Globular proteins

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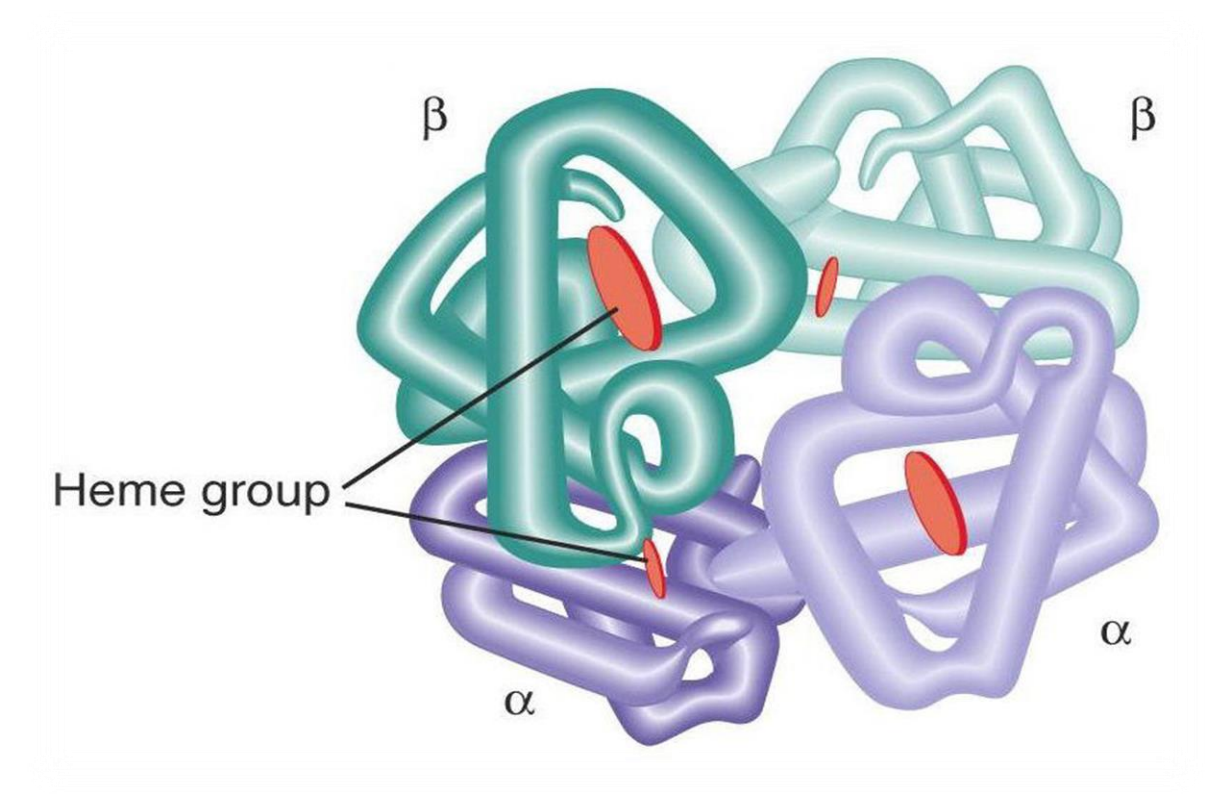


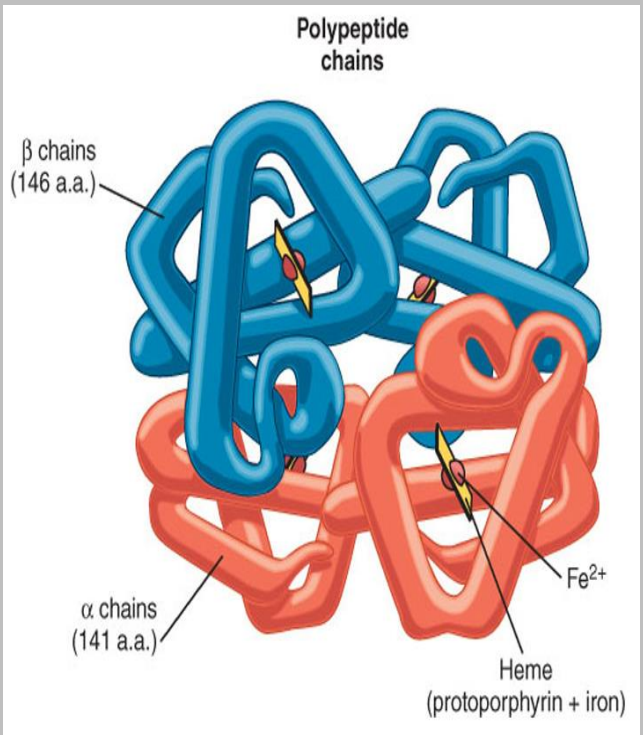
Globular Proteins

Amino acid chains fold into spheres.This type of folding increases solubility of proteins in water. Polar groups on the protein's surface, Hydrophobic groups in the interior, Fibrous proteins are mainly insoluble structural proteins(such as

hemoglobin	Most common globular protein, oxygen transport function •
Myoglobin	: oxygen storage/supply function in heart and muscle •
α_1, α_2, β-globulins	various functions •
γ-globulins	(immunoglobulins): immune function •
Enzymes	(Most of the enzymes are globular protein , catalysis of biochemical reactions •

Hemoglobin :

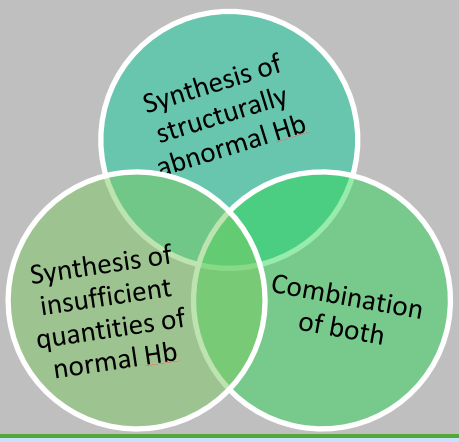
quaternary in structure.
major globular protein in humans.
Composed of 4 polypeptide chains:
two α and two β chains,
Held together by non-covalent interactions (Non-covalent are weak but many so their strength come from their number) . Each subunit has a heme group in the center that carries oxygen, 4 heme groups in one Hb carry 4 molecules of O_2.



Normal Hemoglobin	HbA (97%)	HbA= 2a + 2b	1) When hemoglobin doesn't carry O_2 the bond between dimmers is stronger and the structure is taut. 2) When hemoglobin carries O_2 the bond between dimmers is weaker and the structure is more relaxed. helping in O_2 exchange in tissue. Carries O_2 from the lungs to tissues& CO_2 from tissues back to the lungs Normal level (g/dL): Males: 14-16 Females: 13-15
	HbA2 (2%)	HbA_2 = 2a + 2d(delta)	Appears ~12 weeks after birth Constitutes ~2% of total Hb Composed of two a and two d globin chains
	HbF (1%)	HbF= 2a+2g	Major hemoglobin found in the fetus and newborn Tetramer with two a and two g chains Higher affinity for O2 than HbA Transfers O2 from maternal to fetal circulation across placenta
	HbA1c	HbA_{1c} = HbA+glucose (glycosylated hemoglobin) if high it is abnormal	HbA undergoes non-enzymatic glycosylation (Glucose binds with Hb). Glycosylation depends on plasma glucose levels HbA1c levels are high in patients with diabetes mellitus.
Abnormal : Unable to transport O_2	CarboxyHb	high in smokers	CO replaces O_2 and binds 200X tighter than O_2 (in smokers
	Met Hb	has highly oxidized iron	Contains oxidized Fe^{3+} (~2%) that cannot carry O_2
	SulfHb	Contains high sulfur level	Forms due to high sulfur levels in blood (irreversible reaction

Hemoglobinopathies

Disorders of hemoglobin caused by:



Sickle cell (HbS) disease		Caused by a single mutation in β-globin gene Glutamic acid at position 6 in HbA is replaced by valine. The mutant HbS contains β^S chain The shape of RBCs become sickled Causes sickle cell anemia.
Hemoglobin C disease:		Caused by a single mutation in b-globin gene Glutamic acid at position 6 in HbA is replaced by lysine Causes a mild form of hemolytic anemia.
Methemoglobinemia:		Caused by oxidation of Hb to ferric (Fe^{3+}) state Methemoglobin cannot bind oxygen Caused by certain drugs, reactive oxygen species and NADH-cytochrome b5 reductase deficiency Chocolate cyanosis: brownish-blue color of the skin and blood
Defective synthesis of either a or b-globin chain due to gene mutation	**a-thalassemia:**	**Synthesis of a-globin chain is decreased or absent Causes mild to moderate hemolytic anemia**
	b-thalassemia:	**Synthesis of b-globin chain is decreased or absent Causes severe anemia Patients need regular blood transfusions**

Myoglobin

Globular protein. Stores and supplies oxygen in heart & muscles (during aerobic exercise)
single polypeptide chain forming a subunit with 8 a-helixes. gives red color to skeletal muscles.The heme group exist at the center of the molecule

Myoglobin Diseases

Myoglobinuria: Myoglobin is excreted in urinedue to muscle damage (rhabdomyolysis). May causeacute renal failure
Specificmarker for muscle injury
Lessspecific marker for heart attack

Immunoglobulins

Defensive proteins produced by the B-cells of the immune system
Y-shaped structure with 2 heavy and 2 light polypeptide chains
Neutralize bacteria and viruses
Types: IgA, IgD, IgE, IgG, IgM

Questions :

1: which of the following is the function of Hemoglobin :
a : immune function .
b : oxygen transport function .
c : various function .
> B <
2 : Hemoglobin composed of four polypeptide and contain ..... dimmers.
a: two
b: four c : six > A <

3 : A hemoglobin molecular contain :
a : 4 heme groups and carries 4 molecules of O_2
b : 4 heme groups and carries 2 molecules of O_2
c : 2 heme groups and carries 4 molecules of O_2

> A <

4 : which one of the following is Major hemoglobin found in the fetus and newborn
a : HB fetal
b : HB A
c : HB A1c

> A <

5 : …….. gives red color to skeletal muscles.
a : hemoglobin
b : myoglobin
c : immunoglobin

> B <