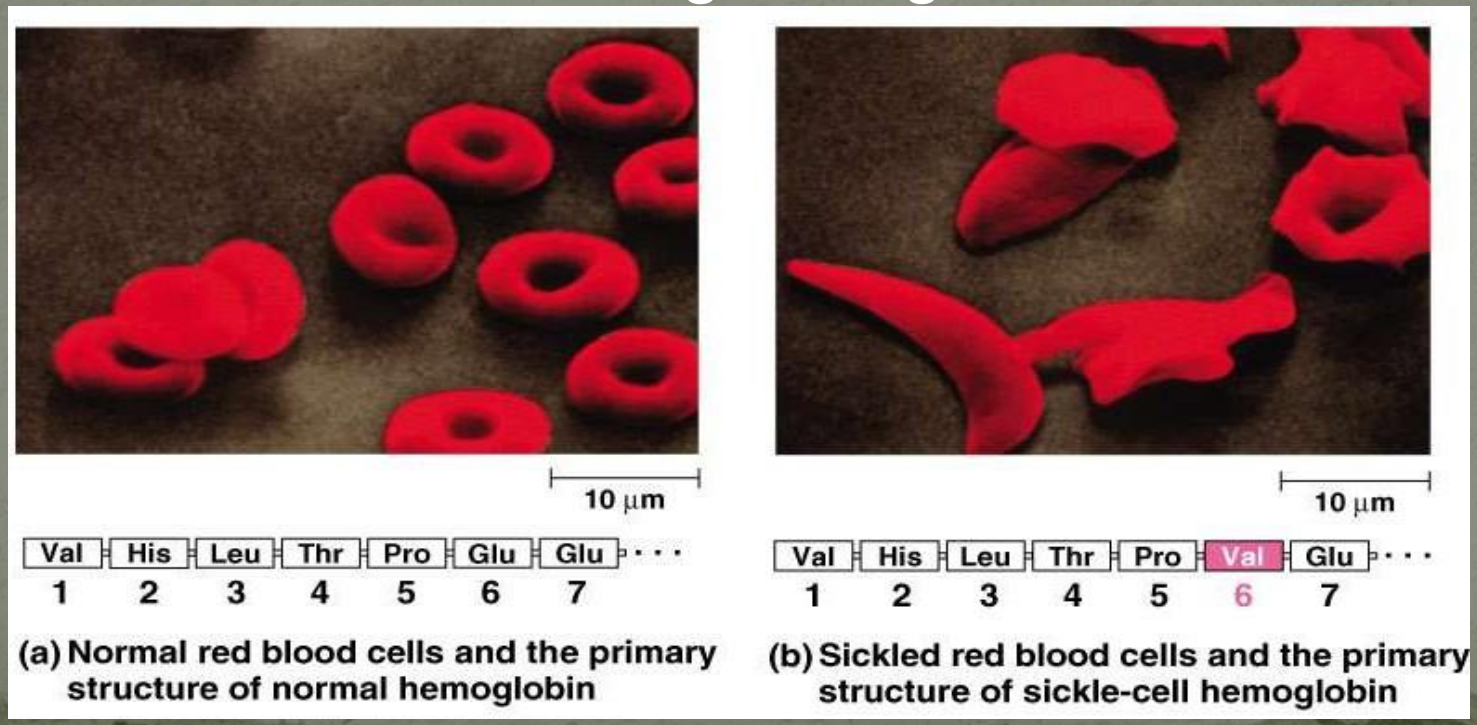
Fig. 5.18

Primary (1°) Structure



Example: Sickle Cell Anemia

- abnormal hemoglobin develop because of a single amino acid substitution (change)
- causes hemoglobin to crystallize, deforming the red blood cells and leading to clogs in blood vessels.

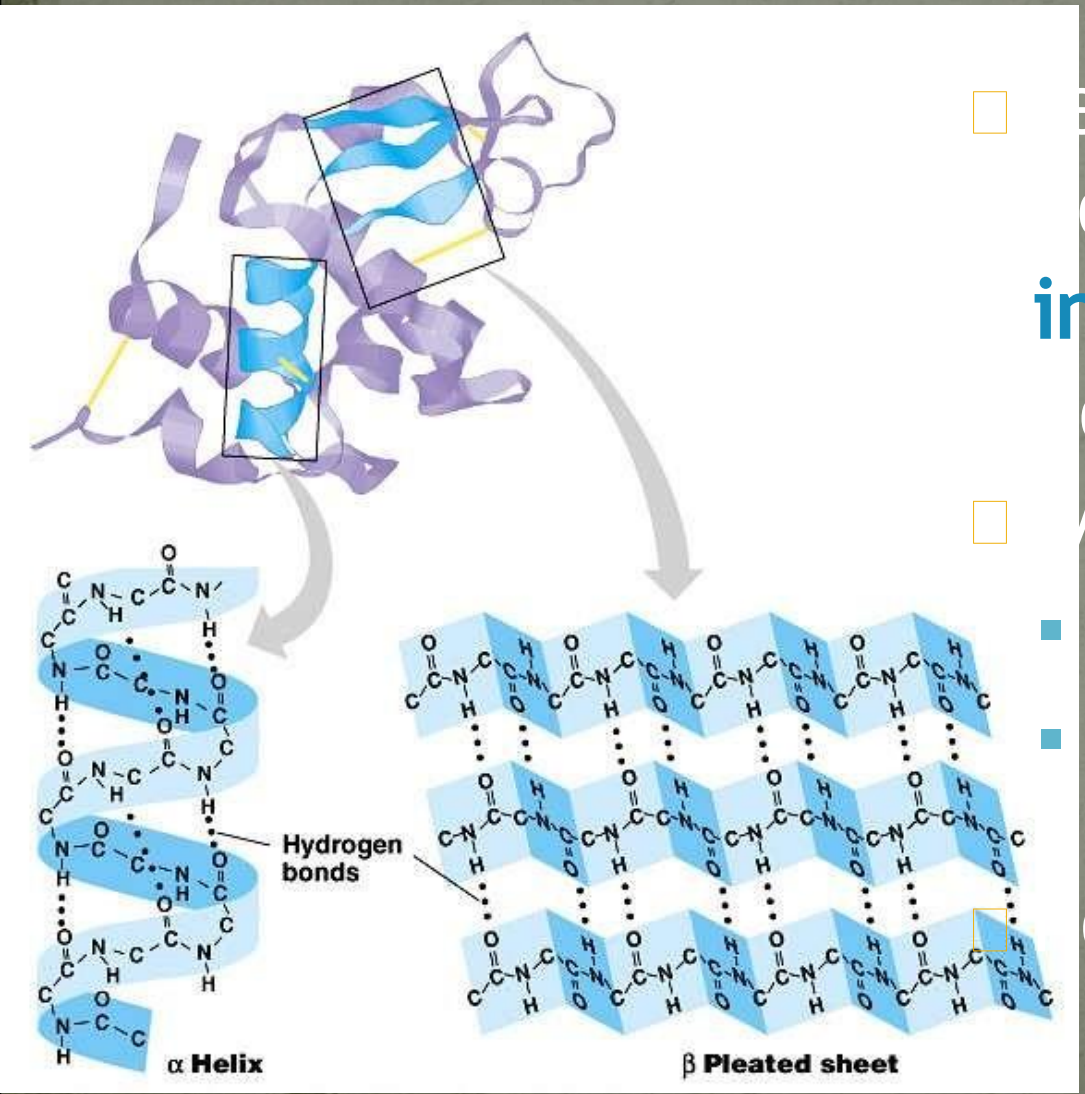


(a) Normal red blood cells and the primary structure of normal hemoglobin

(b) Sickled red blood cells and the primary structure of sickle-cell hemoglobin

Fig. 5.19

Secondary (2°) Structure



- esults from **hydrogen** onds at **regular intervals** along the olypeptide **backbone**
- ypical shapes:
  - alpha helix (coils)
  - beta pleated sheets (folds)
- ot found in all proteins

Fig. 5.20

Tertiary (3°) Structure

Interactions between:

- R groups and R groups
- R groups and backbone

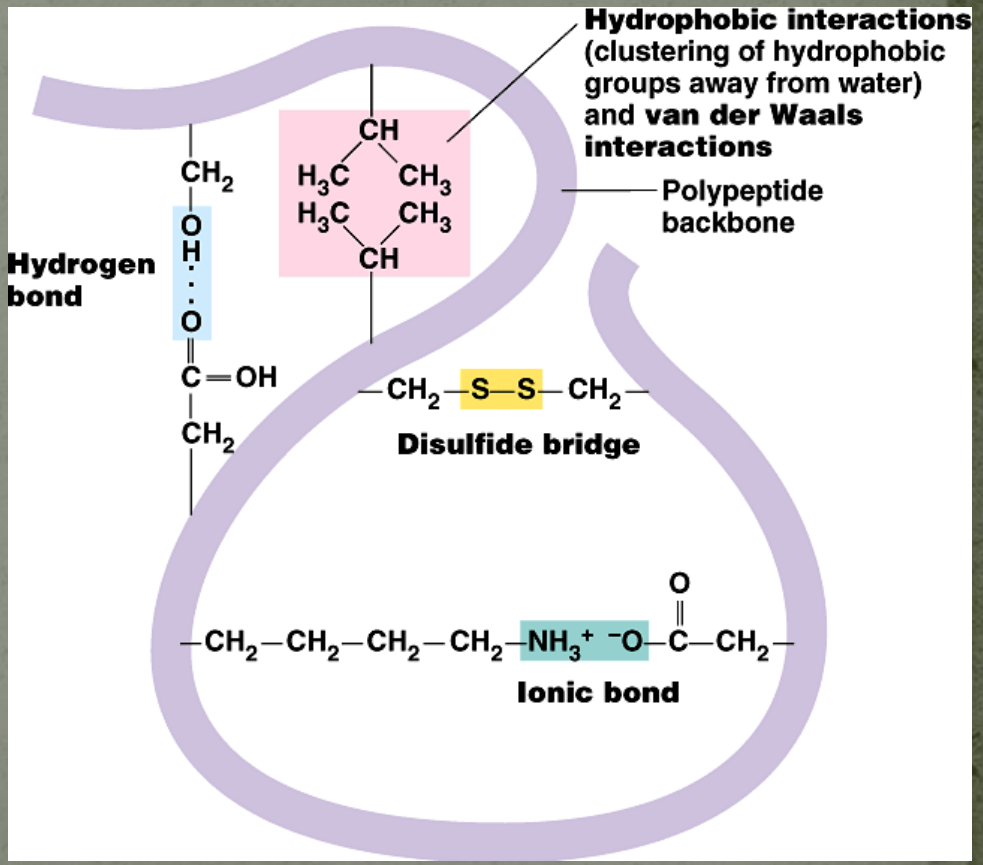


Fig. 5.22

Tertiary (3°) Structure

Types of interaction:

- **Hydrogen** bonds
- **Ionic** bonds
- **Hydrophobic** interactions
  - often in interior of protein
- **Covalent** bonds
  - **Disulfide bridge**: formed between the sulfhydryl groups (SH) of cysteine amino acids

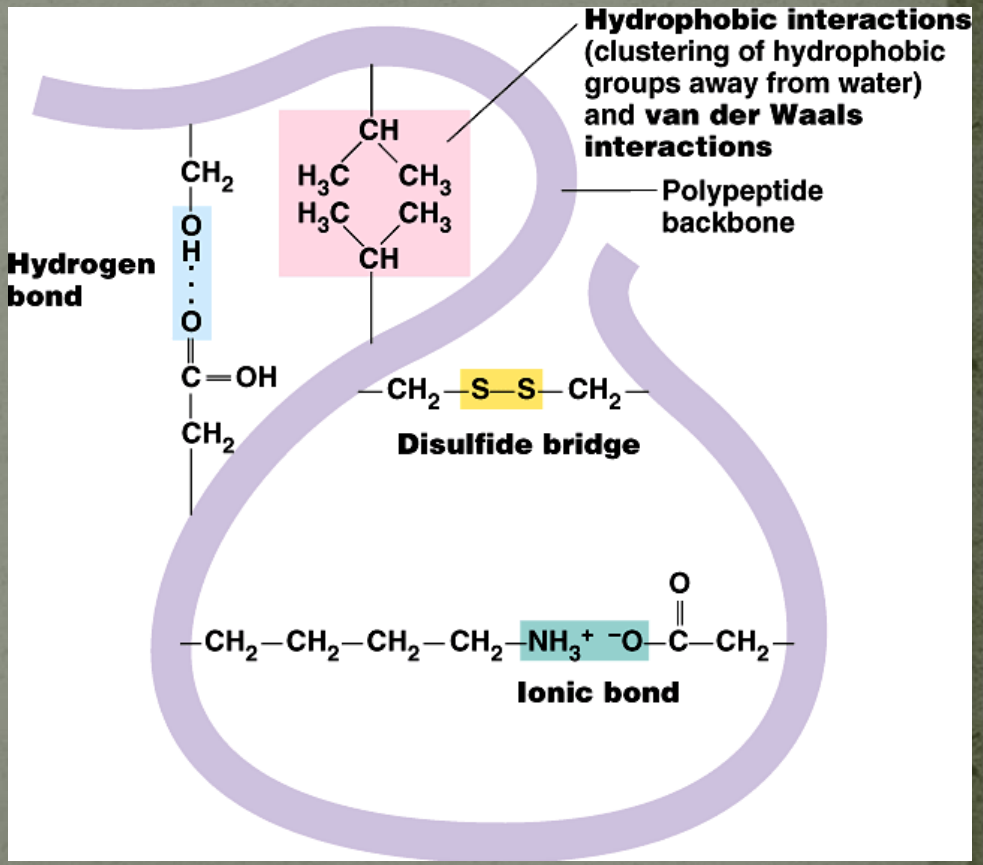
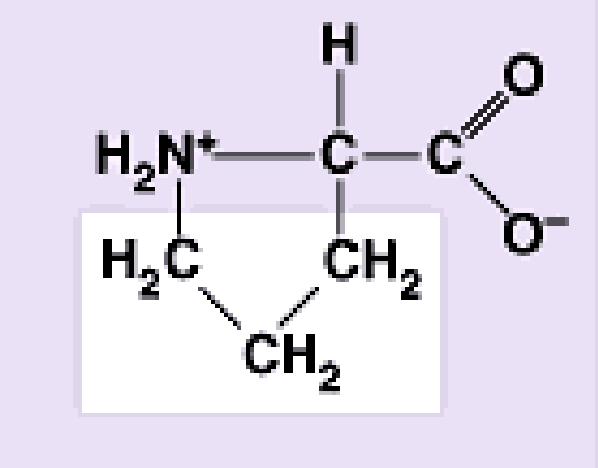
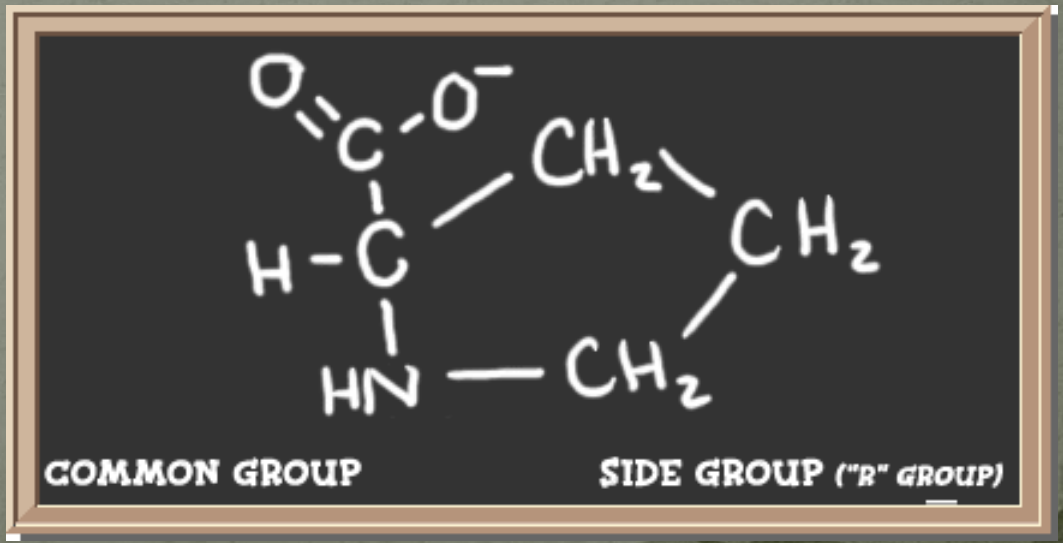


Fig. 5.22

Tertiary (3°) Structure: Proline kink

- Proline is the only amino acid in which the R group is attached to the amino group
- Forms a natural kink in the polypeptide
- Helps to shape tertiary structure





Quaternary (4°) Structure

- aggregation of two or more polypeptide subunits
- forms 2 types of proteins: globular and fibrous
- not found in all proteins

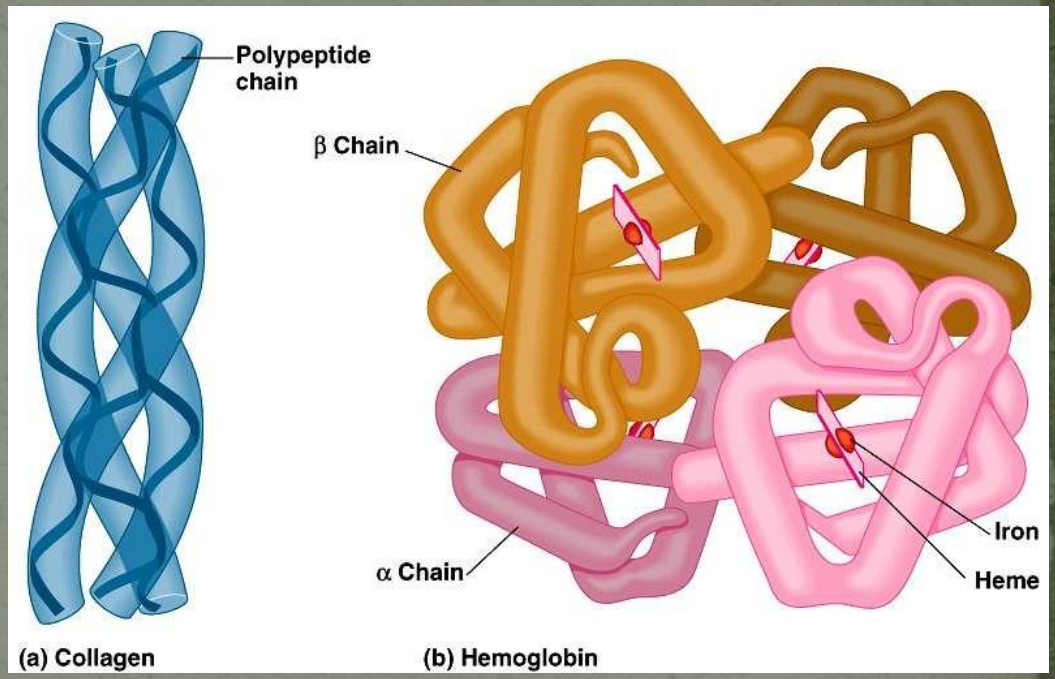
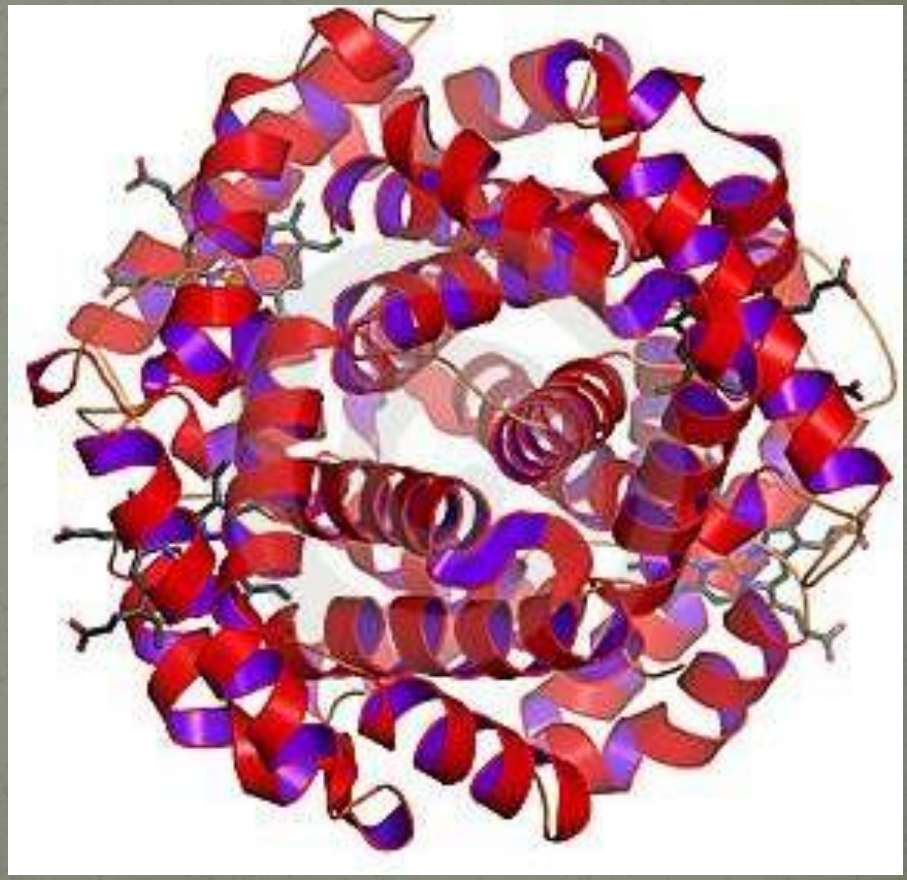


Fig. 5.23

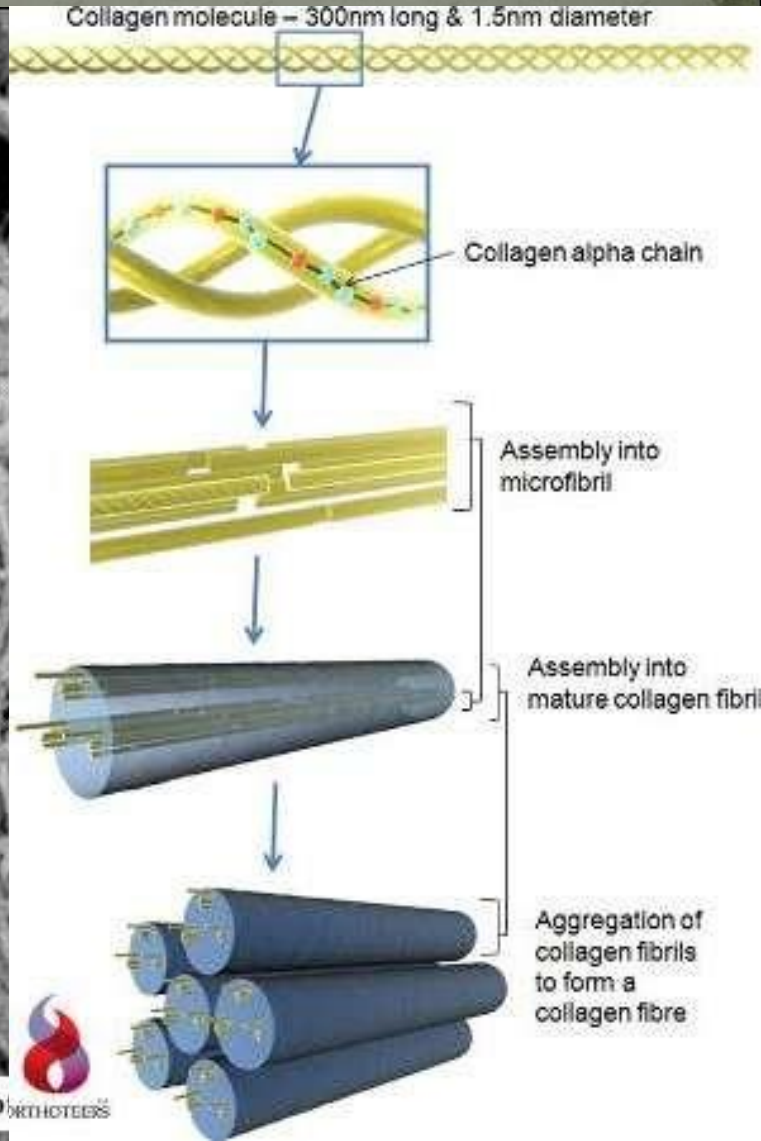
Quaternary (4°) Structure: Globular

- Water soluble
- Compact, spherical
- Example: hemoglobin



Quaternary (4°) Structure:Fibrous

- Water insoluble
- Threadlike
- Example: collagen
  - 3 polypeptides supercoiled like a rope
  - provides structural strength for role in connective tissue



Levels of Protein Structure

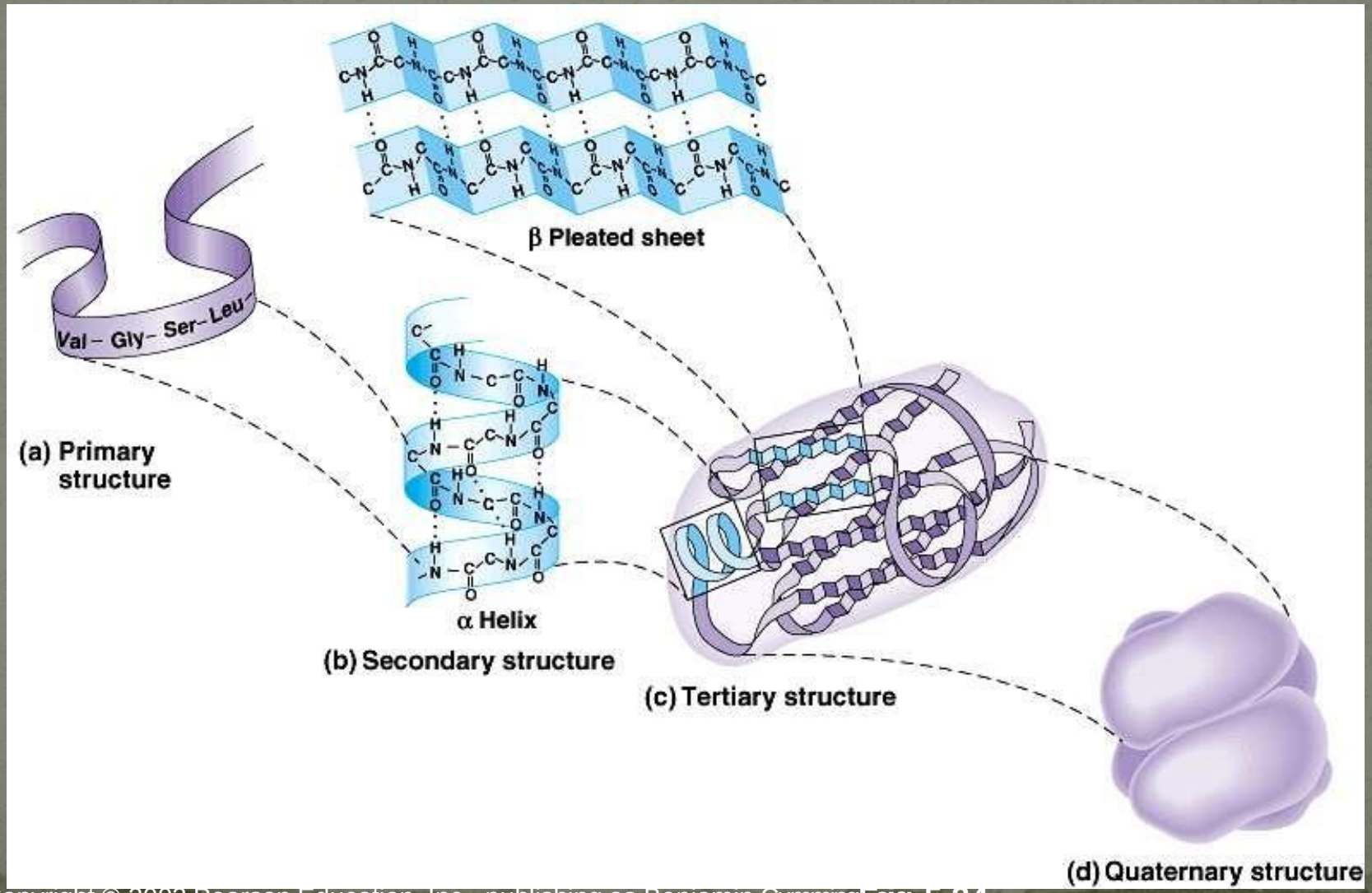


Fig. 5.24

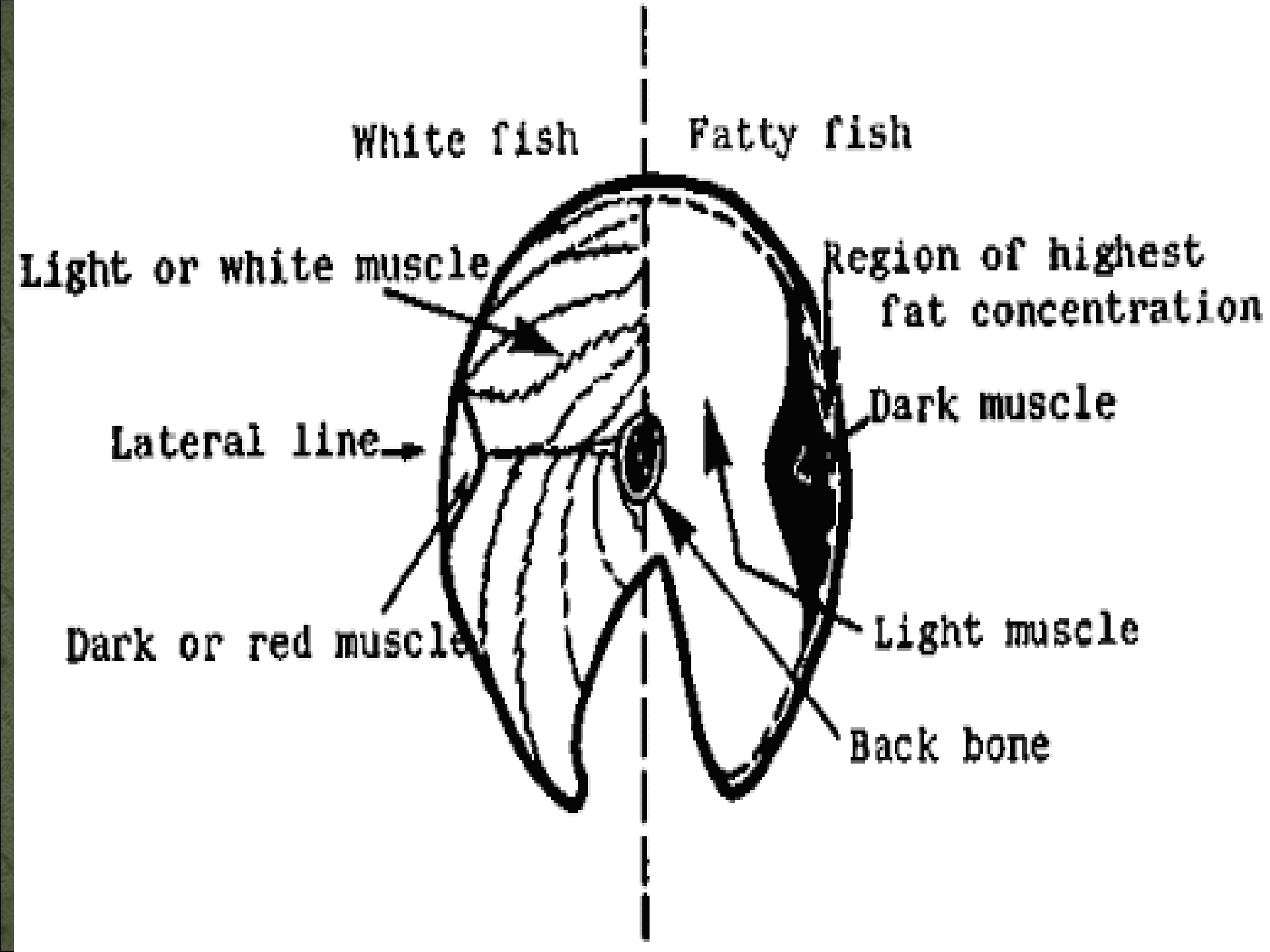
Troponin and Tropomyosin-

- Troponin and tropomyosin regulate muscle contraction.
- Troponin covers 8-10% of total myofibrillar proteins.
- There are 3 type of troponin-

1. **Troponin –C (calcium binding)**
2. **Troponin-I (inhibitory protein)**
3. **Troponin-T (tropomyosin binding).**

- Tropomyosin covers 5-10% of total myofibrillar protein.
- Tropomyosin have two polypeptide alpha and beta chain and combine to form a tropomyosin dimer.

- Myosin consists of **six polypeptide chains** and out of them **two heavy chains** and **four light chains**.
- Myosin is a motor molecule that works to move the cell. This will result in a contraction and expansion movement.
- Myosin is a special protein that converts adenosine triphosphate (ATP), a molecule that cells use in order to live and work, into mechanical energy (energy of work). This will then generate force and movement.
- Actin,troponin,tropomyosin are thin filaments.


White fish
Fatty fish
Light or white muscle
Region of highest fat concentration
Dark muscle
Lateral line
Dark or red muscle
Light muscle
Back bone

Function of proteins