# Hemoglobin structure function & degradation

# Course outcomes

- Define History of blood bank & mechanism of hemostasis, coagulation pathways and physiology of blood cells.
- At the end of the course student will be able to Perform donor selection and investigations done on donor blood , screening & cross matching.

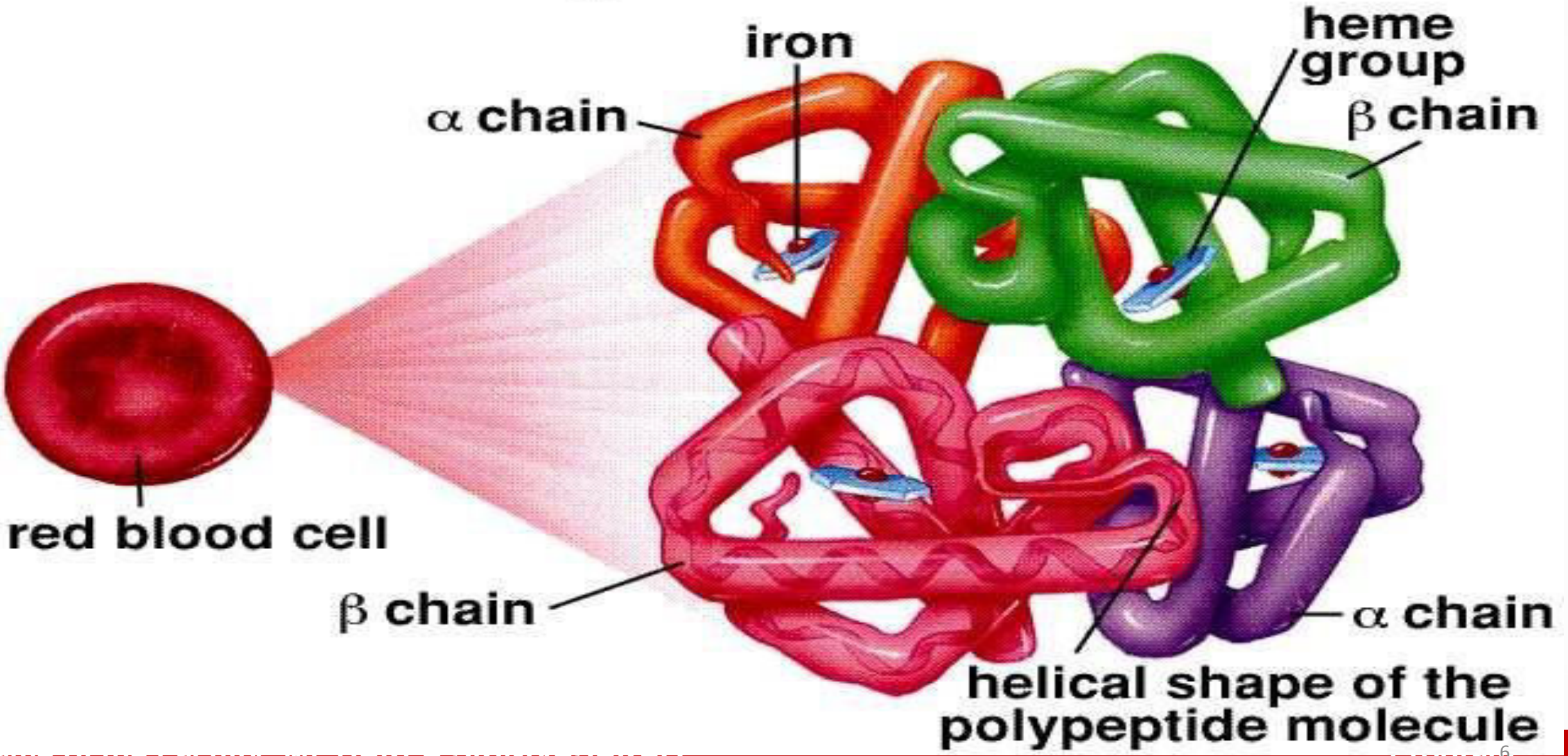
# Learning outcomes

| | |
|---|---|
| 1 | Understand the hemoglobin structure |
| 2 | Understand the Hemoglobin function |

- Hemoglobin - **Structure Content** : It is composed of the protein globin (a polypeptide), and the pigment heme.
- The hemoglobin has the ability to combine with oxygen is due to the four iron atoms associated with each heme group within the molecule.
- A heme group consists of an iron (Fe) ion held in a heterocyclic ring, known as a *porphyrin*.
- This porphyrin ring consists of *four pyrrole molecules* cyclically linked together (by methine bridges) with the *Iron ion* bound in the centre.

- Hemoglobin (Hb) is a chromoprotein.
- Molecular weight 64,458 Dalton
- Each hemoglobin molecule caries four molecule of oxygen and each gram of hemoglobin can carry 1.34 ml oxygen.
- About 6.25 grams of hemoglobin is synthesized each day to replace the hemoglobin lost due to normal destruction of RBCs
- Synthesis begin from proerythroblast to reticulocyte.

# Hemoglobin Molecule



## Hemoglobin content:

- Average Hb content of blood is= 14-16gm/dl.
- Varies with age and gender.
- At the time of birth, in infants and growing children the RBC count is more and so is the hemoglobin content.
- In adult males-14-16gm%
- In adult females-12-14.5gm%

# Hemoglobin types:

Two types :

Adult (Hb A): the globin contains two alpha and two beta chains and has less affinity to oxygen

Fetal (Hb F):there are two alpha and two gama chains and has more affinity for oxygen

# METHODS OF ESTIMATION OF HEMOGLOBIN

Colour based

Based on color of hemoglobin or derivative of hemoglobin Physical method

Based on specific gravity

Chemical method

Based on iron content of hemoglobin

Gasometric method

Based on oxygen combining capacity of hemoglobin.

Spectrophotometric method

Based on measurement using spectrophotometric devices.

# HAEMOGLOBIN ESTIMATION

Method: **Sahli's haemoglobinometer**.

conversion of haemoglobin to acid haematin

- Men - **14-18 gm%**
- Women - **11.5-16.5 gm%**

- Infants full term cord blood -13.5-19.5 gm%

- Children,1 yrs -**11.0-13.0 gm%**

- Children, 10-12 yrs -**11.5-14.5 gm%**

# SAHLI MEHOD PRINCIPLE

Hemoglobin +0.1 HCL → Acid hematin(brown color)

GLOBIN

The resulting color is diluted with water and matched with brown color glass.


HAEMOMETER
SAHLI PLANO
Type Square

**L-R:**

Pipette

Sahli's Standard

Hemometer Tube

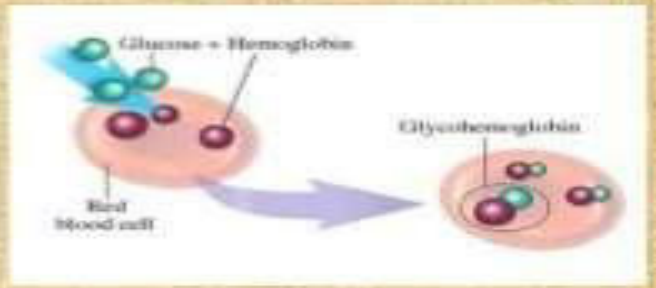
Stirring Rod

Dropper

# PURPOSE OF ESTIMATING HAEMOGLOBIN

- To detect the oxygen carrying capacity of blood.
- The result assists in detecting diseases, which causes a deficiency or excess of haemoglobin.
- Studying changes in haemoglobin concentration before or after operations and blood transfusions.
- To detect anaemia and its severity and to monitor an anemic patients response to treatment.
- To check haemoglobin level of blood prior to donating blood.
- To calculate red cell indices.

# Glycated hemoglobin



- Human Hemoglobin inside erythrocytes undergoes a non enzymatic chemical reaction with glucose.
- The rate and extent of this reaction are thought to be depended on the average blood glucose concentration during the life time of the erythrocytes there are several reaction procedure, "Glycated hemoglobin", which collectively Hb A1.
- The most abundant of these is Hb A1c the ratio of Hb A1c or HbA1 to the total HbA concentration has been suggested as a reliable measure of the degree of metabolic control in diabetic patients.

# Reference

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# Thank you